

2013

CARNEGIE MELLON UNIVERSITY

UNDERGRADUATE RESEARCH OFFICE
CMU.EDU/URO

MEETING
OF THE
MINDS

WELCOME

Welcome to the 18th annual Meeting of the Minds, our campus-wide celebration of undergraduate research at Carnegie Mellon University. It is a real privilege to work with these talented students who choose to get involved with exploring new knowledge, whether it be creating an inventive work of art; delving into the mechanisms of a protein; developing new nano-materials; understanding human behavior; or uncovering a new archive for historical work.

The abstracts in this program are a good place to start as you plan your time at Meeting of the Minds. Then you can travel around to the diverse posters on the first and second floors of the University Center, including Rangos Ballroom. You can also attend the oral presentations taking place in the various rooms along the second floor corridor. Remember as well to visit the visual art projects in the Connan Room on the first floor and to enjoy a performance or film in McConomy Auditorium.

There are two afternoon times that are important to keep in mind. At 2:30, Amy Burkert, Vice Provost for Education, will deliver a short keynote address in the first floor Kirr Commons area. We will also hold a drawing for a student prize and make announcements for the final rounds of particular competitions.

At 5:00 pm, our Awards Ceremony begins in McConomy Auditorium. Winners of the eighteen Meeting of the Minds competitions will be announced and prizes will be awarded. A list of all of the competitions is included near the end of this program booklet.

Please enjoy Carnegie Mellon's 18th Annual Meeting of the Minds!

Stephanie Wallach, Ph.D.

Assistant Vice Provost for Undergraduate Education

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SPECIAL THANKS

WE EXTEND OUR SPECIAL THANKS TO:

- ALUMNI RELATIONS FOR THE CORPORATE BREAKFAST
- CARNEGIE INSTITUTE OF TECHNOLOGY DEAN'S OFFICE FOR THE MID-AFTERNOON WELCOME
- SCHOOL OF COMPUTER SCIENCE DEAN'S OFFICE FOR THE JUDGES' RECEPTION

THIS SYMPOSIUM WAS FUNDED BY THE OFFICE OF THE PROVOST AND THE UNDERGRADUATE RESEARCH OFFICE.

Many thanks to Kourtney Bandish, Amy Burkert, Catherine Copetas, Thomas Cortina, Joanna Dickert, Marcia Gerwig, Beth Glick, Michelle Guarino, Stephanie Jin, Jen Keating-Miller, M. Stephanie Murray, Kurt Larsen, Jamie Rossi, Shoba Subramanian, Joanne Ursenbach, Jen Weidenhof, Kurt Wichman, Instructional Technology, University Catering Staff, University Center Staff, AlphaGraphics, A.G. Trimble Company, Miss Elaineous Balloons, and all the other wonderful students and staff who make this event work.

Please note:

Research project titles, student names, advisor names and abstracts were submitted by the student researchers. Due to the great number of students and the large volume of text contained in this booklet, it is impossible for the Undergraduate Research Office to ensure the accuracy or omission of information submitted for publication.

PRESENTATIONS

DESCRIPTIONS OF TYPES OF PRESENTATIONS

STUDENTS WHO ARE PRESENTING AT THE SYMPOSIUM COULD REGISTER FOR ONE OF FOUR DIFFERENT TYPES OF PRESENTATIONS:

1 POSTER PRESENTATIONS

Students will be standing by their posters for two hours or so to answer questions. Students participating in the Sigma Xi poster competition will be by their posters from 10 a.m. until 12:30 p.m. in **Rangos 2 and 3**. Students participating in the CIT poster competition will be by their posters from 12 noon to 2:30 p.m. in **Rangos 1**. Students participating in the general poster session will be by their posters from 12 noon until 2:30 p.m. or from 3 p.m. until 5 p.m. in the common areas of the University Center. Please feel free to wander through the poster presentations and ask questions of the students.

2 ORAL PRESENTATIONS

Students have been assigned a 20-minute time slot and will be located in one of six rooms along the second floor corridor (**Dowd, Pake, McKenna, Peter, Wright or Class of '87**). Students have been instructed to prepare a 10-minute oral presentation about their research, leaving five minutes for questions from the audience and five minutes to gather up their materials and make way for the next presentation..

3 VISUAL ARTS

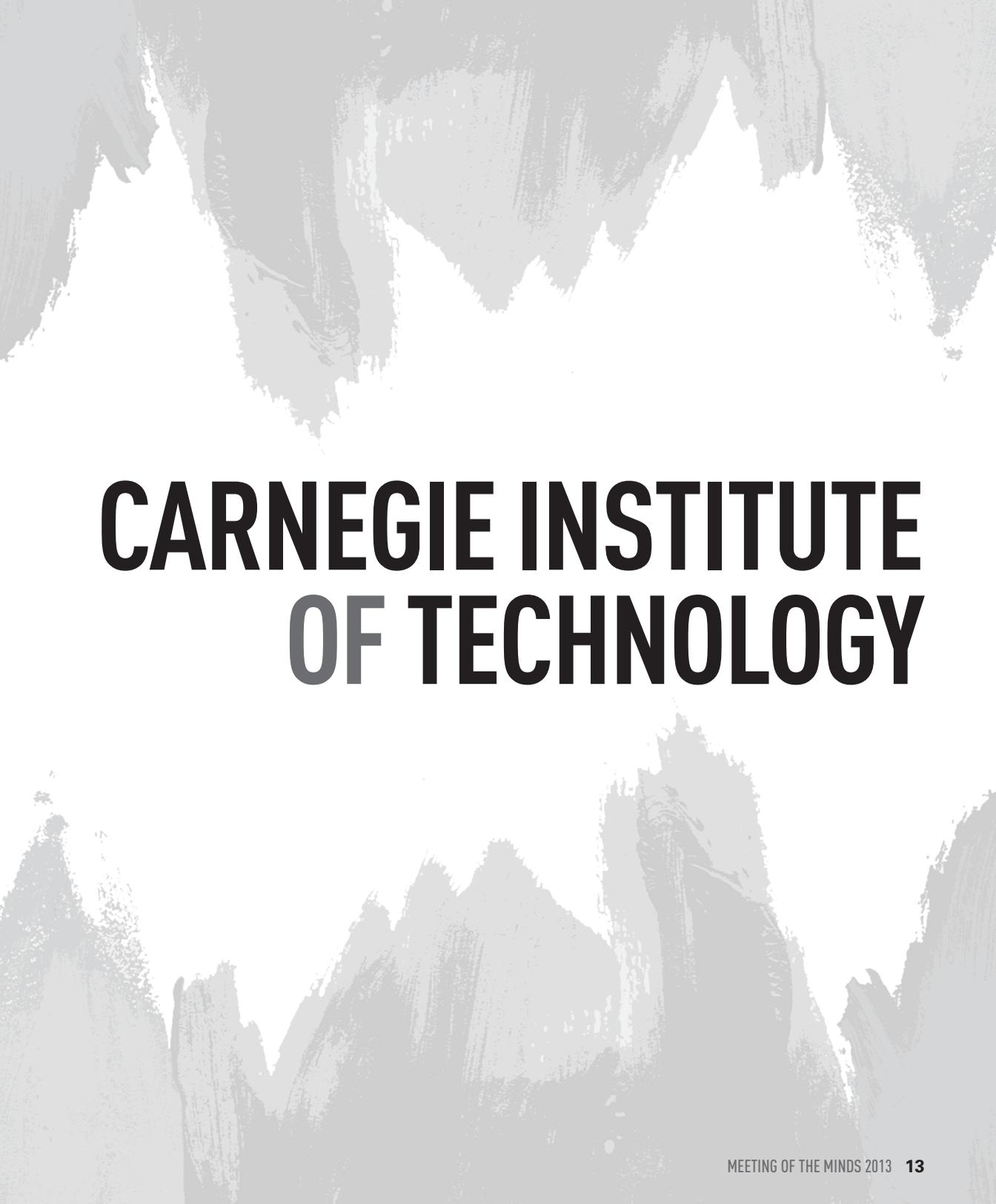
Students' work is displayed in the **Connan Room** and other areas of the University Center. Students will be standing by their work from 12 noon until 2:30 p.m. or from 3 p.m. until 5 p.m. to answer questions.

4 PERFORMING ARTS PRESENTATIONS

Students will perform in McConomy Auditorium at a time assigned to them. They have been instructed to leave time after their performance for discussion with the audience.



ABSTRACTS



CARNEGIE INSTITUTE OF TECHNOLOGY

CHEMICAL ENGINEERING

ACCELERATING MUSCLE TISSUE RECOVERY AFTER AN INJURY: THE ROLE OF MORPHOGENETIC PROTEIN-3 IN MYOGENESIS

STUDENTS Hiroataka Nakagawa *Chemical Engineering*

ADVISORS Phil Campbell *ICES*

ROOM/TIME Rangos 2&3/Sigma Xi Group 1 / 10:00 am

Understanding the chemical signals that control stem cell differentiation into muscle may underlie potential therapies for the speedy recovery of injured muscles. Differentiation of stem cells into mature bone cells is widely known to be regulated by Bone Morphogenetic Proteins (BMPs). Very recently, our lab group unexpectedly determined that BMP-3 may radically improve muscle regeneration in vivo. Thus the purpose of this project was to confirm this result in vitro toward validation and to optimize our current in vivo therapy. BMP3 has been proved to significantly enhance muscle tissue development, which can potentially be used clinically to accelerate the recovery of the injured muscle.

AEROSOLIZATION OF DMPC SURFACTANTS FOR PULMONARY DRUG DELIVERY

STUDENTS Yi Shi *Chemical Engineering*

ADVISORS Stephen Garoff *Physics* | Todd Przybycien *Biomedical Engineering* | Robert Tilton *Chemical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 10:00 am

Surface tension gradients initiate “Marangoni flow,” which is a convective flow where fluid moves from areas of low surface tension to high surface tension [1]. This surfactant-driven Marangoni flow can be utilized to move exogenous fluid through the lung for pulmonary drug delivery [2]. The addition of surfactant to the drug formulations may cause Marangoni stresses to drive the aerosol droplets to spread along the lung airway surface liquid after deposition. Therefore, the pulmonary delivery of drugs will be more uniform and can reach the poorly accessible regions due to obstructive lung diseases (such as cystic fibrosis). In this project, the lipid surfactant DMPC (1,2-dimyristoyl-sn-glycero-3-phosphocholine, No.P-5141) was used. Because DMPC is an insoluble lipid which forms vesicles in water, we would like to use aerosolization to break up the DMPC vesicles to release the surfactant. The spreading area for DMPC aerosolization was compared with that for DMPC single droplet deposition. Moreover, the effect of concentrations of DMPC for spreading area of DMPC single droplet was also tested. 1% PA (polyacrylamide) solution was used in all the experiments as the liquid subphase.

CHEMICAL MODIFICATION OF ANTIMICROBIAL PEPTIDES TO INCREASE EFFECTIVENESS AGAINST BIOFILMS

STUDENTS Kathleen Bates *Chemical Engineering*

ADVISORS Robert Tilton *Chemical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 1 / 11:25 am

Biofilms are notorious for their persistence in industrial settings and medical environments, where they can cause contamination and infections, respectively. By chemically modifying an existing antibiotic to produce an amphiphilic molecule, the ability of the antibiotic to eradicate biofilms could potentially increase due to

increased membrane interactions. Bacitracin, a common antimicrobial peptide found in skin antibiotic ointments like Neosporin™, was modified with one of six different hydrocarbon moieties of varying length and at differing binding sites to produce a surfactant-like antibiotic. The results indicate that activity of the bacitracin derivatives against biofilms is significantly increased compared to unmodified bacitracin, with the hexyl hydrazine derivative being the most active. In addition, the collected data indicate that the chemical modifications performed changed the mechanism of action of bacitracin.

COMPUTATIONAL MODELING OF MOTOR-MEDIATED INTRACELLULAR CARGO TRANSPORT IN NEURONAL CELLS

STUDENTS Breanna Stillo *Chemical Engineering*

ADVISORS Ge Yang *Biomedical Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

Intracellular transport of protein and organelle cargoes is an essential requirement for all mammalian cells, but because of their long axons, specific targeting locations, and signaling mechanisms, neurons are especially reliant on this process. Therefore, many neurodegenerative diseases are attributable to defects in axonal transport. This motor-mediated process is driven mainly by the anterograde directional protein kinesin, which transports cargoes in the microtubule plus-end direction (away from the neuron's basal body), and the retrograde directional protein dynein, which transports cargoes in the microtubule minus-end direction (towards the cell's basal body). Experiments like in vitro motility assays or theoretical energy landscape analysis of single-molecule biophysics have gained important knowledge into how these proteins actually function individually. However, it is insufficient to use solely physical theory and in vitro experimentation to infer how these proteins function in the highly dynamic and heterogeneous intracellular environment. In particular, a significant knowledge gap exists in how these transport molecules coordinate to achieve overall intracellular transport in vivo. This project focuses on developing an in vivo computational model of motor protein collective behavior by simulating dynamic transitions and dissociation kinetics.

DELIVERY OF QUANTUM DOTS TO THE NUCLEUS AS A MEANS OF MICRORHEOLOGICAL MEASUREMENT

STUDENTS James Weltz *Chemical Engineering*

ADVISORS Kris Dahl *Biomedical Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

The nucleus is the stiffest and largest organelle. It is composed of a heterogeneous network of DNA in densely packed heterochromatin and lightly packed euchromatin. The organizational state of DNA, as well as nuclear location and presence of transcription factors and other signaling moieties, determines the transcriptional state of DNA. Therefore the mechanical properties and diffusive characteristics of the complex nuclear environment are important for understanding the regulatory control exerted by the nucleus.

The diffusive properties of bound nuclear proteins within the nucleus are well characterized. However, using bound, endogenous nuclear proteins as probes offers some limitations. Because the probes are bound to the chromatin mesh within the nucleus, they provide only a measurement of the chromatin diffusion through the nucleus. An unbound probe would measure diffusion of the chromatin as well as diffusion between chromatin elements. Furthermore, transfection of endogenous fluorescent nuclear proteins changes the inherent nature

of these proteins and their interaction with components of the nucleus. Therefore measurement of nuclear diffusion through an exogenous, unbound probe would aid in understanding the environment within the nucleus.

Quantum dots are small, on the order to nanometers, semiconductors that have specific fluorescent properties that make them appealing for biological use. Their resistance to photobleaching, small diameter, and high quantum yield (brightness) make them a good candidate as an exogenous nuclear probe for rheological measurement. In this study, we attempt to deliver quantum dots in the nucleus, observe the diffusion of the quantum dots as exogenous, unbound probes, and use the diffusive measurements as a means of microrheological measurement.

DESIGN AND DEVELOPMENT OF THERMOCOUPLE AND FUEL CELL CARS

STUDENTS Katia Bazzi *Chemical Engineering* | Jonathan Berman *Chemical Engineering* | Madison Calhoun *Chemical Engineering* | Anusha Chinthaparthi *Chemical Engineering* | Alisa De Bruyn Kops *Chemical Engineering* | Onyenma Enwereji *Undecided* | Alexandra Frankel *Chemical Engineering* | Stephen Greco *Electrical & Computer Engineering* | Dennis Guo *Chemical Engineering* | Sam Klein *Chemical Engineering* | Joshua Kubiak *Materials Science Engineering* | Rebecca Lui *Chemical Engineering* | Ishan Nag *Chemical Engineering* | Kaitlyn Nowak *Chemical Engineering* | Sanjana Padmanabhan *Chemical Engineering* | Allison Perna *Chemical Engineering* | Yijie Qiu *Chemical Engineering* | Anand Sastry *Chemical Engineering* | Stephen Scannell *Chemical Engineering* | Wooram Seok *Chemical Engineering* | Joseph Whitmore *Chemical Engineering* | Patrick Xia *Undecided* | Amy Yuan *Chemical Engineering*

ADVISORS James Miller *Chemical Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

The purpose of this project is to prepare two cars for the AIChE Chemical Engineering Car Regional Competition hosted in New Jersey April of 2013. Two cars will be simultaneously entered in competition by Carnegie Mellon. The car that performs the best will compete at the National Competition in San Francisco in Fall of 2013. The Chemical Engineering Car Competition is a national, collegiate competition sponsored by the American Institute of Chemical Engineers (AIChE). It is based on the challenge of designing and building a model-sized car that is powered by a chemical reaction. The car must stop at a distance between 50 and 100 feet and carry a load of water. Both the distance and load are specified on the day of the competition. The competition is designed to give student engineers the opportunity to apply their knowledge to a design project and to gain research experience. It also gives students an opportunity to meet with other students across the country, share ideas, and network. Two separate cars will be prepared for the competition. The first car will be powered by a thermocouple and an exothermic reaction with a bimetallic strip-based stopping mechanism and the second car will be powered by a hydrogen fuel cell with a pressure-syringe-based stopping mechanism. In October 2011, the team placed 5th out of the 33 best teams throughout the United States at AIChE's National Competition. Our goal is to again perform well at the 2013 Regional Competition to qualify for the following National Competition.

DEVELOPMENT OF BIODEGRADABLE ELASTOMERIC DEVICES FOR THE TREATMENT OF INTRACRANIAL ANEURYSMS

STUDENTS Sharanya Venkat *Chemical Engineering*

ADVISORS Christopher Bettinger *Materials Science Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

Endovascular embolization of intracranial aneurysms is a minimally-invasive treatment in which an implanted material forms a clot to isolate the weakened vessel. There is a need for fabrication of a biodegradable

endovascular device to prevent coil herniation. This project uses soft covalent networks based on biodegradable poly(glycerol-co-sebacate) (PGS) coupled with multifunctional maleimide precursors using Diels-Alder cycloaddition chemistry. These elastomers can be processed into complex three-dimensional geometries using mild crosslinking conditions. The degradation of these materials was observed. These materials were shown to exhibit potential as a suitable material candidate for applications in temporary mechanically compliant medical devices.

DISCRETELY VARIABLE, TORQUE CONTROLLED ENERGY RECYCLING ACTUATOR: (DUTCERA)

STUDENTS Jayon Wang *Mechanical Engineering* | Robert Wojno *Chemical Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 10:37 am

Our goal is to create a small-scale, torque controlled linear actuator with the additional capacity to recapture energy. This actuator is designed to optimize energy usage and performance in prosthetics, robotics and exoskeleton applications; however, potential achievements are not limited to these industries.

Our design is unique because it uses hydraulic fluid channeling to capture energy normally lost in brake phases of traditional electric motors and redelivers this captured energy back into the system in the next forcing phase. This concept is especially important in applications where energy lost due to braking is high, such as walking or running.

Our current proof-of-concept design combines our functioning prototype with a force sensor and a foot-actuated loading mechanism into a compact testing rig. From this rig, we have gathered force data that supports our claim that the DUTCERA mechanism can output discrete forces in a controlled manner. Future work will involve incorporating electric motors to create system-level energy usage analyses and energy recapture experiments.

E RECYCLING AND RARE EARTH ELEMENT REUSE

STUDENTS Sophie Grodinsky *Civil and Environmental Engineering* | Marissa Morales *Chemical Engineering* | Annette Ritchie *Materials Science Engineering*

ADVISORS Kelvin Gregory *Civil and Environmental Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The ultimate question that we hope to answer with this research project is to identify the most feasible, cost effective, and efficient way to recycle and reuse rare earth elements to be extracted from used electronics and other devices. When China, the world's leading exporter, closed its borders to rare earth element trade, the United States along with many other countries was forced to find other means of obtaining these critical materials in order to maintain production. The U.S. Department of Energy has begun to develop a critical materials strategy, which includes support of possible rare earth element recycling using retired electronics. Professor Kelvin Gregory will support this research team in doing an on campus survey of Carnegie Mellon policies regarding retired electronics as well as a feasibility study of all current possible methods to recycle the critical elements within these electronics to be used again. By coming up with our own strategy regarding electronic recycling and rare earth metal reuse, we can then share that information with other universities, companies, and organizations to decrease the U.S. need for imported critical elements.

ENCAPSULATING LIVING ORGANISMS IN DROPLETS

STUDENTS Sarah McCormick *Chemical Engineering*

ADVISORS Shelley Anna *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

The goal of this project was to allow for the study of living organisms through encapsulating them in droplets. By placing organisms in droplets, the ability to study individual bacterium or cells and the process through which they live and interact with their surrounding environment will be gained. Over the summer, I was able to control the number of particles that would be encapsulated in each droplet. The next step was to work on storing these drops for long periods of time such that the cells could be studied over time. While this has been a challenge, the work has shown real potential for progress. With the base that has been created through my research, there are many applications that can be explored in the future.

ESTIMATING SECONDARY ORGANIC CARBON USING THE EC TRACER METHOD

STUDENTS Minghui Zhang *Chemical Engineering*

ADVISORS Spyros Pandis *Chemical Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

Atmospheric organic particulate matter is either emitted directly to the atmosphere (primary) or formed during the oxidation of volatile organic compounds (secondary). The elemental carbon (EC) tracer method has been used during the last thirty years to determine the contribution of secondary organic aerosol (OA) to the total. In this observation based method the EC is used as a tracer for the primary OA. Recent developments in our understanding of the OA properties and atmospheric processing challenge some of the major assumptions of the EC tracer method.

We use a state-of-the-art three dimensional chemical transport model (PMCAMx) including the latest information about OA to test the applicability of the EC tracer method. PMCAMx treats the primary OA as semi-volatile. Part of it evaporates after emission. Both the primary and secondary vapors continue reacting in the atmosphere in a process called chemical aging. We estimate the ratio of primary OA to EC for a number of areas in the Eastern US, calculate the secondary OA using the EC tracer method and then compare these results with the actual PMCAMx predictions.

The EC tracer method clearly underpredicts the secondary OA and overpredicts the primary OA in all areas. This is due to the abundance of secondary OA and the fact that there are no periods when the primary OA dominates the composition of even the large urban areas. A number of variations of the EC tracer methods are tested. Even if they result in improvements of the predictions of the method, they still provide only a lower bound of the secondary OA.

EXPERIMENTAL ANALYSIS OF THE MENISCUS IN THE HORIZONTAL RIBBON GROWTH PROCESS

STUDENTS James Church *Chemical Engineering*

ADVISORS Erik Ydstie *Chemical Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

This project demonstrates experimental evidence regarding the existence and shape of the lower meniscus in the horizontal ribbon growth (HRG) process. The existence of the meniscus is required to prevent downward

growth of the ribbon and its subsequent attachment to the crucible. Measurements of the meniscus taken from observation are subsequently compared to a theoretical representation of the meniscus shape derived from an analytical solution to the governing Young-Laplace equation, as the existence of the meniscus is defined by hydrostatics and capillarity. Experiments are conducted varying the distance between the ribbon and crucible edge as well as the angle at which the ribbon is drawn.

IDENTIFYING COGNITIVE PATTERNS IN UNDERSTANDING AND DESIGNING MULTI-SCALE MUSCULAR SYSTEMS

STUDENTS Tiffany Ho *Chemical Engineering*

ADVISORS Jonathan Cagan *Mechanical Engineering* | Paul Egan *Mechanical Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

Effective reasoning through complex systems requires both domain-specific knowledge, which is contextual background information, as well as systems thinking, which is information on system functions as a whole. In this project, the learning processes of both engineers and medical practitioners enable them to apply their knowledge in their work in contrasting ways. This project studies these various cognition patterns, through the understanding of the multi-scale relations between stochastic interactions in individual myosin molecules and the entire physiological functioning of muscle as a whole. The goal is to bridge the gap between domain knowledge and systems thinking, enable designers to create more effective nanotechnologies, and allow medical practitioners gain a better means for understanding and treating patients.

IMPROVING THE STABILITY AND SOLUBILITY OF PNA USING MINIPEG

STUDENTS Jack Li *Chemical Engineering* | Robert Wu *Chemistry*

ADVISORS Danith Ly *Chemistry*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 11:13 am

Peptide nucleic acids (PNAs) are nucleic acid analogs with the added benefit of thermal stability and resistance to enzyme degradation that utilize natural base pairs to bind to natural nucleic acid targets. This makes them the ideal tool in the development of therapeutics, reagents in molecular biology, and diagnostics. This project focuses on modifying natural nucleobases with minipeg groups and then coupling them to PNA in hopes of improving solubility of PNA molecules and potentially increasing their binding strength.

INTERACTION OF ENGINEERED NANOPARTICLES WITH ENVIRONMENTALLY RELEVANT POLYSACCHARIDES

STUDENTS Zeinab Mohamed *Chemical Engineering*

ADVISORS Robert Tilton *Chemical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 10:13 am

Nanoparticles have many consumer and industrial applications with uses in medical to chemical and consumer fields. Often nanoparticles are incorporated into consumer products due to their anti-microbial properties as well as their ability to block UV light, and for their optical, catalytic, electromagnetic and mechanical properties. However, despite the usage of nanoparticles in many products, testing of the fate, transport and effects of nanomaterials in biological and environmental systems has not been fully conducted. For this project, gold nanoparticles were exposed to varying concentrations of mucilage solutions (mimicking roots of aquatic plants)

to determine whether nanoparticles aggregate. Testing of the solutions indicate that with mucilage concentrations as low as 0.3 weight %, the nanoparticles aggregate, suggesting that aquatic mucilage may function as a sink for nanoparticles. Results from this and similar research can help guide regulatory policy concerning the use of engineered nanoparticles in consumer products.

MICROFLUIDIC ENCAPSULATION FOR CONTROL OF STEM CELL FATE

STUDENTS Dennis Guo *Chemical Engineering*

ADVISORS Stefan Zappe *Biomedical Engineering*

ROOM/TIME Pake / 2:00 pm

Stem cells hold tremendous promise for use in regenerative medicine. However, development of cell-instructive materials is necessary to control stem cell fate in support of specific therapeutic aims. We have developed a process for microencapsulation of stem cells based on agarose gel template formation and capsule wall formation through either covalent cross-linking or complexation of oppositely charged polymers. A microfluidic device was used to automatically generate cell-containing gel templates, with low dispersity regarding capsule size. Adult rat neural stem cells (rNSCs) were used to demonstrate cell-instructive properties of two types of microcapsules based on the naturally occurring polymers collagen and hyaluronic acid (HA).

MICROFLUIDICS AS A PLATFORM FOR PROBING UNIFORM CRYSTALLIZATION PROCESSES

STUDENTS Jyo Lyn Hor *Chemical Engineering*

ADVISORS Shelley Anna *Mechanical Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

Crystallization processes are often involved in the purification of active pharmaceutical ingredients (API). One limitation encountered in these processes is the inadequate knowledge of the role of process conditions such as flow rate and temperature/concentration variations, on crystal nucleation and growth, and on the resulting crystal structures. This work aims to develop a high throughput screening method using uniform microscale droplets as crystallization “reactors” in which process conditions can be varied systematically. While conventional crystallization processes utilizes cooling to achieve supersaturation and hence, nucleation, microfluidic devices with storage traps allow the isolated crystallizing droplets to achieve supersaturation via mass transfer of solvent isothermally, leading to concentration of the solution. The objective of this research is to explore the efficiency of this novel mechanism in consistently producing uniform crystals.

MICROSTRUCTURED COATINGS FOR CONTROLLING HOST RESPONSES TO IMPLANTS

STUDENTS Nicholas Karabin *Chemical Engineering*

ADVISORS Newell Washburn *Chemistry*

ROOM/TIME Rangos 1 / 12-2:30 pm

Tissue engineering strategies will be implemented to develop coatings capable of controlling interactions at the host-biomaterial interface in medical implants. Microfabrication techniques will be used to generate biologically active coatings with characteristic length scales of order 100 micrometers. Structural characterization and in vitro testing will be performed to assess the effectiveness of this strategy.

MOTHERHOOD AND FEAR: THE INFLUENCE OF TRADITIONAL RELIGION ON AMERICAN AND JAPANESE HORROR

STUDENTS Natalie Brandell *Chemical Engineering*

ADVISORS Yasufumi Iwasaki *Modern Languages*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

With the sensation generated by the 2002 release of *The Ring*, the American take on the classic Japanese horror film *Ringu*, a new trend in American horror was born. Shifting its attention away from more common Western themes, Hollywood focused on emulating the Japanese psychological viewpoint by shying away from demented murderers and turning instead to vengeful ghosts and cursed apparitions.

Aside from these backbone elements, however, the emergence of Japanese horror remakes highlighted another distinct, fundamental difference between the traditional American and Japanese takes on horror: the portrayal of powerful, villainous women. Why does American horror suggest contempt for female characters, whereas Japanese horror suggests the opposite: fearful respect? What factors influence these portrayals? These are the questions I aim to answer.

Through examination of traditional American and Japanese religious doctrine, historically predominant cultural views, and the treatment of female characters in both visual and literary horror genres, I have reached the conclusion that the portrayal of women in horror reflects religion-based societal views on motherhood, the most fundamental form of women's power. In Christian-based American culture, motherhood and childbirth are fundamentally associated with impurity and guilt, the characteristic result of Eve's disobedience in the Garden of Eden. This negative connotation subsequently manifests as fearful contempt of dominant, villainous women in American horror. In contrast, traditionally Shinto Japanese culture regards childbirth and the creation of life as an almost divine act, and reverence for this mystical power manifests as fearful respect of the frightening, dangerous female characters in Japanese horror.

OPTIMIZATION OF STUDENT DORMITORY PREFERENCES IN CARNEGIE MELLON UNIVERSITY

STUDENTS Neha Nandakumar *Chemical Engineering* | Yu-Hua Wang *Mathematics* | Kenneth Wong *Mathematics*

ADVISORS Fatma Kilinc-Karzan *Business Administration*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 11:13 am

Each May, Carnegie Mellon University's Housing & Dining Services gathers a list of incoming freshman students and assigns them to on-campus dormitories. Assigning students to dorms based on preferences is a tremendous issue to deal with every year, because dorm living plays a huge part in a freshman's college experience, and produces most of Housing & Dining Services' revenue. Our group decided to investigate this optimization problem as a two-phase Assignment Problem. We hope that our findings would reduce the amount of complaints from the students about their dorm room assignments and improve upon the students' first year experience in Carnegie Mellon University.

PLASTIC THATCH PROJECT

STUDENTS Joel Accorsi *Mechanical Engineering* | Craig Boman *Civil and Environmental Engineering* | Corinne Clinch *Civil and Environmental Engineering* | Seth Cordts *Mechanical Engineering* | Zachary Dawson *Electrical & Computer Engineering* | Eric Desnyder *Mechanical Engineering* | Madelyn Gioffre *Civil and Environmental Engineering* | Kyra Gould *Mechanical Engineering* | Yoon Hee Ha *Mechanical Engineering* | Veronica Jaime-Lara *Mechanical Engineering* | Benjamin Paren *Materials Science Engineering* | Deepak Ravi *Mechanical Engineering* | Minghui Zhang *Chemical Engineering*

ADVISORS Larry Cartwright *Civil and Environmental Engineering*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

The Plastic Thatch Project aims to convert waste plastic bottles into reusable plastic material by developing a semi-automated manufacturing process. The knowledge from this research could benefit current plastic sorting techniques or prompt successful reuse of other waste materials. A successful plastic reuse machine will allow communities in developing countries to process and transport plastic bottle waste. Low cost plastic material will act as a catalyst for small business enterprises in roofing and other endeavors, such as green-house material. The work has been divided into three design groups: hopper/sorter, fusing section, and thatch cutting. Our research consists of prototyping until a full scale model is functional as a whole machine. Through this research, the students involved will gain valuable experience in efficient project management, rapid prototyping, and applying engineering skills to real-world issues.

QUANTITATIVE CHARACTERIZATION OF PHYSICAL SOLVENTS USING RAMAN SPECTROSCOPY AND MODELING FOR PRE-COMBUSTION CO₂ CAPTURE

STUDENTS Albert Liang *Chemical Engineering*

ADVISORS John Kitchin *Chemical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 10:13 am

Capturing CO₂ from a syngas stream in an Integrated Gasification Combined Cycle power plant before combustion holds promise for large reductions of CO₂ emissions using existing technology. Physical solvents in particular are good candidates for pre-combustion absorption processes, but their properties must be characterized before implementation. Current methods of quantifying solubility of CO₂ in physical solvents require relatively large quantities of solvent, unwieldy equilibrium cells, and expensive gas chromatographs. A new method of using Raman spectroscopy to quantify the solubility of CO₂ in microliter amounts of liquid solvents was explored and proven under relevant high pressure pre-combustion capture conditions. New data analysis methods allowed for the extraction of quantitative information from Raman spectra that previously have been limited to qualitative chemical analyses. Fundamental relationships in Raman spectroscopy were applied to find Henry's Law constants for CO₂ in alkanes and silicone oils that agreed with literature values obtained through conventional methods. This method developed is not limited to CO₂-solvent systems, and with minimal further development can be adapted to characterize other gas-solvent systems. Using the data gathered from our experiments, further work was performed using equilibrium absorption models to explore the performance of pre-combustion capture processes with different solvents. Parametric analyses of various operating conditions and solvent properties were performed to observe trends and patterns in order to draw conclusions on the optimal set of conditions. A complete equilibrium absorption and stripping process model was eventually finalized to determine costs and effects of uncertain operational parameters.

SAFETY-CLIP -PNA

STUDENTS Jack Li *Chemical Engineering*

ADVISORS Danith Ly *Chemistry*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

Protein nucleic acids (PNAs) are nucleic acid analogues that have the capacity to hybridize to DNA and RNA through sequence specific recognition by the nucleobases. One of the limitations in nucleic acid binding is a lack of complete target sequence specificity. The goal of this project is to demonstrate a novel form of PNA with increased target recognition specificity. This project seeks to address this problem through the use of a safety-clip modified -PNA, where a significant portion of the PNA probe is pre-hybridized to a smaller, branched PNA strand. Recognition specificity is intended to be increased as mismatch base pairs are unlikely to displace pre-hybridized base pairs.

SELECTIVE ADSORPTION ON CHIRAL NANOPARTICLES

STUDENTS Nathaniel Ondeck *Chemical Engineering*

ADVISORS Nisha Shukla *ICES*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

Dr. Shukla's research group is examining a new method for separation of racemic mixtures with an important pharmaceutical application. The technique being explored involves creating chiral nanoparticles that will selectively adsorb one enantiomer of a racemic solution, allowing for subsequent differentiation and separation of the enantiomers. Wet chemical synthesis and the use of pressure cells were used to synthesize the nanoparticles and the enantiomer separation took place in solution. Proof of concept work has been completed proving that selective adsorption in solution is possible. Current work has shown that optimization of this process can be completed by controlling the size of the nanoparticles, temperature of the solution, as well as the wavelength of the polarimeter used for analysis. Decreasing the size of the nanoparticles, increasing the temperature, and increasing the wavelength of the polarimeter, all prove to enhance the separation and analysis process. The long-term vision of the proposed work is to lay the foundation for the preparation of highly selective and stable chiral nanoparticles and for a better understanding of how novel synthesis methods for nanoparticles can be used to tailor activity and selectivity.

SURFACE CHARACTERISTICS OF ZNO CHEMIRESTIVE THIN-FILM SENSORS

STUDENTS Russell Sparks *Chemical Engineering*

ADVISORS James Miller *Chemical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

Ongoing research has demonstrated that Zinc Oxide (ZnO) has many properties that make it useful as a gas sensor. Adsorption of Oxygen molecules onto the ZnO surface causes a decrease in electrical conductivity, which can be used as a sensor response. The performance of the sensor depends on its physical and chemical properties, which, in turn, are determined by its preparation methods. During the ongoing research, it was found that film preparation methods such as cleanliness and annealing temperature caused a change in sensor response. The goal of my research is to determine most suitable thin film preparation to increase sensor sensitivity and specificity.

THE DC FORCE EXERTED ON A CHARGED PARTICLE BY AN AC ELECTRIC FIELD

STUDENTS Edmund Tang *Chemical Engineering*

ADVISORS Dennis Prieve *Chemical Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

In dilute solutions of KOH or NaHCO₃ in water, a 5 to 10 micron, negatively charged polystyrene sphere is levitated about 200 nanometers above a negatively charged planar indium tin oxide electrode by double-layer repulsion. The distribution of elevations sampled by the particle through Brownian motion is observed using total internal reflection microscopy and the potential energy profile of the particle is determined. The application of an oscillating field with a frequency reaching 10 kHz and magnitude reaching 10 kV/m produced oscillations in elevation which were swamped by Brownian motion. Despite this, a steady attractive force, comparable in magnitude to the net weight of the sphere (0.05 pN), was detected. This additional force was proportional to the square of the electric field strength and is about a factor of 2 stronger in KOH compared to NaHCO₃. The steady force appears to be dielectrophoretic attraction resulting between aligned dipoles induced in the sphere and the planar electrode by the electric field.

THE EFFECT OF TAU PROTEIN ON THE NERUONAL TRANSPORT OF EB-1 IN DROSOPHILA.

STUDENTS Stacey Lee *Chemical Engineering*

ADVISORS Ge Yang *Biomedical Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

Tau protein is responsible for stabilizing microtubules, structures which have multiple functions in cells including providing tracks for transport of cargo and forming the cytoskeleton. In neurodegenerative diseases such as Alzheimer's, tau protein is thought to aggregate, thereby destabilizing microtubules, leading to the impaired trafficking of cargo vital for the normal function of a neuron. To study the effect of various tau protein pathologies in neurons, Drosophila larvae were dissected to isolate the nerves, and imaged. Fluorescently labeled Eb-1, a protein transported on the microtubule, was examined. It was found that for Drosophila expressing an overabundance of tau protein, there were several instances of irregular accumulation of fluorescence along the nerves, which was not seen in flies with wild-type tau expression. These findings indicate that the over-expression of tau protein may cause the jamming of Eb-1 protein due to aggregation, which limits the transport of other cargoes due to the unstablized microtubule track.

THE EFFECTS OF LYSOZYME PROTEIN ADSORPTION ON COLLOIDAL SILICA PHASE BEHAVIOR

STUDENTS Rocio Garay *Chemical Engineering*

ADVISORS Robert Tilton *Chemical Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

Protein adsorption from solution is the simplest method for biofunctionalizing colloidal particles. At high concentrations, the effects of protein-particle interactions on the system phase behavior must be considered. In this experiment, the interaction between the protein lysozyme in buffer solution and a colloidal silica suspension was studied. At low lysozyme concentrations, inter-particle electrostatic repulsion dominates and a clear silica gel results. Dilution produces a clear liquid of well-dispersed particles. At high lysosyme concentrations, numerous positively charged proteins adsorb to the negative silica surfaces and cause irreversible aggregation of the silica particles, evident via visible clusters of white precipitate in solution that do not disappear upon

dilution. Thus, the phase diagram between gelation and flocculation for the lysozyme-silica system is mapped.

THE INVESTIGATION OF THE ROLE OF HEDGEHOG IN NEURAL PATTERNING OF PATIRIA MINIATA LARVAE

STUDENTS Annette Ko *Chemical Engineering* | Lazar Lalone *Biology and Psychology* | Sowmya Yennam *Biological Sciences*

ADVISORS Veronica Hinman *Biological Sciences*

ROOM/TIME Dowd / 4:00 pm

During embryogenesis, the cells of embryos undergo rapid division and differentiation to eventually lead to the development of an adult organism. Throughout this process, much genetic signaling occurs that collectively determines the later function of these early cells. The pathways responsible for this signaling are often specific to a species, but cases have also been found in which the same gene appears to have similar function across species, suggesting evolutionary relatedness between organisms. One such conserved gene is Sonic Hedgehog (Hh), which is responsible for patterning the nervous system of humans, but has also been found in *Patiria miniata*, sea stars. Such a similarity between vertebrates and sea stars is not unexpected, as both are deuterostomes and undergo similar embryonic development, but research has not been conducted on the extent of this similarity. In this project, we will work to better characterize the neural patterning in sea star embryos, investigate the possible role of Hedgehog in the formation of the invertebrate nervous system, and then compare this to Hh expression in humans. To do this, we will knockdown Hedgehog using Hedgehog morpholino antisense oligomer (morpholino) and observe its effect on motor and sensory neurons via in situ hybridization. The gene knockdown will also be performed with cyclopamine to cross-check the effect of morpholino and to investigate how Hedgehog knockdown affects neural patterning in embryos at different stages of development. It is expected that in addition to humans and sea stars both expressing Hh in neural development, a similar patterning mechanism may exist as well. If this is the case, this research could give insight to the evolution between these organisms as well as neural development in humans, which could be particularly useful for better characterizing and treating neurological diseases which often interrupt these genetic pathways.

THERMODYNAMIC CHARACTERIZATION OF LAMIN PROTEIN TAIL DOMAINS

STUDENTS Kelli Coffey *Chemical Engineering*

ADVISORS Kris Dahl *Biomedical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 1 / 10:13 am

The cell contains many filamentous network systems: the cytoskeleton is found throughout the cellular interior, and the nucleoskeleton is found inside the inner nuclear membrane. The nucleoskeleton provides mechanical stability to the nucleus and aids in expression of genes. The nucleoskeleton is formed from independent networks of intermediate filaments primarily made of lamin A and lamin B proteins. There are numerous disease-causing mutations in lamin A, including the premature aging disorder Hutchinson Gilford progeria syndrome (HGPS). A duplication of the lamin B gene LMNB1 causes adult-onset autosomal dominant leukodystrophy (ADLD), which is progressive neurological disorder. We have studied thermodynamic changes of the tail domain conformation of these proteins, since the tail domain is responsible for most of the protein-protein association. We examine mature lamin B, mature lamin A, prelamin A and the mutant form of lamin A associated with HGPS, 50, by stepwise increases in temperature or changes in salt, and we analyzing the changes of the fluorescence of the tryptophan residues inside the the Ig-fold found in the tail domains.

Temperature- and salt-induced changes the conformation of both prelamin A and 50 from a more to less compact form, and this conformational change is necessary for nuclear membrane association. The effective changes in thermodynamic stability may provide molecular insight into progression of nucleoskeletal disorders.

TOTAL INTERNAL REFLECTION MICROSCOPE AS A TOOL FOR TEACHING COLLOID SCIENCE

STUDENTS Erin Donnelly *Chemical Engineering*

ADVISORS Paul Sides *Chemical Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

Total Internal Reflection Microscopy (TIRM) is an apparatus and method invented by Professor Dennis Prieve at Carnegie Mellon to characterize the electrostatic interaction between a particle and proximate surface. In TIRM, one monitors the Brownian motion of a single microscopic sphere that is submerged in an aqueous solution and sediments near a transparent solid. The separation distance between the sphere and the plate is measured as a function of the intensity of light scattered by the sphere when illuminated by an evanescent wave. The result is a plot of the potential energy distribution of the particle as a function of height. The plot reveals the balance of electrostatic repulsion and gravitation. The height resolution is 1 nanometer and the force resolution is pico-newtons. The method previously has been used only for research. We have adapted the TIRM technique as an educational experiment for the Colloids, Surfaces and Polymers laboratory courses. By simplifying the optics behind the technique, this new design provides a robust and inexpensive alternative to the traditional TIRM technique.

USING SURFACE INITIATED ASSEMBLY TO INVESTIGATE THE MECHANICAL PROPERTIES OF EXTRACELLULAR MATRIX PROTEINS

STUDENTS Rebecca Wells *Chemical Engineering*

ADVISORS Adam Feinberg *Biomedical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 3 / 10:37 am

The extracellular matrix (ECM) is composed of protein fibers including fibronectin, laminin, fibrinogen, and collagen. It has been proposed that ECM proteins contain cryptic binding domains that become exposed in a force-induced manner (Vogel, *Annu. Rev. Biophys. Biomol. Struct.* 2006). This study focused on the ECM proteins fibronectin (FN) and Laminin (LM). FN is a critical component of the ECM during wound healing and embryonic development whereas LM is the major component of the basement membrane. Understanding the mechanical properties of these proteins and how this influences their bioactivity could lead to the development of advanced strategies for tissue regeneration and cancer treatment. A method termed surface-initiated assembly was used to create FN and LM nanofibers that were adhered across microfabricated trenches and subsequently strained. FN achieved an average strain value of 334% and LM achieved an average strain value of 134%

CIVIL AND ENVIRONMENTAL ENGINEERING

ANALYZING PSYCHOSTIMULANT USE IN THE CARNEGIE MELLON STUDENT POPULATION

STUDENTS Kevin Handerhan *Social & Decision Sciences* | Andrew Klein *Civil and Environmental Engineering* | Luke Racek *Economics* | Peter Satagaj *Mathematics* | Won Woo Sohn *Economics*

ADVISORS Trent Gaugler *Statistics* | Tracy Sweet *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

In general, performance-enhancing drugs are a sensitive and controversial issue. The most pervasive coverage of this in popular media deals with drugs used by professional and amateur athletes to improve their athletic performance. However, there is rarely coverage of so-called “academic” drugs, such as amphetamines, which are ubiquitous on college campuses in America. The use of these drugs, often without a legal prescription, is mysterious and students have many different opinions on the ethicality of their use and the potential benefits and risks one assumes when consuming them. This topic is particularly interesting at Carnegie Mellon because many Carnegie Mellon students believe that the university’s stressful and strenuous academic environment may incentivize, or even necessitate for some, the use of psychostimulants to maintain good course grades and secure a sound financial future. Studying the CMU student population’s relationship with psychostimulants, both legally and illegally consumed, through voluntary surveys may help us to discover revealing information about the state of the academic environment.

DESIGN AND MANUFACTURE OF HIGH EFFICIENCY HULLS FOR SOLAR POWERED BOATS

STUDENTS Kathryn Davis *Mechanical Engineering* | Thomas Eliot *Electrical & Computer Engineering* | Irene Lee *Mechanical Engineering* | Peter McHale *Physics* | Allen Miller *Mechanical Engineering* | Alexander Warzinski *Civil and Environmental Engineering* | Patricia Xu *Materials Science Engineering*

ADVISORS Susan Finger *Civil and Environmental Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Solar-powered boats offer a novel opportunity to replace nonrenewable petroleum products with renewable energy. Although solar energy is plentiful, it is difficult to use efficiently. One way to increase efficiency is to minimize water resistance on the hull. Hull resistance can be analyzed and minimized through the use of computational fluid dynamics analysis. After a hull shape is chosen, it is important to construct the hull so that it can resist the various forces it is subject to in the water. Carbon fiber and core materials can be used to reinforce the hull with a higher strength-to-weight ratio than traditional fiberglass layup. The research group used CFD analysis to create a set of hulls to test as scale models. Different combinations of core material, fiberglass, and carbon fiber were implemented in model hulls and stress-tested. Stress testing results and an analysis tank were used to determine an ideal hull with high strength, low resistance, and reasonable cost. These results will be presented at the Meeting of the Minds Symposium.

E RECYCLING AND RARE EARTH ELEMENT REUSE

STUDENTS Sophie Grodsinsky *Civil and Environmental Engineering* | Marissa Morales *Chemical Engineering* | Annette Ritchie *Materials Science Engineering*

ADVISORS Kelvin Gregory *Civil and Environmental Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The ultimate question that we hope to answer with this research project is to identify the most feasible, cost effective, and efficient way to recycle and reuse rare earth elements to be extracted from used electronics and other devices. When China, the world's leading exporter, closed its borders to rare earth element trade, the United States along with many other countries was forced to find other means of obtaining these critical materials in order to maintain production. The U.S. Department of Energy has begun to develop a critical materials strategy, which includes support of possible rare earth element recycling using retired electronics. Professor Kelvin Gregory will support this research team in doing an on campus survey of Carnegie Mellon policies regarding retired electronics as well as a feasibility study of all current possible methods to recycle the critical elements within these electronics to be used again. By coming up with our own strategy regarding electronic recycling and rare earth metal reuse, we can then share that information with other universities, companies, and organizations to decrease the U.S. need for imported critical elements.

EXPLORING VOLUNTARY CARBON OFFSETS AT CARNEGIE MELLON

STUDENTS William Elmore *Civil and Environmental Engineering*

ADVISORS Deanna Matthews *Engineering and Public Policy*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 11:25 am

Climate change has become today's most impending and widespread environmental danger. Though most communities lack a solution that singlehandedly manages carbon emissions and related processes, many have developed a diverse portfolio of strategies to minimize their carbon footprint. One of these strategies increasingly used in Western nations is carbon offsetting. Carbon offsetting is the allocation of money to counteract carbon emissions. This research involved determining the willingness of Carnegie Mellon University community members to pay to offset emissions resulting from their personal vehicle use. Questions involving commute frequency, environmental philosophy, blind and informed willingness to pay, and preferred methods of carbon mitigation were compiled in a survey for distribution to individuals near campus parking facilities. Preliminary results indicate that the blind willingness to pay of subjects was, on average, far greater than necessary. Even after being informed about how much it costs to offset carbon emissions, participants were on average willing to pay more than necessary. Additional work on assessing the data is planned for the coming months, and a formal paper will be compiled upon its completion.

HAZELWOOD LTV BROWNFIELD CASE STUDY

STUDENTS Alejandra Mendoza *Civil and Environmental Engineering*

ADVISORS Chris Hendrickson *Civil and Environmental Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

Successful redevelopment of brownfield sites, which are commonly defined as idle or abandoned post-industrial properties, can play a critical role in initiating reinvestment and economic revitalization for surrounding neighborhoods. The 178-acre LTV Steel brownfield site in Hazelwood, Pa is one of the last

undeveloped riverfront brownfields in the city of Pittsburgh. This case study identifies and explores possible barriers to sustainable redevelopment for the Hazelwood LTV site. Examination of local crime rates, unemployment, and the current road infrastructure highlights factors that could complicate redevelopment for the LTV site. The primary results of this work show that while many of the site characteristics do not inhibit successful redevelopment, the current road infrastructure could delay progress. This research establishes a more comprehensive and updated context for redevelopment at the site and could inform future development initiatives at other sites. This case study could also lead to further research comparing successful sites and Hazelwood to quantify the significance of the discussed disadvantages.

IMPLEMENTING A STORMWATER SUSTAINABILITY RATINGS SYSTEM FOR DISTRESSED AND VACANT URBAN PROPERTIES

STUDENTS Sarah Ramp *Civil and Environmental Engineering*

ADVISORS Chris Hendrickson *Civil and Environmental Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

Sustainability ratings systems (SRS), such as LEED or Green Globes, incentivize individual, commercial, industrial, and institutional investment in sustainable building practices. Many SRS reward “green” stormwater management practices through accreditation for water efficiency or minimal hydrologic impact; however, the existing ratings systems are largely connected with buildings, and there is no ratings system that focuses solely on stormwater management investments. In cities with combined stormwater-sanitary sewer outflow, stormwater management is a critical human safety, economic, and environmental health issue that warrants specific attention. The existing SRS ignore the stormwater management of vacant or distressed urban properties, such as brownfields, that will not be redeveloped with buildings. Therefore, this paper proposes a new stormwater SRS that can be applied to any property, synthesized from two prominent, national SRS and from several progressive municipal stormwater management programs. A site must satisfy a weighted combination of the following three objectives to qualify for stormwater SRS accreditation: (1) runoff quantity reduction, (2) runoff quality improvement, and (3) potable water consumption reduction. The weighted combinations of objectives necessary for accreditation vary depending upon each site’s characteristics and major risks; for example, runoff quality is much more critical for a brownfield site than for a comparable greenfield site. Finally, this new stormwater SRS is applied to two sites in Pittsburgh, Pennsylvania: (1) a community farm located on 25 abandoned residential lots and (2) a new 12-acre residential/commercial development. Economic impact analysis with respect to best management practices is performed for each case study. This paper ultimately proposes a stormwater SRS that can be adapted and implemented by municipalities to reduce the costs of stormwater runoff from vacant and distressed properties by incentivizing localized sustainable stormwater infrastructure.

PLASTIC THATCH PROJECT

STUDENTS Joel Accorsi *Mechanical Engineering* | Craig Boman *Civil and Environmental Engineering* | Corinne Clinch *Civil and Environmental Engineering* | Seth Cordts *Mechanical Engineering* | Zachary Dawson *Electrical & Computer Engineering* | Eric Desnyder *Mechanical Engineering* | Madelyn Gioffre *Civil and Environmental Engineering* | Kyra Gould *Mechanical Engineering* | Yoon Hee Ha *Mechanical Engineering* | Veronica Jaime-Lara *Mechanical Engineering* | Benjamin Paren *Materials Science Engineering* | Deepak Ravi *Mechanical Engineering* | Minghui Zhang *Chemical Engineering*

ADVISORS Larry Cartwright *Civil and Environmental Engineering*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

The Plastic Thatch Project aims to convert waste plastic bottles into reusable plastic material by developing a semi-automated manufacturing process. The knowledge from this research could benefit current plastic sorting techniques or prompt successful reuse of other waste materials. A successful plastic reuse machine will allow communities in developing countries to process and transport plastic bottle waste. Low cost plastic material will act as a catalyst for small business enterprises in roofing and other endeavors, such as greenhouse material. The work has been divided into three design groups: hopper/sorter, fusing section, and thatch cutting. Our research consists of prototyping until a full scale model is functional as a whole machine. Through this research, the students involved will gain valuable experience in efficient project management, rapid prototyping, and applying engineering skills to real-world issues.

REGIONAL ECONOMIC IMPACT OF THE TWIN RIDGES WIND FARM

STUDENTS Elissa Goldner *Civil and Environmental Engineering* | Agnieszka Marszalik *Civil and Environmental Engineering*

ADVISORS Paul Fischbeck *Social & Decision Sciences* | Paulina Jaramillo *Engineering and Public Policy*

ROOM/TIME Rangos 2&3/Sigma Xi Group 9 / 10:00 am

With rising growth of the wind power and natural gas sectors, many studies have been published containing economic multipliers that can be used to quantify the regional economic impacts of energy development. This project consists of an analysis of the economic impacts of the Twin Ridges Wind Farm, a wind plant that was recently built on the border of PA and MD. Three types of economic input-output models were used to analyze the impact of the construction of this wind farm: RIMSII, IMPLAN, and JEDI. The multipliers derived from the three models can be used to compare the investment in wind energy in rural areas to investment in natural gas or oil. Because these models make several assumptions about industry, interregional transactions, and economies of scale, field surveys of the construction crew, business owners in the surrounding communities, and land owners were conducted to correct for models overestimation. The use of survey data to correct assumptions in EIO models produced results that more accurately represent the true economic impact of the construction of the Twin Ridges Wind Farm while challenging the inflated multipliers produced by similar studies. While economic multipliers were found to decrease as assumptions were corrected, the more accurate multipliers can still be used as an incentive for future development of wind power in rural areas.

THE ALISAN SCHOOL: SUSTAINABLE LEARNING ENVIRONMENTS IN OFFA, NIGERIA

STUDENTS Christopher Chan *Architecture* | Richa Date *Architecture* | Katherine Marino *Architecture* | Harris Mazur *Architecture* | Melissa Mohrenweiser *Civil and Environmental Engineering* | Hannah Schmitt *Architecture* | Dan Sztanga *Architecture*

ADVISORS Azizan Abdul-Aziz *Architecture* | Stephen Lee *Architecture*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

In response to an impoverished rural Nigerian community with plans for a new school, we have proposed an initial design for a sustainable school complex. This design serves as a teaching tool for environmental construction techniques that address the local resources, climate, and culture of the area. Currently the primary building material in the area is concrete, which is costly and has a large carbon footprint. Other building materials include items imported from other countries, like China, which is costly and takes a lot of time. In response, we propose earth brick construction based on its local abundance and thermal properties. This real design scenario has served as an academic exploration in vernacular construction as well as an experience working with a client.

ELECTRICAL & COMPUTER ENGINEERING

ADAPTING RAIL GUN THEORY TO CONSTRUCT A STABLE STATIC MAGNETIC FIELD ELECTRIC MOTOR

STUDENTS Mikio David *Mechanical Engineering* | Nidhi Doshi *Electrical & Computer Engineering* | Viswa Tej Koganti *Electrical & Computer Engineering*

ADVISORS Cecil Higgs *Mechanical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 10:00 am

How to make produce a stable, powerful, and robust electric motor? This project constructed an electric motor based on principles of electromagnetic acceleration. Along with the motor, a capacitor bank power supply was constructed. The designs focused on stability of current pulse of the power supply and the structural integrity of the motor. This motor has the potential to be used in modern electric cars in order to provide cheaper more efficient methods of transportation.

AN EVALUATION OF THE EFFECTIVENESS OF CAREER FAIRS AT CARNEGIE MELLON UNIVERSITY

STUDENTS Robert Eckels *Statistics* | Alex Klarfeld *Electrical & Computer Engineering* | Soham Sengupta *Economics and Statistics* | Shreepal Shah *Computer Science* | Jonathan Yu *Statistics*

ADVISORS Trent Gaugler *Statistics* | Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

A primary reason that many students come to Carnegie Mellon University is to improve their prospects of gaining better employment opportunities. The university provides various resources for students to be in touch with potential employers. The career fair is a prime example. Events such as the Employment Opportunity Conference, Business Opportunity Conference, and Technology Opportunity Conference are staples of the academic year. Through our research and analysis, we attempt to understand how effective career fairs are in their purpose to match students with employers. In our research, we control for how qualified a student is and other aspects of the student, to see if career fairs really do help a student's job search. Our research focuses just on the success of undergraduate students.

BUGGY TECHNOLOGY DEVELOPMENT

STUDENTS Gerald Carlson *Mechanical Engineering* | Kellen Chow *Mechanical Engineering* | Elise Everett *Computer Science* | Philip Garrison *Electrical & Computer Engineering* | Connor Hayes *Undecided* | Amy Hung *Mathematics* | Nathaniel Jeffries *Electrical & Computer Engineering* | Preston Ohta *Mechanical Engineering* | Glenn Philen *Mechanical Engineering* | Anibal Pichardo *Mechanical Engineering* | Rachael Schmitt *Undecided* | Guochen Shen *Mechanical Engineering* | James Snyder *Mechanical Engineering* | Patricia Xu *Materials Science Engineering* | Sophia Zikanova *Electrical & Computer Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The goal of this SURG is to improve the performance and safety of buggies (vehicles that compete in CMU's annual Sweepstakes races) by exploring modifications to existing technology as well as developing novel designs. This SURG, which will be focused on Mechanical Engineering design and analysis, will provide an excellent hands-on educational experience to all members involved.

DANGER AREA MARKING USING A LOW-COST ROBOT COLONY

STUDENTS Julian Binder *Electrical & Computer Engineering* | Priyanka Deo *Computer Science* | Yuyang Guo *Computer Science* | Ruben Markowitz *Drama* | Thomas Mullins *Electrical & Computer Engineering* | Rachael Ortega *Mechanical Engineering* | Peyton Randolph *Computer Science* | Matthew Sebek *Electrical & Computer Engineering* | Brent Strysko *Electrical & Computer Engineering* | Patricia Xu *Materials Science Engineering* | Alexander Zirbel *Computer Science*

ADVISORS George Kantor *Robotics Institute*

ROOM/TIME Wright / 12:00 pm

One of the biggest challenges to developing countries are explosive remnants of war (ERWs). ERWs create a structural barrier to development and growth of the area long after war ends. The United Nations Mine Action Centre spends an enormous amount of effort conducting danger area marking (DAM) operations, with an estimated 127 million land mines in as many as 88 countries. Currently, such operations are performed manually, at significant risk to human lives. The Colony Project proposes to create a low cost autonomous team of robots that can help humanitarian efforts to detect and remove these dangers.

DESIGN AND DEVELOPMENT OF THERMOCOUPLE AND FUEL CELL CARS

STUDENTS Katia Bazzi *Chemical Engineering* | Jonathan Berman *Chemical Engineering* | Madison Calhoun *Chemical Engineering* | Anusha Chinthaparthi *Chemical Engineering* | Alisa De Bruyn Kops *Chemical Engineering* | Onyenma Enwereji *Undecided* | Alexandra Frankel *Chemical Engineering* | Stephen Greco *Electrical & Computer Engineering* | Dennis Guo *Chemical Engineering* | Sam Klein *Chemical Engineering* | Joshua Kubiak *Materials Science Engineering* | Rebecca Lui *Chemical Engineering* | Ishan Nag *Chemical Engineering* | Kaitlyn Nowak *Chemical Engineering* | Sanjana Padmanabhan *Chemical Engineering* | Allison Perna *Chemical Engineering* | Yijie Qiu *Chemical Engineering* | Anand Sastry *Chemical Engineering* | Stephen Scannell *Chemical Engineering* | Wooram Seok *Chemical Engineering* | Joseph Whitmore *Chemical Engineering* | Patrick Xia *Undecided* | Amy Yuan *Chemical Engineering*

ADVISORS James Miller *Chemical Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

The purpose of this project is to prepare two cars for the AIChE Chemical Engineering Car Regional Competition hosted in New Jersey April of 2013. Two cars will be simultaneously entered in competition by Carnegie Mellon. The car that performs the best will compete at the National Competition in San Francisco in Fall of 2013. The Chemical Engineering Car Competition is a national, collegiate competition sponsored by the American Institute of Chemical Engineers (AIChE). It is based on the challenge of designing and building a model-sized car that

is powered by a chemical reaction. The car must stop at a distance between 50 and 100 feet and carry a load of water. Both the distance and load are specified on the day of the competition. The competition is designed to give student engineers the opportunity to apply their knowledge to a design project and to gain research experience. It also gives students an opportunity to meet with other students across the country, share ideas, and network. Two separate cars will be prepared for the competition. The first car will be powered by a thermocouple and an exothermic reaction with a bimetallic strip-based stopping mechanism and the second car will be powered by a hydrogen fuel cell with a pressure-syringe-based stopping mechanism. In October 2011, the team placed 5th out of the 33 best teams throughout the United States at AIChE's National Competition. Our goal is to again perform well at the 2013 Regional Competition to qualify for the following National Competition.

DESIGN AND MANUFACTURE OF HIGH EFFICIENCY HULLS FOR SOLAR POWERED BOATS

STUDENTS Kathryn Davis *Mechanical Engineering* | Thomas Eliot *Electrical & Computer Engineering* | Irene Lee *Mechanical Engineering* | Peter McHale *Physics* | Allen Miller *Mechanical Engineering* | Alexander Warzinski *Civil and Environmental Engineering* | Patricia Xu *Materials Science Engineering*

ADVISORS Susan Finger *Civil and Environmental Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Solar-powered boats offer a novel opportunity to replace nonrenewable petroleum products with renewable energy. Although solar energy is plentiful, it is difficult to use efficiently. One way to increase efficiency is to minimize water resistance on the hull. Hull resistance can be analyzed and minimized through the use of computational fluid dynamics analysis. After a hull shape is chosen, it is important to construct the hull so that it can resist the various forces it is subject to in the water. Carbon fiber and core materials can be used to reinforce the hull with a higher strength-to-weight ratio than traditional fiberglass layup. The research group used CFD analysis to create a set of hulls to test as scale models. Different combinations of core material, fiberglass, and carbon fiber were implemented in model hulls and stress-tested. Stress testing results and an analysis tank were used to determine an ideal hull with high strength, low resistance, and reasonable cost. These results will be presented at the Meeting of the Minds Symposium.

ESTIMATING THE HUBBLE TELESCOPE ACS POINT SPREAD FUNCTION THROUGH STATISTICAL METHODS

STUDENTS Shiyao Gan *Business Administration* | Nicholas Thieme *Statistics* | Yunhao Yang *Electrical & Computer Engineering*

ADVISORS William Eddy *Statistics*

ROOM/TIME Kurr Commons-1st Floor, Window side / 12-2:30 pm

In this work we attempt to estimate the point spread function of the Hubble Telescope's Advanced Camera for Surveys; Wide Field Channel using images of (only) stars as an estimate of the PSF. We used two primary approaches, one using parametric statistical techniques from the exponential family, and another using a combination of non-parametric statistics (in the form of smoothing splines) combined with techniques from the field computer vision.

GPU ACCELERATION OF ROBOTIC MOTION PLANNING.

STUDENTS Collin Buchan *Electrical & Computer Engineering*

ADVISORS Chris Atkeson *Robotics Institute*

ROOM/TIME Rangos 1 / 12-2:30 pm

The research explores the parallelization of gradient descent techniques for optimizing Newton-Euler dynamics. Newton-Euler dynamics describe both the translational and rotational dynamics of the robotic system, and minimizing the cost of motion is an important consideration for robot control. The application seeks to compute as many trajectories and their relative costs as possible, and store the results in a lookup table for the robot to quickly reference during real-time operation.

GPU OPTIMIZATIONS OF A MONTE CARLO FRAMEWORK FOR PROBABILISTIC LOAD FLOW APPLICATIONS

STUDENTS Kee Young Lee *Electrical & Computer Engineering*

ADVISORS Franz Franchetti *Electrical & Computer Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

We developed a GPU implementation of a framework for Monte Carlo simulation of distribution networks. The application is to solve probabilistic load flow problems in real time to cope with uncertainties in the power grid.

HAMR NSOM RESEARCH

STUDENTS David Chow *Electrical & Computer Engineering*

ADVISORS James Bain *Electrical & Computer Engineering*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

I will calibrate a new near-field apertureless scanning optical microscope (NSOM). This calibration will be done with known optical sources, like single mode fibers in order to establish the sensitivity and resolution of the technique. Ultimately this technique is envisioned for use in the measurement of near field optical transducer (NFT) efficiency and mode structure. NFT's are used in heat assisted magnetic recording (HAMR) and the characterization of these devices is critical for developing functioning HAMR systems. Specifically, in this work, I will collect NSOM images of light emitted by single mode optical fibers and quantitatively compare the measurements to the theory of expected optical mode. Additionally, I will help assess the signal to noise ratio as a function of optical power level. As time permits, I will assist with modifying the fixturing of the microscope to hold NFT devices and achieve illumination of them.

HEAVY SHOES EXPERIMENTATION

STUDENTS Joshua Caputo *Electrical & Computer Engineering* | Mark Erazo *Mechanical Engineering* | Steven Pepin *Mechanical Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

The purpose of this project is to test the assumption that people prefer to walk in the most metabolically efficient way possible. To accomplish this purpose we created a set of weighted and unweighted shoes to be worn to track and record data on how often and how much a person walked in each. Using this data, we hope to

show scientifically that people will and do adapt to changing walking conditions by changing the way in which they choose to walk.

JOINT LOGIC RESTRUCTURING AND PIN REORDERING AGAINST PBTI AND NBTI INDUCED DEGRADATION IN 22NM TECHNOLOGIES

STUDENTS Niharika Singh *Electrical & Computer Engineering*

ADVISORS Diana Marculescu *Electrical & Computer Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 8 / 10:00 am

Negative Bias Temperature Instability (NBTI), a PMOS aging phenomenon and Positive Bias Temperature Instability (PBTI), its NMOS counterpart, cause significant loss on circuit performance and lifetime. Aggressive technology scaling trends, such as thinner gate oxides without proportional downscaling of supply voltages, necessitate a design optimization flow considering BTI effects at the early stages. In this paper, we present a novel framework using joint logic restructuring and pin reordering for BTI-induced performance degradation. Based on functional symmetries and transistor stacking effects, the proposed methodology involved only wire perturbation and introduces no gate area overhead at all. Simulation results are used to predict the improvements this can cause in circuits using 22nm technology with regards to delay. Moreover, our methodology reduces the number of critical transistors still under severe BTI. Transistor resizing can also be used as a post-processing procedure to further mitigate BTI effects with insignificant area overhead.

LOW-LEVEL POSITION CONTROL FOR OMNI-DIRECTIONAL BASES IN A MANUFACTURING ENVIRONMENT

STUDENTS Neil Abcouwer *Electrical & Computer Engineering*

ADVISORS Howie Choset *Robotics Institute*

ROOM/TIME Rangos 1 / 12-2:30 pm

Manufacturing relies on fixed elements, called “monuments” for assembly lines. This allows for precision in the process but this lacks flexibility for reconfiguration of the line. An alternative is mobile robotic bases to replace these monuments. For these bases, position tracking is critical to maintain precision. This presentation outlines efforts to create precise movement tracking to track omni-directional bases in intervals between global localization routines.

MECHANICAL LOGIC

STUDENTS Spencer Barton *Electrical & Computer Engineering* | Connor Brem *Computer Science* | Steven Cunningham *Mechanical Engineering* | David Lu *Electrical & Computer Engineering* | Rudina Morina *Undecided* | Corinne Vassallo *Music*

ADVISORS James C. Hoe *Electrical & Computer Engineering*

ROOM/TIME Class of '87/12:20 pm (Oral Session)

Kirr Commons-1st Floor, Window side / 3-5 pm (Poster Session)

Boolean logic, the math of true/false or 1/0 values, forms the foundation of many important operations experienced in daily life. This project seeks to demystify basic Boolean logic through the use of mechanical logic gates as a teaching tool for high school students. We will construct a series of push-pull logic gates that will model basic Boolean math operations such as AND, OR, NOT and XOR (exclusive OR). Utilizing these units, we will then teach students the fundamentals of Boolean logic and demonstrate how powerful this concept can

be. Through these education tools and lessons, we hope to interest high school students in Boolean logic and its application in electrical and computer engineering.

MIDI VIOLIN

STUDENTS David Lu *Electrical & Computer Engineering*

ADVISORS Roger Dannenberg *Computer Science*

ROOM/TIME McConomy Auditorium / 12:00 pm

The violin is a musical instrument with substantial expressive potential. In recent times, music technology has allowed musicians to perform and produce music on computers using digital musical instruments, eg a MIDI keyboard. However, there is (currently) no widely available violin-like digital instrument that fulfills the practical needs of a modern violinist. In this project, I designed and built a MIDI violin that is robust, intuitive, and expressive, to fulfill these practical needs.

MULTI ROBOT THREAT DETECTION

STUDENTS Philip Etling *Electrical & Computer Engineering*

ADVISORS Manuela Veloso *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

I worked with Manuela Veloso on her Coral Small Size Robotics team. I worked on designing a new defensive play for the team. I had to do two main things: 1. I had to design an evaluation system which would determine which robots are the biggest threat based on where the ball and the where the closest robot to the ball are located. 2. I had to use this evaluation system to positions two sets of robots. 1. Two are positioned between the closest robots and the biggest threats. 2. Two are used to help defend the goal.

NEURON BEHAVIORAL MODELING FOR ELECTRODE AND ELECTRONIC CO-SIMULATION

STUDENTS Michael Kellman *Electrical & Computer Engineering*

ADVISORS Peter Gilgunn *Electrical & Computer Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

Objective Modern engineering design processes include hierarchical system level modeling and simulation to validate designs prior to the expensive process of fabrication. In this project, behavioral models of a neuron, the extracellular matrix, extracellular space and an implantable electrode that records the output of the neuron, or stimulates the neuron electrically, will be started. A look will be taken at the construction of the classic Hodgkin and Huxley model and Fitzhugh and Nagumo model.

OPTIMAL INVESTMENT IN INCOMPLETE MARKET WITH THE USE OF DOUBLE BINOMIAL MODEL

STUDENTS Shirui Hu *Mathematics* | Tian Kang Lim *Electrical & Computer Engineering*

ADVISORS William Hrusa *Mathematics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 10:48 am

In this project, we use double binomial model, which is an extended model of binomial model, to study the optimal investment strategy in an incomplete market. Mathematically, an incomplete market is a system in

which the number of stocks or derivatives is less than the number of possible states. We will try different utility functions and also investigate the relationship to the mean variance analysis.

OPTIMIZATION OF SLURRY MODELING SOFTWARE

STUDENTS Brian Duff *Electrical & Computer Engineering*

ADVISORS Cecil Higgs *Mechanical Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

Slurries, a watery mixture of a liquid and small particles, have become increasingly important in recent years especially with the advent of chemical-mechanical planarization (CMP) of silicon wafers. With this increased popularity has come an increased desire for accurate models of this process. However, due to the particle nature of these systems, algorithms are often $O(n^2)$ and therefore too slow for simulations of real world situations. Two different pieces of software were adapted in an attempt to facilitate more rapid modeling.

PENOPTES - CROWD SOURCED EMBEDDED AUTOMOTIVE SYSTEMS

STUDENTS Torstein Stromme *Electrical & Computer Engineering*

ADVISORS Kunal Mankodiya *Electrical & Computer Engineering* | Priya Narasimhan *Electrical & Computer Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

The project aims to crowd-source sensory information from vehicles in order to provide updated and accurate information about road- and weather conditions, such as potholes and air pollution.

PICOCTF 2013

STUDENTS Garrett Barboza *Electrical & Computer Engineering* | John Davis *Computer Science* | Ryan Goulden *Computer Science* | Tyler Nighswander *Computer Science*

ADVISORS David Brumley *Electrical & Computer Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

picoCTF is a computer security competition for high school students. The competition is a series of challenges centered around a unique storyline where participants must reverse engineer, break, hack, decrypt, or do whatever it takes to solve the challenge. The challenges are all set up with the intent of being hacked, making it an excellent, legal way to get hands-on experience. picoCTF 2013 is the first of hopefully multiple picoCTF events.

PLASTIC THATCH PROJECT

STUDENTS Joel Accorsi *Mechanical Engineering* | Craig Boman *Civil and Environmental Engineering* | Corinne Clinch *Civil and Environmental Engineering* | Seth Cordts *Mechanical Engineering* | Zachary Dawson *Electrical & Computer Engineering* | Eric Desnyder *Mechanical Engineering* | Madelyn Gioffre *Civil and Environmental Engineering* | Kyra Gould *Mechanical Engineering* | Yoon Hee Ha *Mechanical Engineering* | Veronica Jaime-Lara *Mechanical Engineering* | Benjamin Paren *Materials Science Engineering* | Deepak Ravi *Mechanical Engineering* | Minghui Zhang *Chemical Engineering*

ADVISORS Larry Cartwright *Civil and Environmental Engineering*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

The Plastic Thatch Project aims to convert waste plastic bottles into reusable plastic material by developing a semi-automated manufacturing process. The knowledge from this research could benefit current plastic

sorting techniques or prompt successful reuse of other waste materials. A successful plastic reuse machine will allow communities in developing countries to process and transport plastic bottle waste. Low cost plastic material will act as a catalyst for small business enterprises in roofing and other endeavors, such as greenhouse material. The work has been divided into three design groups: hopper/sorter, fusing section, and thatch cutting. Our research consists of prototyping until a full scale model is functional as a whole machine. Through this research, the students involved will gain valuable experience in efficient project management, rapid prototyping, and applying engineering skills to real-world issues.

PROJECT METIS

STUDENTS Job Bedford *Mechanical Engineering* | Connor Brem *Computer Science* | Jenna MacCarley *Electrical & Computer Engineering* | William Maynes *Computer Science* | Peter McHale *Physics* | Audrey Yeoh *Electrical & Computer Engineering*

ADVISORS David Kosbie *Computer Science*

ROOM/TIME Rangos 2&3/Sigma Xi Group 8 / 10:13 am

We aim to create a new kind of programming curriculum and the tools for that curriculum. Our project's aims are the following:

- To create a syntax free programming language and IDE based on MIT's scratch program
- To have an android app that will allow you to write such code from a mobile phone or tablet
- To allow students to write code which offers a real world result from their code which can be tested efficiently in a classroom setting.

We believe such a curriculum will raise excitement over programming upfront when students see the physical results of their code and will allow students to focus on learning programmatic logic without the pains of syntax in the beginning. We also believe that such an attitude toward computer education has the potential to make a dramatic change in the United States STEM education system. The tools for our curriculum include a robot to be controlled, a 4' X 4' physical auto-grading sensor array, and an application that can be ported to a phone or a tablet to write and save drag-and-drop code.

QUANTUM DOT MICRODISK LASERS FOR HAMR

STUDENTS Evan Quirk *Electrical & Computer Engineering*

ADVISORS James Bain *Electrical & Computer Engineering* | Yi Luo *Electrical & Computer Engineering* | Ed Schlesinger *Electrical & Computer Engineering*

ROOM/TIME Rangos 1 / 10:00 am-12:00 pm

Heat Assisted Magnetic Recording (HAMR) hard drives are currently an active topic of research as a next generation storage technology. HAMR offers increased storage density over current generation hard drives, but presents a number of technical challenges. In HAMR a laser is used to heat a small area on a hard drive platter, changing its magnetic properties. A recent proposal has made the case for integrating near field transducers with microcavity lasers for use as HAMR heating sources. I present the findings of my research performing photoluminescence spectroscopy on quantum dot microdisk lasers.

SCOTTIE DOCK: A MOBILITY ASSIST DEVICE FOR MANUAL WHEELCHAIR USERS

STUDENTS Adewale Desalu *Electrical & Computer Engineering* | Brooke Gladstone *Materials Science Engineering* | Sohini Roy *Materials Science Engineering* | Andre Sutanto *Mechanical Engineering* | Ramyata Upmaka *Materials Science Engineering*

ADVISORS Mark Friedman *Biomedical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 10:00 am

As part of the Biomedical Engineering Design (BME) course (42-401), our group is interested in designing a manual wheelchair assist device. Currently, standard manual wheelchairs are cost-effective but a difficult form of transportation for independent, mobility-impaired individuals. The only mainstream alternative is an expensive and heavy power wheelchair. With Professor Friedman as our academic advisor, we aim to create an assist device ("Scottie Dock") whereby the manual wheelchair will be docked onto a platform that is attached to a motorized scooter. Additional features may be added to the scooter-platform system to enable backward movement, speed control, and an emergency stop mechanism. This device has the potential to make transportation for manual wheelchair users significantly easier at a fraction of the cost of a power wheelchair. Our targeted market is the elderly in nursing homes, rehabilitation facilities, and assisted living developments where this device can be used as a shared, inexpensive, resource. While we will be able to receive some funding from the BME department, additional funding from the SURG grant will significantly increase our ability to successfully design, build, and test several iterations before the end of the Spring 2013 semester.

SINGLE PARTICLE COEFFICIENT OF RESTITUTION AND MULTI-PARTICLE GRANULAR FLOW STUDIES USING THE EXPLICIT FINITE ELEMENT METHOD

STUDENTS Gautham Nagaraju *Electrical & Computer Engineering*

ADVISORS Cecil Higgs *Mechanical Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

Solids and fluids are well understood in the field of mechanical engineering. Granular flows, however, have been much harder to understand and predict as they exhibit multi-phase behavior, as both a solid and a liquid. The study of granular flow behavior in rough, loaded sliding contacts is of particular importance in several industries including pharmaceuticals, fossil-fuel energy, and solids processing. In this work, granular flows between relative sliding contacts are examined through both computer modeling using the explicit finite element modeling (FEM) method (via LS-DYNA software) and "bearing" experiments using the granular shear cell (GSC). Another important aspect of granular flow studies is understanding interactions at the individual particle level through parameters such as the coefficient of restitution (COR). As such, this work had two main goals. First, investigations were performed to optimize COR calculations obtained via explicit FEM in LS-DYNA. Two approaches for calculating COR were attempted. The first used the traditional approach of dropping a ball (granule) from a fixed height, and the second used terminal velocity instead of height to calculate COR. It was determined that the approaches gave similar COR results, but the second approach turned out to be much more computationally efficient. Second, a code was developed which allows researchers to seed an arbitrary number of granules into a full scale explicit FEM simulation of the GSC in LS-DYNA. This code eliminates the need to manually create multiple granules using the LS-DYNA software and automates the process. This code can also be easily extended to other FEM particle flow applications.

TAGGLE CLOUD

STUDENTS Elena Feldman *Electrical & Computer Engineering*

ADVISORS Ananda Gunawardena *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

Taggle cloud is a way to connect people who may benefit by collaborating with those who have similar interests. Taggle cloud will consists of a web based mobile app. Taggle cloud uses interest profiles (eg: project abstracts) to automatically find potential matches in a given conference setting.

THE EFFECT OF DIGITAL REPLICATION ON EMOTIONAL ATTACHMENT TO PHYSICAL OBJECTS

STUDENTS Christopher Ioffreda *Design* | Beth Katz *Electrical & Computer Engineering*

ADVISORS Aisling Kelliher *Design*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

This research examines the difference between owning an original possession versus owning a duplicate of the same object. This study compared the emotional attachment subjects felt to the original instance of an object versus a replica. This research was conducted to study the future application of moving physical possessions online with the ability to later 3D print exact replicas of that object.

MATERIALS SCIENCE ENGINEERING

BONDING ALUMINUM AND CARBON FIBER TO MANUFACTURE LIGHTWEIGHT RACECAR PARTS

STUDENTS Korey Haug *Mechanical Engineering* | Joshua Kubiak *Materials Science Engineering* | Brian Langone *Mechanical Engineering*

ADVISORS Satbir Singh *Mechanical Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

A critical factor in the design of all racecar parts is weight. Keeping weight to a minimum enhances both performance and efficiency. However, trimming weight normally comes at the expense of losing strength. This is an issue because a racecar must be able to withstand significant force on its parts during sharp cornering. Carbon fiber presents a potential solution to this dilemma because of its high strength to weight ratio. But, traditionally, carbon fiber parts have not been used in high stress applications in the Carnegie Mellon Racing (CMR) Formula SAE vehicle or vehicles in general. Carbon fiber is difficult to use on its own in two-force members and other structural components because fittings on carbon fiber parts are prone to splitting and fracture causing failure which makes interfacing the parts with the rest of the car difficult. As a way of circumventing this issue, the Carnegie Mellon Racing team investigated the possibility of binding aluminum inserts to carbon fiber tubes to create parts such as pull rods, tie rods, and turnbuckles. Not much work has been done creating automobile parts in this manner, although similar applications have been used in bicycles and aircraft. The CMR team then adapted this technology for application in their newest Formula SAE car.

The two main issues with the fabrication of these parts are ensuring that the metal and carbon fiber do not separate and preventing the cathodic corrosion of the aluminum when it is brought into contact with the carbon fiber, both of which would cause unexpected and catastrophic failure. Different combinations of metal, epoxy, insulation, and geometry were used to create test samples resembling pull rods to determine which combinations are best suited to the creation of automobile parts. The tensile strengths of the samples were tested on Instron machines both before and after an accelerated corrosion treatment, and the most promising samples were further developed into a final product. These parts are applicable not only in CMR racecars, but also in consumer vehicles where fuel efficiency is a concern and parts are often exposed to corrosive conditions due to road deicing.

BUGGY TECHNOLOGY DEVELOPMENT

STUDENTS Gerald Carlson *Mechanical Engineering* | Kellen Chow *Mechanical Engineering* | Elise Everett *Computer Science* | Philip Garrison *Electrical & Computer Engineering* | Connor Hayes *Undecided* | Amy Hung *Mathematics* | Nathaniel Jeffries *Electrical & Computer Engineering* | Preston Ohta *Mechanical Engineering* | Glenn Philen *Mechanical Engineering* | Anibal Pichardo *Mechanical Engineering* | Rachael Schmitt *Undecided* | Guochen Shen *Mechanical Engineering* | James Snyder *Mechanical Engineering* | Patricia Xu *Materials Science Engineering* | Sophia Zikanova *Electrical & Computer Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The goal of this SURG is to improve the performance and safety of buggies (vehicles that compete in CMU's annual Sweepstakes races) by exploring modifications to existing technology as well as developing novel designs. This SURG, which will be focused on Mechanical Engineering design and analysis, will provide an excellent hands-on educational experience to all members involved.

DANGER AREA MARKING USING A LOW-COST ROBOT COLONY

STUDENTS Julian Binder *Electrical & Computer Engineering* | Priyanka Deo *Computer Science* | Yuyang Guo *Computer Science* | Ruben Markowitz *Drama* | Thomas Mullins *Electrical & Computer Engineering* | Rachael Ortega *Mechanical Engineering* | Peyton Randolph *Computer Science* | Matthew Sebek *Electrical & Computer Engineering* | Brent Strysko *Electrical & Computer Engineering* | Patricia Xu *Materials Science Engineering* | Alexander Zirbel *Computer Science*

ADVISORS George Kantor *Robotics Institute*

ROOM/TIME Wright / 12:00 pm

One of the biggest challenges to developing countries are explosive remnants of war (ERWs). ERWs create a structural barrier to development and growth of the area long after war ends. The United Nations Mine Action Centre spends an enormous amount of effort conducting danger area marking (DAM) operations, with an estimated 127 million land mines in as many as 88 countries. Currently, such operations are performed manually, at significant risk to human lives. The Colony Project proposes to create a low cost autonomous team of robots that can help humanitarian efforts to detect and remove these dangers.

DESIGN AND DEVELOPMENT OF THERMOCOUPLE AND FUEL CELL CARS

STUDENTS Katia Bazzi *Chemical Engineering* | Jonathan Berman *Chemical Engineering* | Madison Calhoun *Chemical Engineering* | Anusha Chinthaparthi *Chemical Engineering* | Alisa De Bruyn Kops *Chemical Engineering* | Onyenma Enwereji *Undecided* | Alexandra Frankel *Chemical Engineering* | Stephen Greco *Electrical & Computer Engineering* | Dennis Guo *Chemical Engineering* | Sam Klein *Chemical Engineering* | Joshua Kubiak *Materials Science Engineering* | Rebecca Lui *Chemical Engineering* | Ishan Nag *Chemical Engineering* | Kaitlyn Nowak *Chemical Engineering* | Sanjana Padmanabhan *Chemical Engineering* | Allison Perna *Chemical Engineering* | Yijie Qiu *Chemical Engineering* | Anand Sastry *Chemical Engineering* | Stephen Scannell *Chemical Engineering* | Wooram Seok *Chemical Engineering* | Joseph Whitmore *Chemical Engineering* | Patrick Xia *Undecided* | Amy Yuan *Chemical Engineering*

ADVISORS James Miller *Chemical Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

The purpose of this project is to prepare two cars for the AIChE Chemical Engineering Car Regional Competition hosted in New Jersey April of 2013. Two cars will be simultaneously entered in competition by Carnegie Mellon. The car that performs the best will compete at the National Competition in San Francisco in Fall of 2013. The Chemical Engineering Car Competition is a national, collegiate competition sponsored by the American Institute of Chemical Engineers (AIChE). It is based on the challenge of designing and building a model-sized car that is powered by a chemical reaction. The car must stop at a distance between 50 and 100 feet and carry a load of water. Both the distance and load are specified on the day of the competition. The competition is designed to give student engineers the opportunity to apply their knowledge to a design project and to gain research experience. It also gives students an opportunity to meet with other students across the country, share ideas, and network. Two separate cars will be prepared for the competition. The first car will be powered by a thermocouple and an exothermic reaction with a bimetallic strip-based stopping mechanism and the second car will be powered by a hydrogen fuel cell with a pressure-syringe-based stopping mechanism. In October 2011, the team placed 5th out of the 33 best teams throughout the United States at AIChE's National Competition. Our goal is to again perform well at the 2013 Regional Competition to qualify for the following National Competition.

DESIGN AND MANUFACTURE OF HIGH EFFICIENCY HULLS FOR SOLAR POWERED BOATS

STUDENTS Kathryn Davis *Mechanical Engineering* | Thomas Eliot *Electrical & Computer Engineering* | Irene Lee *Mechanical Engineering* | Peter McHale *Physics* | Allen Miller *Mechanical Engineering* | Alexander Warzinski *Civil and Environmental Engineering* | Patricia Xu *Materials Science Engineering*

ADVISORS Susan Finger *Civil and Environmental Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Solar-powered boats offer a novel opportunity to replace nonrenewable petroleum products with renewable energy. Although solar energy is plentiful, it is difficult to use efficiently. One way to increase efficiency is to minimize water resistance on the hull. Hull resistance can be analyzed and minimized through the use of computational fluid dynamics analysis. After a hull shape is chosen, it is important to construct the hull so that it can resist the various forces it is subject to in the water. Carbon fiber and core materials can be used to reinforce the hull with a higher strength-to-weight ratio than traditional fiberglass layup. The research group used CFD analysis to create a set of hulls to test as scale models. Different combinations of core material, fiberglass, and carbon fiber were implemented in model hulls and stress-tested. Stress testing results and an analysis tank were used to determine an ideal hull with high strength, low resistance, and reasonable cost. These results will be presented at the Meeting of the Minds Symposium.

E RECYCLING AND RARE EARTH ELEMENT REUSE

STUDENTS Sophie Grodsinsky *Civil and Environmental Engineering* | Marissa Morales *Chemical Engineering* | Annette Ritchie *Materials Science Engineering*

ADVISORS Kelvin Gregory *Civil and Environmental Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The ultimate question that we hope to answer with this research project is to identify the most feasible, cost effective, and efficient way to recycle and reuse rare earth elements to be extracted from used electronics and other devices. When China, the world's leading exporter, closed its borders to rare earth element trade, the United States along with many other countries was forced to find other means of obtaining these critical materials in order to maintain production. The U.S. Department of Energy has begun to develop a critical materials strategy, which includes support of possible rare earth element recycling using retired electronics. Professor Kelvin Gregory will support this research team in doing an on campus survey of Carnegie Mellon policies regarding retired electronics as well as a feasibility study of all current possible methods to recycle the critical elements within these electronics to be used again. By coming up with our own strategy regarding electronic recycling and rare earth metal reuse, we can then share that information with other universities, companies, and organizations to decrease the U.S. need for imported critical elements.

EXPERIMENTAL INVESTIGATION ON TRIBOLOGICAL PERFORMANCE OF SOLID LUBRICANT RESERVOIR TRIBOSYSTEMS IN SLIDING CONTACTS

STUDENTS Daniel Cardenas Rivero *Materials Science Engineering*

ADVISORS Cecil Higgs *Mechanical Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

The purpose of this investigation was to study the effects of linear speed and slider load on the behavior of the friction coefficient. Stainless steel pads were modified with a mechanical micromachining process to achieve solid lubricant reservoirs with different geometries. Reservoirs with 2 different depths and diameters were machined and used throughout the experiments. For each slider reservoir geometry, speeds of 4 m/s, 8 m/s and 12 m/s and loads of 4 lbs, 8 lbs, and 13 lbs were considered. This study used 1.5 micron Molybdenum disulfide powder as the solid lubricant reservoir material. The tribosystem consisted of a slider arm holding the stainless steel pad in place against a rotating stainless steel disk. It was observed that the time it took for a test configuration to reach the dry coefficient of friction from the lubricated coefficient of friction was highly dependent on speed and load combination and was greater with less extreme values for speed and load.

FABRICATION AND RESISTIVE SWITCHING OF RUDDLESSEN-POPPER OXIDE

STUDENTS Juan Infante *Materials Science Engineering*

ADVISORS Paul Salvador *Materials Science Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

Resistance switching has now been studied for oxides in which a functional layer is sandwiched by two electrodes. The potential applications for these electro-resistive devices range from non-volatile data storage to reconfigurable logic to trainable neural networks. Some interesting oxide switches adopt the tetragonal Ruddlesden-Popper (RP) structure, in which the oxygen diffusion is highly anisotropic. As a result, the switching behavior is expected to be dependent on crystallographic orientation. In this study the growth of Sr₂TiO₄

and La₂NiO₄ thin films via pulse laser deposition (PLD) and the switching characteristics of the Sr₂TiO₄ devices were studied.

MEDICAL VOLUNTEERISM IN UNDERDEVELOPED COUNTRIES: CAN WE MAKE IT BETTER?

STUDENTS Ashley Brienza *Materials Science Engineering*

ADVISORS Caroline Acker *History*

ROOM/TIME Pake / 12:40 pm

The practice of using untrained international medical volunteers to provide care in underdeveloped countries is largely unregulated, inefficient, and inappropriate. In recent years, the flow of volunteers from rich countries to poor countries has risen markedly, and the level of care delivered has remained unchecked. Rather than accepting medical volunteerism as something where we “take what we can get”, we should aim to harvest the energy that these “medical tourists” offer to create volunteer trips that are regulated, cooperative, informative, and most of all, appropriately helpful. The aim of this research project is to analyze the benefits of foreign medical aid for patients in third-world countries. The benefit of these “trips” to the volunteers will be weighed against the cost of the trip and benefit to patients through analysis of program summaries and post-trip-surveys for various medical volunteer programs that students at Carnegie Mellon University have experienced. The ultimate aim of the project is to expose misconceptions about medical volunteerism and suggest guidelines to help better the quality of care delivered through international volunteer programs in underdeveloped countries.

MOTOR APPLICATIONS IN EXTREME ENVIRONMENTS

STUDENTS Anya Prasitthipayong *Materials Science Engineering*

ADVISORS Michael McHenry *Materials Science Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

Due to their high cost and scarcity, the use of rare earth materials should be limited in motor applications while magnet performance must be maintained. To limit the use of rare earths, there has been a significant development of motor applications including size and cost reduction, increased power density, increased efficiency and increased reliability. Further development can be achieved through the proper motor design, the use of optimum hard and soft magnets and the reduction of motor’s operating temperature through active cooling systems.

OPTIMIZED NUTRIENT BIOAVAILABILITY OF AFRICAN LEAFY VEGETABLES

STUDENTS Jessica Yuan *Materials Science Engineering*

ADVISORS Philip LeDuc *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

Amaranth is an underutilized African leafy vegetable that contains high levels of provitamin A and dietary minerals; increased consumption could contribute to a reduction in health complications resulting from vitamin A deficiency, such as childhood blindness. This research proposes to utilize cell mechanics-based approaches to manipulate the structural and functional properties of amaranth leaves post-harvest with the goal of creating nutritious and palatable plant-based fare that maximizes nutrient bioavailability. To reach this goal, this project aims to characterize the effect of mechanical stimulation on the microstructural response of amaranth foliage and correlate microstructural properties to the bioavailability of nutrient molecules within the amaranth food system.

PLASTIC THATCH PROJECT

STUDENTS Joel Accorsi *Mechanical Engineering* | Craig Boman *Civil and Environmental Engineering* | Corinne Clinch *Civil and Environmental Engineering* | Seth Cordts *Mechanical Engineering* | Zachary Dawson *Electrical & Computer Engineering* | Eric Desnyder *Mechanical Engineering* | Madelyn Gioffre *Civil and Environmental Engineering* | Kyra Gould *Mechanical Engineering* | Yoon Hee Ha *Mechanical Engineering* | Veronica Jaime-Lara *Mechanical Engineering* | Benjamin Paren *Materials Science Engineering* | Deepak Ravi *Mechanical Engineering* | Minghui Zhang *Chemical Engineering*

ADVISORS Larry Cartwright *Civil and Environmental Engineering*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

The Plastic Thatch Project aims to convert waste plastic bottles into reusable plastic material by developing a semi-automated manufacturing process. The knowledge from this research could benefit current plastic sorting techniques or prompt successful reuse of other waste materials. A successful plastic reuse machine will allow communities in developing countries to process and transport plastic bottle waste. Low cost plastic material will act as a catalyst for small business enterprises in roofing and other endeavors, such as green-house material. The work has been divided into three design groups: hopper/sorter, fusing section, and thatch cutting. Our research consists of prototyping until a full scale model is functional as a whole machine. Through this research, the students involved will gain valuable experience in efficient project management, rapid prototyping, and applying engineering skills to real-world issues.

POLYMER-FUNCTIONALIZED ENZYMES FOR USE IN BLOCK COPOLYMER MEMBRANES: CHARACTERIZATION OF MODIFIED ENZYMES USING DYNAMIC LIGHT SCATTERING

STUDENTS Ashley Figatner *Materials Science Engineering*

ADVISORS Michael Bockstaller *Materials Science Engineering* | Ilhem-Faiza Hakem *Materials Science Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 10:48 am

Polymer-functionalized nanoparticles can be blended with polymers to improve the optical, electrical, and mechanical properties of the resulting composite material. Block copolymers form unique morphologies, such as cylinders or lamellae, and can be used as templates for the dispersion of functionalized nanoparticles. Dispersion of inorganic nanoparticles in block copolymers has been widely studied and has been shown to be size dependent. Dispersion of organic nano-fillers, such as enzymes, has not been studied. In order to see if the same dispersion trends apply to functionalized enzymes, accurate measurements of the radii of enzymes with different functionalization parameters must be made. Dynamic Light Scattering was used to measure the radius of hydration of PEGylated HRP with varying degrees of polymerization and polymer-to-lysine ratios. Experimental results were in agreement with theoretical calculations, increasing the confidence in the results. Possible applications for a block copolymer/enzyme blend system include tunable membranes for water filtration or for hazardous chemical detection, in which the polymer-coated enzymes located at contractible membrane pores react to toxins or airborne diseases in high risk environments.

REDESIGNING THE EPINEPHRINE AUTO INJECTOR.

STUDENTS Alan Fu *Materials Science Engineering* | Siri Amrit Ramos *Mechanical Engineering*

ADVISORS Conrad Zapanta *Biomedical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 10:25 am

The current form factor of the epinephrine auto-injector (branded as the Epi-Pen) is essentially a very large marker. Although it is effective during injection, it is cumbersome to store and transport everyday. As a result,

far too many people who are at risk for anaphylaxis knowingly do not carry the treatment. We propose to change the form factor by creating a novel casing and the syringe mechanism from the ground up as a flat rectangular plane so that it can specifically be attached as a case to a smart phone. This would ensure that the treatment is never far away from the person.

SCOTTIE DOCK: A MOBILITY ASSIST DEVICE FOR MANUAL WHEELCHAIR USERS

STUDENTS Adewale Desalu *Electrical & Computer Engineering* | Brooke Gladstone *Materials Science Engineering* | Sohini Roy *Materials Science Engineering* | Andre Sutanto *Mechanical Engineering* | Ramyata Upmaka *Materials Science Engineering*

ADVISORS Mark Friedman *Biomedical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 10:00 am

As part of the Biomedical Engineering Design (BME) course (42-401), our group is interested in designing a manual wheelchair assist device. Currently, standard manual wheelchairs are cost-effective but a difficult form of transportation for independent, mobility-impaired individuals. The only mainstream alternative is an expensive and heavy power wheelchair. With Professor Friedman as our academic advisor, we aim to create an assist device ("Scottie Dock") whereby the manual wheelchair will be docked onto a platform that is attached to a motorized scooter. Additional features may be added to the scooter-platform system to enable backward movement, speed control, and an emergency stop mechanism. This device has the potential to make transportation for manual wheelchair users significantly easier at a fraction of the cost of a power wheelchair. Our targeted market is the elderly in nursing homes, rehabilitation facilities, and assisted living developments where this device can be used as a shared, inexpensive, resource. While we will be able to receive some funding from the BME department, additional funding from the SURG grant will significantly increase our ability to successfully design, build, and test several iterations before the end of the Spring 2013 semester.

SELF-ASSEMBLY AND STRENGTH TOUGHENING OF POLYMER-GRAFTED NANOPARTICLE THIN FILMS DUE TO HOMOPOLYMER ADDITION

STUDENTS Sangita Sharma *Materials Science Engineering* | Zachary Urbach *Chemistry*

ADVISORS Michael Bockstaller *Materials Science Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 11:37 am

Polymer-Grafted nanoparticles have unique self-assembly properties and structures. There is a trade off however between ordering of particles and mechanical strength of the thin films that are formed. By introducing free chain polymers into the empty interstitials of the monolayer structure, both properties should be retained. Experimental tests will vary the size of the free polymer added to the nanoparticles and the relative amounts of free polymer to polymer-grafted nanoparticles to see what conditions form the most ordered and mechanically strengthened material. Transmission electron microscopy will be used to analyze structures of monolayers and nanoindentation will be used to measure mechanical strength of multilayers.

SYNTHESIS OF GOLD NANOWIRE STRUCTURES WITH SOFT LITHOGRAPHY BASED WET PROCESSING METHOD

STUDENTS Jeeyoung Lee *Materials Science Engineering*

ADVISORS Michael Bockstaller *Materials Science Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

Due to the growing interest in utilizing flexible transparent conducting materials in various electronic devices, much research has been dedicated to understanding and improving the properties and fabrication methods of metal nanowire network structures. This particular research was to explore various gold nanoparticle solutions and PDMS soft lithography methods to synthesize and pattern the gold nanowire structures on a silicon substrate. The gold nanoparticles were synthesized from the reduction of hydrochloroauric acid by trisodium citrate and patterned using micromolding in capillaries. With the gold particle diameter of 10-15nm and continuous pattern formations, this synthesis method indeed shows potentials to be used for the scalable production of metal nanowire structures.

THE APPLICATION OF MAGNETITE NANOPARTICLES IN CANCER THERMOTHERAPY

STUDENTS Blair Graham *Materials Science Engineering*

ADVISORS Priyanka Anand *Materials Science Engineering* | Michael McHenry *Materials Science Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

Nanoparticles are significant to current healthcare research due to their small size, which ranges from 1 to 100 nanometers, allowing for unique interactions with the body. Magnetite nanoparticles have been examined as a potential material for use in cancer thermotherapy as a substitute for chemotherapy. These particles are of particular interest due to their response to radio frequency heating. It is hypothesized that the use of these particles in vivo has the potential to extinguish cancer cells with minimal harm to the patient due to a lower temperature onset of apoptosis in comparison to unmutated somatic cells.

THE ROLE OF ATMOSPHERE ON PHASE TRANSFORMATIONS OF ULVOSPINEL.

STUDENTS Catherine Groschner *Materials Science Engineering*

ADVISORS Michael McHenry *Materials Science Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

We have synthesized the antiferromagnetic mineral ulvospinel, Fe_2TiO_4 , in Ar to assess the role of inert atmosphere on phase formation and magnetic properties. We report the role of atmosphere on a possible phase transition and the magnetic properties of this mineral. Atmosphere dependent transformations of ulvospinel are observed with increasing temperature. Oxidation of ulvospinel to form metastable titanomaghemite is shown to occur at 300°C in atmospheric conditions. Only slight titanomaghematization was observed in samples transformed under pressure in in-situ temperature dependent x-ray experiments. Formation of ilmenite and hematite from ulvospinel was observed under high temperature, high pressure, and low oxygen atmosphere conditions.

ULTRA-COMPLIANT ELECTRODE ARRAYS WITHIN HYDROGEL NETWORKS FOR ADVANCED BIOMEDICAL IMPLANTS

STUDENTS Marvin Alim *Materials Science Engineering* | Evan Gates *Mechanical Engineering*

ADVISORS Christopher Bettinger *Materials Science Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 10:37 am

An ultra-compliant, electrically conductive biomaterial that can be implanted into the body has tremendous potential clinical applications involving electrical stimulation ranging such as retinal and neural interfaces. Hydrogels such as PEG (Poly(ethylene glycol)) and HEMA (2-hydroxyethyl methacrylate) represent excellent

soft biomaterials that have been widely used and received FDA-approval for a diverse number of biomedical applications. At the other end of the spectrum, metals such as silver and gold are well known to be excellent electrical conductors. However, with moduli on the order of gigapascals, metal are far too stiff to implant alongside soft tissues in the body, which have moduli in the kilopascal range. This project aims to bridge this gap in mismatch by seeking to combine the desired mechanically soft and biocompatible properties of the hydrogel with the electrical conductive properties of gold to obtain a soft hydrogel embedded with gold electrodes at pre-defined locations. Research efforts thus far have studied the requirements for the polymeric network to be on the same order of stiffness as that of human tissues. The current focus has been on studying and understanding the metallization embedding process for our specific polymeric network. Another major research thrust is to characterize and perform studies on our polymeric networks with and without metallization.

VISUALIZATION TOOL FOR AUTOMATED HISTOLOGY

STUDENTS Leah Yingling *Materials Science Engineering*

ADVISORS Jelena Kovacevic *Biomedical Engineering*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

We present a software tool for the visualization of large histology images with a unique focus on automated analysis of these images. Histology, the study of the microscopic anatomy of cells and tissue, requires sectioning and staining of tissues followed by examination through optical microscopy. Though technology has allowed for automatic slide preparation and imaging, analysis of the resulting images remains a time-consuming and subjective processes requiring highly-trained histopathologists. Our lab has focused on automating some of this analysis. In support of that goal, we have developed a software tool that allows visualization of histology images, annotation of the images by pathologists, and the display of automatically generated annotations. These features make the tool well-suited to achieve increased efficiency and more productive collaboration in histology research.

WEAR AND FRICTION IN ARTIFICIAL HIP JOINTS

STUDENTS Hannah Shepard *Materials Science Engineering*

ADVISORS Cecil Higgs *Mechanical Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

Modern hip joints consist of two major components, a hemispherical socket to replace the acetabular cup, and a ball and stem to replace the femoral head. The most common material combinations for artificial hip joints are metal on metal, ceramic on ceramic, ceramic head on UHMWPE, and metal head on UHMWPE. The metals include stainless steel, titanium alloys, and cobalt-chromium-molybdenum alloys, while the common ceramics are zirconia and alumina. While UHMWPE provides excellent mechanical strength and toughness, wear resistance is still a major drawback to the material's use. As the femoral head slides against the UHMWPE cup, microscopic wear particles enter the surrounding tissue inducing osteolysis in the bone surrounding the implant. Osteolysis is an autoimmune reaction to foreign agents where the body's immune responders induce the maturation of bone resorbing cells. This in turn disrupts the careful balance of bone formation and destruction and leads to increased bone loss, aseptic loosening, and a 75 % reduction in expected joint life. In this study, parametric studies were conducted using a pin-on-disc tribometer at loads and speeds relevant to the human gait cycle. Friction and wear data from these tests were analyzed using different hip joint materials, under both dry and lubricated conditions, to establish optimal tribological conditions for each combination.

MECHANICAL ENGINEERING

A MODEL AND SIMULATION OF MUSCLE USING INPUTS OF REVERSE ENGINEERED TITIN AND MYOSIN MOLECULES

STUDENTS Felix Chiu *Mechanical Engineering*

ADVISORS Jonathan Cagan *Mechanical Engineering* | Paul Egan *Mechanical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 11:00 am

The goal of this project is to develop a comprehensive, detailed, and accurate model of a muscle. Once completed, this model will have several hierarchical levels, from the lowest (a single myosin) to the highest, a whole muscle, and will have properties that can be adjusted to simulate types of muscles found in the real world (such as human cardiac muscle, or the muscles of other animals such as scallops), as well as be used to develop artificial muscles with new and unique properties. Currently this has been achieved by starting with titin and myosin molecules (with properties gathered from experimental data) and modeling their interaction to simulate behavior of greater units such as thick filaments and sarcomeres.

ADAPTING RAIL GUN THEORY TO CONSTRUCT A STABLE STATIC MAGNETIC FIELD ELECTRIC MOTOR

STUDENTS Mikio David *Mechanical Engineering* | Nidhi Doshi *Electrical & Computer Engineering* | Viswa Tej Koganti *Electrical & Computer Engineering*

ADVISORS Cecil Higgs *Mechanical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 10:00 am

How to make produce a stable, powerful, and robust electric motor? This project constructed an electric motor based on principles of electromagnetic acceleration. Along with the motor, a capacitor bank power supply was constructed. The designs focused on stability of current pulse of the power supply and the structural integrity of the motor. This motor has the potential to be used in modern electric cars in order to provide cheaper more efficient methods of transportation.

ANALYZING RADIATIVE PROPERTIES OF NANOSTRUCTURES FOR SOLAR THERMOPHOTOVOLTAIC CELLS

STUDENTS Kaiyang Liew *Mechanical Engineering*

ADVISORS Sheng Shen *Mechanical Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

Solar thermophotovoltaic (TPV) cells are a type of 3rd generation solar cells based on solar thermal energy conversion. They work by absorbing almost the entire solar spectrum, and then emitting a narrow band of light with wavelength tuned to match the band gap of a traditional solar cell. This increases the efficiency of a single junction solar cell up to a maximum theoretical limit of 85.4%. A key component of such TPV systems is a selective absorber that has a large absorbance of wavelengths below 2 μm to absorb maximum sunlight, while having low absorbance above 2 μm to minimize reemission. The aim of this project is to design and analyze various nanostructures to create the best selective absorber for TPV cells.

AUTOMATIC 3-D HEXAHEDRAL MESHING FOR EXTRUDED GEOMETRY

STUDENTS Kyung Jae Lee *Mechanical Engineering*

ADVISORS Yongjie Zhang *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

In engineering design process, engineers require a way to test the feasibility of a product before building a physical prototype. For example, in order to test if a bridge will collapse under torsion and bending, engineers utilize computer aided engineering (CAE) software to analyze the model before building a scaled prototype. In this computer testing process, engineers use a method called finite element analysis (FEA), which in this case divides up the bridge into very small sections, do the analysis in each of these sections, and sum it all up for overall test results. This division of the geometry is called meshing – typically, a 3-D mesh is composed of hexahedrons and tetrahedrons, and these hexahedrons and tetrahedrons fill up the volume of the geometry (the bridge). A mesh contributes greatly to the accuracy of the simulation results – a fine mesh will make a simulation run longer, but give very accurate results, and a coarse mesh will do the opposite. In addition, a hexahedral mesh also produces more accurate simulation than a tetrahedral mesh. Therefore, it is vital to create a hexahedral mesh that has the optimum fineness; however, unfortunately, manual hexahedral meshing using conventional CAE software is time consuming and extremely difficult. Therefore, it is vital to improve the efficiency of hexahedral meshing. This study aims to make hexahedral meshing of 3-D geometry that is extruded in a direction. The goal of the study is to create a MATLAB program that can create quadrilateral meshes for any 2-D geometry given a set of points that sufficiently describe the curves of the geometry and extrude the mesh to get the 3-D mesh. The user will be able to define whether the mesh will be external or internal – external meshes can be used for situations such as wind tunnel analysis whereas internal meshes can be used for stress analysis. The output of the mesh will be in Plot3D format.

AUTOMATION OF MICROCONTACT PRINTING FOR PRODUCTION OF WEARABLE ELECTRONICS

STUDENTS Claire Usiak *Mechanical Engineering*

ADVISORS Carmel Majidi *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Up until this point, the field of wearable electronics has mainly been composed of units made of rigid sensors and circuits. However, an alternative to the idea of rigid electronics is currently being developed in the Soft Machines Laboratory: the production of soft, elastic electronics that allow circuits to stretch and bend as the body moves. Development of these soft electronics requires the production microfluidic circuits, which are composed of PDMS sheets embedded with an array of micro channels filled with liquid phase metal alloy eutectic Gallium-Indium. Current fabrication methods for the microfluidic circuits are extremely labor intensive and difficult to automate for large-scale production. For my project, I aim to devise a method of producing these circuits via microcontact printing, a method rooted in soft lithography manufacturing. I plan to do this by: developing a step-by-step protocol for microcontact printing, creating a database that maps the wetting compatibility of liquid-phase metal alloys, and constructing a PDMS stamp aligner using linear translation stages and a stereomicroscope.

BONDING ALUMINUM AND CARBON FIBER TO MANUFACTURE LIGHTWEIGHT RACECAR PARTS

STUDENTS Korey Haug *Mechanical Engineering* | Joshua Kubiak *Materials Science Engineering* | Brian Langone *Mechanical Engineering*

ADVISORS Satbir Singh *Mechanical Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

A critical factor in the design of all racecar parts is weight. Keeping weight to a minimum enhances both performance and efficiency. However, trimming weight normally comes at the expense of losing strength. This is an issue because a racecar must be able to withstand significant force on its parts during sharp cornering. Carbon fiber presents a potential solution to this dilemma because of its high strength to weight ratio. But, traditionally, carbon fiber parts have not been used in high stress applications in the Carnegie Mellon Racing (CMR) Formula SAE vehicle or vehicles in general. Carbon fiber is difficult to use on its own in two-force members and other structural components because fittings on carbon fiber parts are prone to splitting and fracture causing failure which makes interfacing the parts with the rest of the car difficult. As a way of circumventing this issue, the Carnegie Mellon Racing team investigated the possibility of binding aluminum inserts to carbon fiber tubes to create parts such as pull rods, tie rods, and turnbuckles. Not much work has been done creating automobile parts in this manner, although similar applications have been used in bicycles and aircraft. The CMR team then adapted this technology for application in their newest Formula SAE car. The two main issues with the fabrication of these parts are ensuring that the metal and carbon fiber do not separate and preventing the cathodic corrosion of the aluminum when it is brought into contact with the carbon fiber, both of which would cause unexpected and catastrophic failure. Different combinations of metal, epoxy, insulation, and geometry were used to create test samples resembling pull rods to determine which combinations are best suited to the creation of automobile parts. The tensile strengths of the samples were tested on Instron machines both before and after an accelerated corrosion treatment, and the most promising samples were further developed into a final product. These parts are applicable not only in CMR racecars, but also in consumer vehicles where fuel efficiency is a concern and parts are often exposed to corrosive conditions due to road deicing.

BUGGY TECHNOLOGY DEVELOPMENT

STUDENTS Gerald Carlson *Mechanical Engineering* | Kellen Chow *Mechanical Engineering* | Elise Everett *Computer Science* | Philip Garrison *Electrical & Computer Engineering* | Connor Hayes *Undecided* | Amy Hung *Mathematics* | Nathaniel Jeffries *Electrical & Computer Engineering* | Preston Ohta *Mechanical Engineering* | Glenn Philen *Mechanical Engineering* | Anibal Pichardo *Mechanical Engineering* | Rachael Schmitt *Undecided* | Guochen Shen *Mechanical Engineering* | James Snyder *Mechanical Engineering* | Patricia Xu *Materials Science Engineering* | Sophia Zikanova *Electrical & Computer Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The goal of this SURG is to improve the performance and safety of buggies (vehicles that compete in CMU's annual Sweepstakes races) by exploring modifications to existing technology as well as developing novel designs. This SURG, which will be focused on Mechanical Engineering design and analysis, will provide an excellent hands-on educational experience to all members involved.

BUILDING A PRAYING MANTIS ROBOT

STUDENTS Mark Sun *Mechanical Engineering*

ADVISORS David Touretzky *Computer Science*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

The goal of the project is to design and build an autonomous hexapod robot that is modeled after the body of a praying mantis. Theoretically, the robot's front legs will be able to be adapted for manipulation when the robot is not travelling. The majority of the project will tackle mechanical design questions that are posed by implementing the stability and movement of the robot. Additionally, there will be machining and programming involved in the process. The tasks for this project will consist of producing a more detailed design of the legs of the robot that will offer the range of motion and the workspace required to be an ambidextrous manipulator, designing the body of the robot that will be stable with various leg orientations and weight distributions, programming the robot for autonomy, and machining the parts required for the robot. On board the robot will be Robotis MX-64 and RX-28 servos, a Microsoft Kinect for vision, a fit-PC2 computer, and the Tekkotsu software framework designed by Dr. Dave Touretzky, the research advisor. The project will be similar to the Chiara robot previously designed, with different mechanical design obstacles. Working on the project is a team of three students: one mechanical engineer (myself) and two computer scientists. The goal over this Summer is to have a full design and simulation of the robot, and if possible to construct the robot itself which will function autonomously. Work on this began on May 15, and is currently in progress.

DANGER AREA MARKING USING A LOW-COST ROBOT COLONY

STUDENTS Julian Binder *Electrical & Computer Engineering* | Priyanka Deo *Computer Science* | Yuyang Guo *Computer Science* | Ruben Markowitz *Drama* | Thomas Mullins *Electrical & Computer Engineering* | Rachael Ortega *Mechanical Engineering* | Peyton Randolph *Computer Science* | Matthew Sebek *Electrical & Computer Engineering* | Brent Strysko *Electrical & Computer Engineering* | Patricia Xu *Materials Science Engineering* | Alexander Zirbel *Computer Science*

ADVISORS George Kantor *Robotics Institute*

ROOM/TIME Wright / 12:00 pm

One of the biggest challenges to developing countries are explosive remnants of war (ERWs). ERWs create a structural barrier to development and growth of the area long after war ends. The United Nations Mine Action Centre spends an enormous amount of effort conducting danger area marking (DAM) operations, with an estimated 127 million land mines in as many as 88 countries. Currently, such operations are performed manually, at significant risk to human lives. The Colony Project proposes to create a low cost autonomous team of robots that can help humanitarian efforts to detect and remove these dangers.

DESIGN AND MANUFACTURE OF HIGH EFFICIENCY HULLS FOR SOLAR POWERED BOATS

STUDENTS Kathryn Davis *Mechanical Engineering* | Thomas Eliot *Electrical & Computer Engineering* | Irene Lee *Mechanical Engineering* | Peter McHale *Physics* | Allen Miller *Mechanical Engineering* | Alexander Warzinski *Civil and Environmental Engineering* | Patricia Xu *Materials Science Engineering*

ADVISORS Susan Finger *Civil and Environmental Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Solar-powered boats offer a novel opportunity to replace nonrenewable petroleum products with renewable energy. Although solar energy is plentiful, it is difficult to use efficiently. One way to increase efficiency is to minimize water resistance on the hull. Hull resistance can be analyzed and minimized through the use of com-

putational fluid dynamics analysis. After a hull shape is chosen, it is important to construct the hull so that it can resist the various forces it is subject to in the water. Carbon fiber and core materials can be used to reinforce the hull with a higher strength-to-weight ratio than traditional fiberglass layup. The research group used CFD analysis to create a set of hulls to test as scale models. Different combinations of core material, fiberglass, and carbon fiber were implemented in model hulls and stress-tested. Stress testing results and an analysis tank were used to determine an ideal hull with high strength, low resistance, and reasonable cost. These results will be presented at the Meeting of the Minds Symposium.

DISCRETELY VARIABLE, TORQUE CONTROLLED ENERGY RECYCLING ACTUATOR: (DVTCERA)

STUDENTS Jayon Wang *Mechanical Engineering* | Robert Wojno *Chemical Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 10:37 am

Our goal is to create a small-scale, torque controlled linear actuator with the additional capacity to recapture energy. This actuator is designed to optimize energy usage and performance in prosthetics, robotics and exoskeleton applications; however, potential achievements are not limited to these industries. Our design is unique because it uses hydraulic fluid channeling to capture energy normally lost in brake phases of traditional electric motors and redelivers this captured energy back into the system in the next forcing phase. This concept is especially important in applications where energy lost due to braking is high, such as walking or running. Our current proof-of-concept design combines our functioning prototype with a force sensor and a foot-actuated loading mechanism into a compact testing rig. From this rig, we have gathered force data that supports our claim that that the DVTCERA mechanism can output discrete forces in a controlled manner. Future work will involve incorporating electric motors to create system-level energy usage analyses and energy recapture experiments.

ENHANCING OCCUPATIONAL THERAPY FOR FOCAL HAND DYSTONIA

STUDENTS Ruthika Ruthika *Mechanical Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Focal hand dystonia is the loss of motor control of one's fingers through repetitive motion of the fingers for elongated periods of time. As this condition is currently incurable, one of the most effective ways to alleviate the symptoms is occupational therapy. Hence, I am proposing a wearable device that would accelerate the recovery of the affected hand muscles. The design of the device is finalized after an iteration of multiple prototypes. It is expected that the proposed device would aid the patient in occupational therapy and accelerate the recovery of his motor skills.

EXAMINING THE EFFECTS OF PATELLOFEMORAL OSTEOARTHRITIS ON ONE'S OVERALL MOTION

STUDENTS Julie Rekant *Mechanical Engineering*

ADVISORS Conrad Zapanta *Biomedical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Patellofemoral osteoarthritis is often referred to in conjunction with osteoarthritis in the tibiofemoral joint. In

order to evaluate and compare the effects of these two classifications of knee joint osteoarthritis, biomechanical measurements were taken while subjects performed a sit-to-stand task and walked on an inclined treadmill. It is expected that analysis of this data will show that subjects with patellofemoral osteoarthritis display differences in biomechanics from those without patellofemoral osteoarthritis, leading to deficiencies in other areas of the body due to compensation. By examining the biomechanics of these subject, it is hoped that a pattern will become apparent in their deficient mechanics, giving physical therapists an area of focus when it comes to rehabilitating patients suffering from patellofemoral osteoarthritis.

FUEL CELL MODELING

STUDENTS Victor Medina *Mechanical Engineering*

ADVISORS Shawn Litster *Mechanical Engineering*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

My research consists of developing a fuel cell model to cross validate between theoretical and real world data. The model gives a more accurate understanding of fuel cells by providing more information of the mass transport within the fuel cell.

FUTURE COST ESTIMATES AND MODELING OF OFFSHORE WIND POWER PLANTS

STUDENTS Wee Chuan Tor *Mechanical Engineering*

ADVISORS Edward Rubin *Engineering and Public Policy*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

The objective of this paper is to look at present and future cost trends in the offshore wind power industry. The building of a performance and cost model of an offshore wind plant will give some understanding of the installation and component cost of the system. This will allow for the estimation of the levelized cost of electricity and sensitivity testing of the technology. A review on technical innovation and learning rate of offshore wind system is done to understand the methods employed in future cost estimation and to give insights to the drivers of cost increase and reduction in the recent decades. Future cost trends of the technology are then modeled by breaking down the cost model into various component groups accounting for cost reduction drivers of the components.

GEOTHERMAL FLUID MODELING

STUDENTS Phanindraja Ancha *Mechanical Engineering*

ADVISORS John Shelton *Mechanical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 11:13 am

In the pursuit to make geothermal energy a more economically viable alternative renewable energy resource, a methodical investigation of the role drilling muds play in the momentum and energy transfer process at the drill bit-rock interface is currently being performed. Through a computational fluid dynamics (CFD) code developed in MATLAB by the investigator, the characteristics of momentum and energy transfer of the drilling mud flowing through heated parallel plates are analyzed. The drilling mud was modeled as a non-Newtonian pseudoplastic fluid that cycles between a highly viscous clay with structural characteristics to a less viscous liquid with more desirable flow traits. The set of Reynolds numbers used in this investigation to describe the mud flowing between the parallel plates is held between the values of 100 and 1000, thus ensuring laminar flow. Also, the

thermal boundary conditions are such that the Boussinesq approximations are valid assumptions. With the results from this analysis, a critical set of base data is now available for drilling mud design engineers to use in the development of newer muds with enhanced momentum and thermal energy transfer characteristics at the drill bit-rock interface.

HEAVY SHOES EXPERIMENTATION

STUDENTS Joshua Caputo *Electrical & Computer Engineering* | Mark Erazo *Mechanical Engineering* | Steven Pepin *Mechanical Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

The purpose of this project is to test the assumption that people prefer to walk in the most metabolically efficient way possible. To accomplish this purpose we created a set of weighted and unweighted shoes to be worn to track and record data on how often and how much a person walked in each. Using this data, we hope to show scientifically that people will and do adapt to changing walking conditions by changing the way in which they choose to walk.

IMPACT TESTING OF NITINOL 60: A NEXT-GENERATION BEARING MATERIAL FOR AEROSPACE APPLICATIONS

STUDENTS Benjamin Cosio *Mechanical Engineering*

ADVISORS Cecil Higgs *Mechanical Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

A common cause of wear on ball bearing systems is high contact stresses. These high stresses can result from the combination of high hardness and high elastic modulus witnessed in most ball bearing materials. The large elastic modulus results in smaller contact areas and hence larger contact stresses when under heavy loading. While high hardness is normally associated with high elasticity for most materials, an ideal ball bearing material would be one that exhibited a high Moduli (H/E) where H = hardness and E = elastic modulus. This means the longest-lasting materials will have a high hardness to withstand the contact forces while having a low modulus of elasticity to prevent stress fracture. Low elasticity reduces contact stress by deforming under loads more, which increases the contact surface area. This increases the longevity of the bearings by more evenly distributing the load. NITINOL 60 (60NiTi) is currently being tested and examined as the next-generation bearing material for use in aerospace landing systems. As the name may suggest, it is an alloy that is 60-wt% Nickel and 40-wt% Titanium. 60NiTi is unique because it has high hardness but a low elastic modulus. Its elastic modulus is 50% that of steel and 33% of Si3N4; two very common rolling element bearing (REB) materials. In this work, the elastic potential of 60NiTi is explored through impact testing using a newly designed and fabricated drop test rig. Experiments are specifically performed to determine the coefficient of restitution between prestressed and non-prestressed 60NiTi balls and substrates. In this manner, these studies can be used to determine if the elastic performance of 60NiTi can be further improved through prestressing.

INVESTIGATING THE USE OF AERODYNAMICS TO IMPROVE FUEL EFFICIENCY AND OPTIMIZE DRAG COEFFICIENT ON FORMULA SAE RACECARS

STUDENTS Haluk Akay *Mechanical Engineering* | Gianfranco Colombi *Mechanical Engineering*

ADVISORS Burak Ozdoganlar *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

Use of sophisticated aerodynamic systems in half-size Formula racecars to improve fuel economy and enhance performance has always been a characteristic among top tier Formula SAE teams, and this year Carnegie Mellon Racing will be introducing aerodynamics into their latest vehicle design. FSAE groups around the world are now aiming less for raw power in their design, and more for a light, aerodynamically efficient model which uses fluid dynamics to increase down force on the vehicle and thereby increase velocity without altering the motor. The Aerodynamics Division of CMU Racing wishes to increase efficient energy consumption of their latest vehicle design by a system of diffusers on the undertrain of the car. The aim of this study is to identify the effect of adding a diffuser and wings to a half-size formula racecar with respect to down force generated and increased fuel efficiency. Using Computational Fluid Dynamics (CFD) simulations, different compound materials will be tested to create an optimal aerodynamic system for CMU Racing's latest racecar design.

LARGE SCALE SOLUTION PROCESSED TRANSPARENT CONDUCTING ELECTRODES

STUDENTS Evan Gates *Mechanical Engineering*

ADVISORS Christopher Bettinger *Materials Science Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

The technology behind photovoltaics and touchscreen displays depends on transparent conducting electrodes (TCEs). Existing fabrication methods include metal organic chemical vapor or molecular beam deposition, spray pyrolysis, and pulsed laser deposition. These methods require the use of hazardous and expensive materials and the consumption of significant energy. We are developing a TCE constructed from a two-dimensional grid of silver nanowires. Previous attempts to generate a silver nanowire TCE required significant labor to ensure proper wire alignment. The fabrication process for this system is comparatively cheap, fast, and environmentally safe. We expect this TCE to exhibit low electrical resistivity and high optical transmissivity, with values comparative to the values of existing devices. Our next step is the characterization of these values in our system. The information provided in this presentation outlines the fabrication process.

LIQUID-PHASE GALLIUM-INDIUM ALLOY ELECTRONICS WITH MICRO-CONTACT PRINTING

STUDENTS Arya Tabatabai *Mechanical Engineering*

ADVISORS Carmel Majidi *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Liquid-phase microelectronics circuits are patterned on an elastomer substrate with a microcontact printer. The printer head dips into a pool of a liquid-phase Gallium-Indium alloy, eg. eutectic Gallium-Indium (EGaIn) or Gallium-Indium-Tin (Galinstan), and deposits a single drop on a silicone elastomer substrate. After patterned deposition, the liquid-phase circuit is sealed with an additional layer of silicone elastomer. We also demonstrate patterned deposition of liquid-phase Ga-In alloy with a molded PDMS stamp that is manually inked and pressed into an elastomer substrate. As with other liquid-phase electronics produced through needle-injection or masked deposition, the circuit is elastically deformable and can be stretched to several times its natural

length without losing electronic functionality. In contrast to existing fabrication techniques, microcontact printing and stamp lithography can be used to produce circuits with any planar geometric feature, including electrodes with large planar area, intersecting and closed-loop wires, and combs with multiple terminal electrodes. In air, the surface of the coalesced droplets oxidize to form a thin oxide skin that preserves the shape of the circuit during sealing. This first demonstration of soft-lithography fabrication with liquid-phase Ga-In alloy expands the space of allowable circuit geometries and eliminates the need for mold or mask fabrication.

MECHANICAL LOGIC

STUDENTS Spencer Barton *Electrical & Computer Engineering* | Connor Brem *Computer Science* | Steven Cunningham *Mechanical Engineering* | David Lu *Electrical & Computer Engineering* | Rudina Morina *Undecided* | Corinne Vassallo *Music*

ADVISORS James C. Hoe *Electrical & Computer Engineering*

ROOM/TIME Class of '87/12:20 pm (Oral Session)
Kirr Commons-1st Floor, Window side / 3-5 pm (Poster Session)

Boolean logic, the math of true/false or 1/0 values, forms the foundation of many important operations experienced in daily life. This project seeks to demystify basic Boolean logic through the use of mechanical logic gates as a teaching tool for high school students. We will construct a series of push-pull logic gates that will model basic Boolean math operations such as AND, OR, NOT and XOR (exclusive OR). Utilizing these units, we will then teach students the fundamentals of Boolean logic and demonstrate how powerful this concept can be. Through these education tools and lessons, we hope to interest high school students in Boolean logic and its application in electrical and computer engineering.

MINIMALLY-RESTRICTIVE PASSIVE ANKLE FOOT ORTHOSIS FOR IMPROVED REHABILITATION

STUDENTS Jessica Lee *Mechanical Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

Ankle-foot orthoses have been used effectively to give support and stability to patients with disabilities such as muscle weakness in the lower limb or foot drop during rehabilitation. Many of these orthoses focus on providing stationary support through springs, links, and counterweights. Powered active and passive support can also be achieved with motors and clutch mechanisms. My research aims to analyze the effectiveness of passive ankle-foot orthoses in reducing the metabolic energy cost of normal gait motion for use in rehabilitation. An ankle-foot orthosis that utilizes passive support through a lightweight clutch mechanism will be designed and fabricated. To quantitatively examine the performance of this orthosis, we will be measuring the metabolic costs of using the orthosis through indirect respirometry as human participants ambulate on a treadmill. The results from this experiment could lead to a greater understanding of the effectiveness of passive orthoses and help determine whether implementation of these orthoses in rehabilitation can improve the quality of the patient's experience and increase the rate of recovery through the use of enticement rather than social pressure.

MODELING OF TWO-PHASE FLOW IN PARALLEL MICRO CHANNELS

STUDENTS Michael Saitta *Mechanical Engineering*

ADVISORS Shawn Litster *Mechanical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 11:25 am

Hydrogen fuel cells use channels to transport hydrogen and oxygen in air to catalyst sites in order to create electricity. From this process, liquid water is produced which mixes with the flow of air. This mixing can prevent adequate flow to the cathode because of the transient blocking of channels. This liquid water flooding of the cathode results in a drop in produced voltage. This research seeks to use non-linear analysis techniques for modeling systems in order to understand the involved flows. From this, the research will seek to create management strategies to avoid and manage flooding.

NEUTRALLY BUOYANT MAGNETIC MICROROBOTS

STUDENTS Prakjit Jena *Mechanical Engineering*

ADVISORS Metin Sitti *Mechanical Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

An important consideration in the fabrication of untethered microrobots is the attribute of neutral buoyancy in liquid environments. For potential medical applications, 3D magnetically actuated microrobots can be developed for precise drug delivery and patient diagnosis. Neutral buoyancy eliminates the need for weight offset forces and allows for better allotment of hardware resources such as magnetic coil currents. In this work, we present several methods to maintain neutral buoyancy in microrobots through air trapping. Microrobots fashioned from the fabrication methods detailed here experimentally attain a density within 2% of neutral buoyancy.

OPTIMIZATION OF GAIT PARAMETERS FOR PATH PLANNING IN SIMPLE KINEMATIC SYSTEMS

STUDENTS Hugo Ponte *Mechanical Engineering*

ADVISORS Matthew Travers *Robotics Institute*

ROOM/TIME Rangos 1 / 12-2:30 pm

Geometric Mechanics is the study of how underlying geometry impacts, and in most cases simplifies, classical mechanics. For a class of mechanical systems, the constraints which dictate how the system interacts with its environment to locomote can be used to derive reduced dynamic representations. Prior work in geometric mechanics has shown how these reduced representations afford us the ability to gain valuable insight into the relationship that internal shape changes have on net system displacements. Cyclic shape variable changes, or gaits, can then be used for motion planning in kinematic systems operating in the planar space of translations and rotations. We can use visual tools, such as height functions, as a means of parameterizing gaits. With a library of parameterized gaits, motion planning can be thought of as the selection of an optimal set of those gait parameters. My research focused on the use of computationally tractable methods for optimizing over parameterized gait based motion planning.

PLASTIC THATCH PROJECT

STUDENTS Joel Accorsi *Mechanical Engineering* | Craig Boman *Civil and Environmental Engineering* | Corinne Clinch *Civil and Environmental Engineering* | Seth Cordts *Mechanical Engineering* | Zachary Dawson *Electrical & Computer Engineering* | Eric Desnyder *Mechanical Engineering* | Madelyn Gioffre *Civil and Environmental Engineering* | Kyra Gould *Mechanical Engineering* | Yoon Hee Ha *Mechanical Engineering* | Veronica Jaime-Lara *Mechanical Engineering* | Benjamin Paren *Materials Science Engineering* | Deepak Ravi *Mechanical Engineering* | Minghui Zhang *Chemical Engineering*

ADVISORS Larry Cartwright *Civil and Environmental Engineering*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

The Plastic Thatch Project aims to convert waste plastic bottles into reusable plastic material by developing a semi-automated manufacturing process. The knowledge from this research could benefit current plastic sorting techniques or prompt successful reuse of other waste materials. A successful plastic reuse machine will allow communities in developing countries to process and transport plastic bottle waste. Low cost plastic material will act as a catalyst for small business enterprises in roofing and other endeavors, such as green-house material. The work has been divided into three design groups: hopper/sorter, fusing section, and thatch cutting. Our research consists of prototyping until a full scale model is functional as a whole machine. Through this research, the students involved will gain valuable experience in efficient project management, rapid prototyping, and applying engineering skills to real-world issues.

PROJECT LOCI: TANGIBLE INTERACTIONS WITH INFORMATION SYSTEMS

STUDENTS Canute Haroldson *Mechanical Engineering* | Christopher Henley *Design* | Yaakov Lyubetsky *Design* | Ajay Ravindran *Computer Science*

ADVISORS Mark Baskinger *Design*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

There is no doubt that modern technology and access to vast amounts of information has helped enrich our lives throughout the past few decades. Unfortunately the most common way to access this information up to this point has been through screen based interfaces; in effect forcing people to divert the majority of their attention to the screen. Project Loci addresses this issue by developing a backpack that responds to external variables and relays that information to the user using tactile feedback. The backpack is location aware and makes use of large databases of crime statistics to warn the user of their locations danger level by tightening the bags straps, a metaphor for parental attachment. The bag also takes cues from the animal world by its ability to change texture and color in response to environments; a reference to chromatophores and deimatic displays. The design of this backpack offers an example of how a future of interconnected artifacts can allow users to move past the screen to develop a deeper emotional connection with products when accessing information.

PROJECT METIS

STUDENTS Job Bedford *Mechanical Engineering* | Connor Brem *Computer Science* | Jenna MacCarley *Electrical & Computer Engineering* | William Maynes *Computer Science* | Peter McHale *Physics* | Audrey Yeoh *Electrical & Computer Engineering*

ADVISORS David Kosbie *Computer Science*

ROOM/TIME Rangos 2&3/Sigma Xi Group 8 / 10:13 am

We aim to create a new kind of programming curriculum and the tools for that curriculum. Our project's aims are the following:

- To create a syntax free programming language and IDE based on MIT's scratch program
- To have an android app that will allow you to write such code from a mobile phone or tablet
- To allow students to write code which offers a real world result from their code which can be tested efficiently in a classroom setting.

We believe such a curriculum will raise excitement over programming upfront when students see the physical results of their code and will allow students to focus on learning programmatic logic without the pains of syntax in the beginning. We also believe that such an attitude toward computer education has the potential to make a dramatic change in the United States STEM education system. The tools for our curriculum include a robot to be controlled, a 4' X 4' physical auto-grading sensor array, and an application that can be ported to a phone or a tablet to write and save drag-and-drop code.

REDESIGNING THE EPINEPHRINE AUTO INJECTOR.

STUDENTS Alan Fu *Materials Science Engineering* | Siri Amrit Ramos *Mechanical Engineering*

ADVISORS Conrad Zapanta *Biomedical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 10:25 am

The current form factor of the epinephrine auto-injector (branded as the Epi-Pen) is essentially a very large marker. Although it is effective during injection, it is cumbersome to store and transport everyday. As a result, far too many people who are at risk for anaphylaxis knowingly do not carry the treatment. We propose to change the form factor by creating a novel casing and the syringe mechanism from the ground up as a flat rectangular plane so that it can specifically be attached as a case to a smart phone. This would ensure that the treatment is never far away from the person.

ROBOTIC FOOT ANKLE PROSTHESIS

STUDENTS Lizmarie Comenencia Ortiz *Mechanical Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Rangos 1 / 12-2:30 pm

Lower-limb amputation affects more than a 100,000 persons per year only in the US. According to the Amputee Coalition of America, 45% of these lower-limb amputations occur bellow the knee. The most common causes of foot amputation include vascular disease, trauma-related accidents, congenital limb deficiency and cancer-related incidences. The current foot-ankle prosthetic devices in the market do not provide alternatives that are as efficient as the human foot. This project implements the use of prosthetic ankle design parameters and their effect on walking performance into design iterations of a robotic foot-ankle prosthesis actuated by an AC servo-motor through a flexible transmission. The prosthesis was designed to support subjects of a maximum of 240 pounds. Its mechanical design was based on an initial prototype that has shown good performance in pilot studies, the new prototype will support 50 percent more weight than the initial prototype. This will support a wider range of subjects and contribute to the current prosthesis testbed.

SCOTTIE DOCK: A MOBILITY ASSIST DEVICE FOR MANUAL WHEELCHAIR USERS

STUDENTS Adewale Desalu *Electrical & Computer Engineering* | Brooke Gladstone *Materials Science Engineering* | Sohini Roy *Materials Science Engineering* | Andre Sutanto *Mechanical Engineering* | Ramyata Upmaka *Materials Science Engineering*

ADVISORS Mark Friedman *Biomedical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 10:00 am

As part of the Biomedical Engineering Design (BME) course (42-401), our group is interested in designing a manual wheelchair assist device. Currently, standard manual wheelchairs are cost-effective but a difficult form of transportation for independent, mobility-impaired individuals. The only mainstream alternative is an expensive and heavy power wheelchair. With Professor Friedman as our academic advisor, we aim to create an assist device ("Scottie Dock") whereby the manual wheelchair will be docked onto a platform that is attached to a motorized scooter. Additional features may be added to the scooter-platform system to enable backward movement, speed control, and an emergency stop mechanism. This device has the potential to make transportation for manual wheelchair users significantly easier at a fraction of the cost of a power wheelchair. Our targeted market is the elderly in nursing homes, rehabilitation facilities, and assisted living developments where this device can be used as a shared, inexpensive, resource. While we will be able to receive some funding from the BME department, additional funding from the SURG grant will significantly increase our ability to successfully design, build, and test several iterations before the end of the Spring 2013 semester.

SMART OXYGEN TANK SENSOR

STUDENTS Eric Wise *Mechanical Engineering*

ADVISORS Conrad Zapanta *Biomedical Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

This project seeks to create a device that will minimize wasted residual oxygen in medical oxygen tanks while improving the patient experience with their oxygen therapy devices. The device proposed will use a novel combination of onboard electronics with fluid mechanics laws to determine a more accurate measure of the oxygen remaining in a tank as a function of current flow pressure and tank history. Also, the addition of an audible alarm to the device will assist patients in remembering to replace a depleted oxygen tank.

SOLID LUBRICANT ADDITIVE FRICTIONAL PERFORMANCE

STUDENTS Miranda McCoy *Mechanical Engineering*

ADVISORS Cecil Higgs *Mechanical Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 10:25 am

During operation, industrial machinery is subject to a number of harsh operating conditions including high temperatures, transient speed ramping, and high stresses, especially during start-up and shut-down. Under these conditions, traditional lubricants are often unable to prevent severe detrimental wear to the contacting surfaces. In order to create a lubricant which performs well under these conditions, a powder lubricant additive may be added to the base oil to improve performance. Moreover, it has been shown that powder lubricant additives may be combined with more environmentally-friendly oil bases such as canola or vegetable oils without sacrificing frictional performance. Although the addition of additive powders to oil based lubricants has been shown to be effective, the precise mechanism for this improvement is still largely undetermined. The purpose of this study is to develop a mixture of solid lubricant powders and oils which performs well under

harsh industrial conditions. In order to better understand these multi-phase lubricants, parametric studies were run on a tribometer using a mixture of known solid lubricant powders and canola oil. The experiments tested the effects of powder additive concentration, load, and speed on the overall performance of the system with a focus on frictional behavior in different lubrication regimes.

THE DESIGN AND OPTIMIZATION OF LORENTZ FORCE DRIVEN ENGINES

STUDENTS Mikio David *Mechanical Engineering*

ADVISORS Cecil Higgs *Mechanical Engineering* | Michelle Ntampaka *Physics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 10:13 am

Can electromagnetic accelerated motors generate comparable amounts of energy to current electric motors and high power combustible engines? This project explored practical applications of the electromagnetic acceleration theory by constructing and modeling a linear accelerator and electric motor. The motor was designed based on physics principles of electromagnetic acceleration. Analysis of the practical limitations and benefits of the motor were determined in order to create the ground work for designing production ready units.

THE EFFECTS OF VARIOUS PARAMETERS ON MATERIAL REMOVAL RATE AND SURFACE FINISH IN CMP

STUDENTS Michael Heinzlmann *Mechanical Engineering*

ADVISORS Cecil Higgs *Mechanical Engineering*

ROOM/TIME Rangos 1 / 10:00 am - 12:00 pm

Chemical mechanical planarization (CMP) is the manufacturing process of planarizing thin metal films for use in integrated circuits. In CMP, a wafer is pressed against a polyurethane pad while slurry is pumped onto the pad. The rotating pad and slurry cause material to be removed from the wafer's surface. Defects caused by CMP can reduce the performance of integrated circuits. As a result, increased understanding of the parameters which affect material removal during CMP, and analysis of the post-CMP surface, can be useful in improving the CMP process. In this work, various aspects that affect material removal and surface finish in CMP, such as down pressure applied during polishing, were studied.

THERMAL AND THERMOMECHANICAL MODELING OF SOLDER/MAGNETIC NANOCOMPOSITES FOR AREA-ARRAY PACKAGING

STUDENTS Andrea Pickel *Mechanical Engineering*

ADVISORS Michael McHenry *Materials Science Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

The reflow process of FeCo magnetic nanoparticle (MNP)-based solder composites due to eddy current power loss in a substrate and magnetic power loss in solder bumps was modeled using SolidWorks Simulation. For an area-array package, the eddy current power loss needed to achieve solder reflow can cause substrate damage. The use of MNPs lowers the necessary eddy current power loss, thus mitigating damage. Simulations were run for a variety of different MNP concentrations. The resulting temperature profiles were in good agreement with experimental results and demonstrated the ability of localized reflow to enable low-temperature assembly. The temperature as a function of time and position in the solder was also analyzed. Temperature profiles for solder composites with a 0.2 wt % MNP concentration in a 1MHz and 3MHz magnetic

field were also simulated. High field frequency led to larger magnetic power losses and was shown to increase heating efficiency. Additionally, thermomechanical modeling was carried out using ANSYS to assess package performance under cyclic thermal loading conditions and make preliminary fatigue life predictions.

ULTRA-COMPLIANT ELECTRODE ARRAYS WITHIN HYDROGEL NETWORKS FOR ADVANCED BIOMEDICAL IMPLANTS

STUDENTS Marvin Alim *Materials Science Engineering* | Evan Gates *Mechanical Engineering*

ADVISORS Christopher Bettinger *Materials Science Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 10:37 am

An ultra-compliant, electrically conductive biomaterial that can be implanted into the body has tremendous potential clinical applications involving electrical stimulation ranging such as retinal and neural interfaces. Hydrogels such as PEG (Poly(ethylene glycol)) and HEMA (2-hydroxyethyl methacrylate) represent excellent soft biomaterials that have been widely used and received FDA-approval for a diverse number of biomedical applications. At the other end of the spectrum, metals such as silver and gold are well known to be excellent electrical conductors. However, with moduli on the order of gigapascals, metal are far too stiff to implant alongside soft tissues in the body, which have moduli in the kilopascal range. This project aims to bridge this gap in mismatch by seeking to combine the desired mechanically soft and biocompatible properties of the hydrogel with the electrical conductive properties of gold to obtain a soft hydrogel embedded with gold electrodes at pre-defined locations. Research efforts thus far have studied the requirements for the polymeric network to be on the same order of stiffness as that of human tissues. The current focus has been on studying and understanding the metallization embedding process for our specific polymeric network. Another major research thrust is to characterize and perform studies on our polymeric networks with and without metallization.

ULTRASOUND-FITTED EPICARDIAL INJECTION SYSTEM

STUDENTS Adam Costanza *Mechanical Engineering*

ADVISORS Cameron Riviere *Robotics Institute*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

The invasiveness of modern day thoracoscopic surgery pushes us to find new methods of delivering treatments to the beating heart without need to stop the heart or deflate the left lung. Using the subxiphoid approach has proved promising in the miniature robot HeartLander. The drawback of HeartLander is that it is quickly reaching its capabilities in mapping and sensing. Implementing a small ultrasound catheter probe will allow for better visualization and imaging during treatments. From this UltraLander has been born, a small 3D printed medical device largely based on HeartLander but with some significant changes.

UNDECIDED

DESIGN AND DEVELOPMENT OF THERMOCOUPLE AND FUEL CELL CARS

STUDENTS Katia Bazzi *Chemical Engineering* | Jonathan Berman *Chemical Engineering* | Madison Calhoun *Chemical Engineering* | Anusha Chinthaparthi *Chemical Engineering* | Alisa De Bruyn Kops *Chemical Engineering* | Onyenma Enwereji *Undecided* | Alexandra Frankel *Chemical Engineering* | Stephen Greco *Electrical & Computer Engineering* | Dennis Guo *Chemical Engineering* | Sam Klein *Chemical Engineering* | Joshua Kubiak *Materials Science Engineering* | Rebecca Lui *Chemical Engineering* | Ishan Nag *Chemical Engineering* | Kaitlyn Nowak *Chemical Engineering* | Sanjana Padmanabhan *Chemical Engineering* | Allison Perna *Chemical Engineering* | Yijie Qiu *Chemical Engineering* | Anand Sastry *Chemical Engineering* | Stephen Scannell *Chemical Engineering* | Wooram Seok *Chemical Engineering* | Joseph Whitmore *Chemical Engineering* | Patrick Xia *Undecided* | Amy Yuan *Chemical Engineering*

ADVISORS James Miller *Chemical Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

The purpose of this project is to prepare two cars for the AIChE Chemical Engineering Car Regional Competition hosted in New Jersey April of 2013. Two cars will be simultaneously entered in competition by Carnegie Mellon. The car that performs the best will compete at the National Competition in San Francisco in Fall of 2013. The Chemical Engineering Car Competition is a national, collegiate competition sponsored by the American Institute of Chemical Engineers (AIChE). It is based on the challenge of designing and building a model-sized car that is powered by a chemical reaction. The car must stop at a distance between 50 and 100 feet and carry a load of water. Both the distance and load are specified on the day of the competition. The competition is designed to give student engineers the opportunity to apply their knowledge to a design project and to gain research experience. It also gives students an opportunity to meet with other students across the country, share ideas, and network. Two separate cars will be prepared for the competition. The first car will be powered by a thermocouple and an exothermic reaction with a bimetallic strip-based stopping mechanism and the second car will be powered by a hydrogen fuel cell with a pressure-syringe-based stopping mechanism. In October 2011, the team placed 5th out of the 33 best teams throughout the United States at AIChE's National Competition. Our goal is to again perform well at the 2013 Regional Competition to qualify for the following National Competition.



COLLEGE OF FINE ARTS

ARCHITECTURE

AN INTERACTIVE ALGORITHMIC DESIGN TOOL

STUDENTS Brindusa Manolache *Architecture*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The purpose of this project will be to create an algorithmic design tool for the early stages of planning in the architectural process. The tool will be a fun and explorative approach to design, not meant to make decisions for the designer, but meant to inspire him by presenting possible solutions to architectural problems from a new, algorithmic perspective. Ultimately the tool will be available to be used for free online by students searching for inspiration and solutions to their design problems or any curious visitors exploring design.

ARCHITECTURE FOR NEW AGE DIPLOMACY

STUDENTS Dmitriy Yakubov *Architecture*

ADVISORS Mary-Lou Arscott *Architecture* | Dale Clifford *Architecture*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

In 1952 the American embassy in Havana, Cuba was open as the first modern American embassy. Along with the mission in Rio de Janeiro it became the flagship of American diplomacy for a new age. Today, American diplomacy is in need of a new standard, a new flagship, and a symbol for its new diplomacy for the new age.

This project is a proposal for a new American diplomatic mission in Havana, Cuba. It seeks to examine both the architectural and politico-economic possibilities for American foreign policy in the 21st century.

COMMUNITY NARRATIVES: ENGAGING PEOPLE AND SPACE

STUDENTS Anna Bieberdorf *Architecture*

ADVISORS Dylan Vitone *Design*

ROOM/TIME Rangos 2&3/Sigma Xi Group 9 / 10:48 am

How do we revitalize underdeveloped spaces and reinvigorate residential engagement in the community? Over our time spent in Pittsburgh, we have taken increasing interest in the distinct narratives tied to the city's communities. Influenced by the aesthetic and philosophical values of wabi sabi, the Japanese art of imperfection and impermanence, we will explore alternative approaches to redeveloping and revitalizing urban spaces around Pittsburgh. We are proposing a series of installations that encourage community dialogue and reveal the rich history of the neighborhoods we research. Our research and photographic documentation of each site will be compiled into an ethnographic narrative concerning the communities we worked with.

EXPLORING PHYSICAL OUTPUT OF DIGITAL AND ANALOG FABRICATION PROCESSES THROUGH COMPREHENSIVE SHOE DESIGN AND CONSTRUCTION

STUDENTS Morgan Stampf *Architecture*

ADVISORS Scott Smith *Architecture*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The increased practice of digital fabrication and rapid prototyping has engaged architects and designers in an iterative design process that focuses on generative form-making, quick physical output, and a highly precise, yet flexible reciprocity between digital and physical form. The current push in architectural academia has encouraged students to exhaust the use of digital technologies constantly seeking to surpass boundaries conceptually, formalistically, and physically. The exceeding reliance on digital technologies has focused students into the computer and away from the building site, intended users, and tangible dimension of architectural practice. Throughout my four years in architectural school, I have understood the transformation of academic curriculum from a more traditional architectural practice in design representation and theory into a much more futuristic, digitally generative and almost vacuum-like approach to architecture and fabrication. While digital design and fabrication technologies provide enormous opportunities for future building and design, I believe the ability of the architecture student to perceive the tangible, phenomenological, and psychological relationship of the externalization of design into the intended physical environment is sorely lacking.

While architectural design acts as a container for user experience and an environment that engages with the physical world, fashion design on a much smaller scale acts as a container for the human form. The vision, the choice of materials, as well as the form, functionality, and space are just some components of architecture, but these can also be applied to fashion and art in general. All aspects of design are created under the laws of constraint and restraint. Fashion design deals with principles of materiality and form-making in relationship to the structure and movement of the human body through time. The practice of designing and fabricating a wearable piece for the human body must specifically and primarily address the opportunities and constraints of the physical environment in which the design is intended for. Because architectural education remains primarily in design development through drawing and scaled models, the relationship of the physical environment to design is yet to be fully explored and realized. This, I believe, is a major missing link found in architectural academia today.

More and more, blurred disciplinary lines are visible throughout the design world. Architects moonlight as furniture designers, artists as graphic designers, and it seems almost everyone has tinkered in small scale product design. The opportunities that digital fabrication has given us as architects have allowed us to trickle over into other avenues of design that, in their purest essence, boil down to some form of fabricating functional design. This past semester, I have conducted prototypical research to establish a system for translating and integrating analog and digital fabrication processes in shoemaking. I have explored the digital fabrication processes of lasercutting, CNC milling, and vacuum forming in conjunction with analog processes of woodworking and hand sewing to establish a methodology for the architectural fabrication of shoes in a very hands-on, yet automated approach to fashion design. My constructed designs are to act as a "proof-of-concept" in order to illustrate the necessity for a constant flow of digital, analog, and user information during the design/build process and are fabricated at the human scale to provide tangible evidence of this interaction.

THE ALISAN SCHOOL: SUSTAINABLE LEARNING ENVIRONMENTS IN OFFA, NIGERIA

STUDENTS Christopher Chan *Architecture* | Richa Date *Architecture* | Katherine Marino *Architecture* | Harris Mazur *Architecture* | Melissa Mohrenweiser *Civil and Environmental Engineering* | Hannah Schmitt *Architecture* | Dan Sztanga *Architecture*

ADVISORS Azizan Abdul-Aziz *Architecture* | Stephen Lee *Architecture*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

In response to an impoverished rural Nigerian community with plans for a new school, we have proposed an initial design for a sustainable school complex. This design serves as a teaching tool for environmental construction techniques that address the local resources, climate, and culture of the area. Currently the primary building material in the area is concrete, which is costly and has a large carbon footprint. Other building materials include items imported from other countries, like China, which is costly and takes a lot of time. In response, we propose earth brick construction based on its local abundance and thermal properties. This real design scenario has served as an academic exploration in vernacular construction as well as an experience working with a client.

ART

APPETITE LOST

STUDENTS Chloe Newman *Art*

ADVISORS Patricia Bellan-Gillen *Art*

ROOM/TIME Connan / 12-2:30 pm

Previously “The Katsinim Return” (as a working title)

My graphic novel “Appetite Lost” brings three fictitious animal spirits inspired from Hopi Katsina culture into contemporary America, and through their humorous and disturbing encounters expose the flawed modern food systems we have come to accept.

CATHEDRAL OF LEARNING

STUDENTS Mirrie Choi *Art*

ADVISORS Joe Mannino *Art*

ROOM/TIME Kirr Commons-1st Floor, Window Side / 3-5 pm

Cathedral questions the distinction between the man made environment and natural world. It recontextualizes constructed and natural elements to create a contemporary landscape both novel and familiar.

FILLING VOIDS: EXPLORING THE FUNCTIONALITY, PSYCHOLOGY AND IMPLIED AESTHETICS OF STORAGE CONTRAPTIONS.

STUDENTS Justin Lin *Art*

ADVISORS Ali Momeni *Art*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Everyday containers and storage such as cups and cabinets face a functional and aesthetic limitation. Our perception of what these everyday objects should look like are fixed, both from our familiarity with them as well as the functional requirement we expect of them. Most existing variation in the aesthetic of such objects tend to be material, surface finish, or ornamental. The goal of this project is more for the purpose of artistic inquiry than design for industry; it examines the complex relationships we have with containers and the act of storing our possessions. 3 main branches of experimentation will be examined: rigidity, integrity and permanence. The production process combines the use of computer aided manufacturing techniques, CAD/CAM design, with traditional crafts of woodworking and wheel-thrown ceramic vessel construction. The outcome of the project will be a gallery exhibition of hypothetical, avant-garde containers which would move, morph, stretch, expand, break down, or even transform its contents.

PLAGUE & BODY DISMORPHIA

STUDENTS Carter Warren *Art*

ADVISORS Patricia Bellan-Gillen *Art*

ROOM/TIME Connan / 12-2:30 pm

Medieval doctors were ill-equipped to handle plague victims, believing the flea-borne plague to be caused by airborne pathogens or bodily fluids. They did not treat their patients properly, thus incurring deaths by the thousands through bleeding or wasting precious time with useless herbs. Just as previous doctors were unable to contain the plague, today's surgeons failing to pinpoint Body Dysmorphics are merely perpetuating a problem in American society. I want to create large-scale silkscreen advertisements illustrating a parallel between the inept treatment of plague victims and Body Dysmorphics suffering in our body-obsessive culture. Images of useless medieval herbs and the iconic, butcher-like plastic surgery marks will be featured along with objectively attractive females and fleas. Using advertising, the very instrument which plants ugly concepts of 'imperfection' on perfectly fine people, and hardy images of science, doctors and/or organisms, I am hoping to spawn questions within viewers like: Are humans our own virus, mentally and physically? Is poor body image in today's culture really just poor self esteem? Are doctors here for our health or our desires?

PROSTHETIC ARCHETYPES

STUDENTS Caroline Record *Art* | Nicolas Zevallos-Roberts *Art*

ADVISORS Bob Bingham *Art*

ROOM/TIME McConomy Auditorium / 12:30 pm

Nico Zevallos and Caroline Record collaboratively created a series of video pieces that feature two characters who create themselves through sculptural exploration of materials. Each character has a prop that embodies their desired self. They each perpetually attempt to create and evolve this prop using the available materials, eventually broadening their approach to tackle the full costume, personality, and space that the character inhabits. This project explores a performative sculpting of character and environment.

RESONANCE

STUDENTS Adelaide Agyemang *Art*

ADVISORS Edda Fields-Black *History*

ROOM/TIME Connan / 3-5 pm

Oral narrative is a means by which cultures come to terms with their past, a method for people to explore their lives within the context of their traditions. The spontaneous nature of oral storytelling predates never being frozen in time, and this gives a community the freedom to constantly retell and revisit their history. These integral aspects of oral narrative prompted me to create an experiential research project that explores oral narrative traditions of Ghana, West Africa. I will utilize performance, installation, my native dialect of Twi, and stories from my Ashanti heritage in order to fabricate a narrative experience that invites the audience to enter a realm of history melded with fantasy. The performance will reflect on the capacity for stories to unearth our lived experiences and as well as lessons we've derived from the past. It also raises questions about the improvised elements of history—the extent to which historians from any culture reconstruct gaps in our understanding of the past based on their interpretations of evidence. Because stories are capable of preserving the messages and memories of a culture, they are a dynamic agent for sparking cross-cultural dialogue.

THE UNNATURAL ANIMAL

STUDENTS Carter Warren *Art*

ADVISORS Patricia Bellan-Gillen *Art*

ROOM/TIME Connan / 12-2:30 pm

Humans are strangely adept in creating unnatural organisms at a repulsive rate. Our pollution gets into drinking water, air and soil, leading to consumption of strange chemicals by plants, animals and Man alike. These chemicals result in kidney problems, brain issues and reproductive difficulties across the board. Pollution is created through man-kind's unquenchable desire for the 'precious'. The term 'precious' can be applied to gemstones, metals, artwork, exotic foods and other rare goods. Unfortunately, 'precious' is starting to apply to what humans used to refer to as 'commonplace' – pure water, air and soil. 'Precious' is also starting to apply to diversity of species. Animals are showing terrifying signs of mutations – extra limbs and failing organs are just the start of it. Using traditional jeweler's techniques gleaned from a school for Fine Jewelry, I will assemble casted parts and use precious metal to draw animals through traditional silverpoint methods in an attempt to reclaim animals' preciousness in our ecosystem.

THE WORLD TREE

STUDENTS Eleanor Lewis *Art*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Connan / 12-2:30 pm

The World Tree is an in-progress comic book that tells the story of a group of 19th century explorers climbing to the canopy of a mysterious, mountainous tree. Based on aspects of early 20th century adventure stories and Norse mythology, it makes use of breakthroughs and developments in modern graphic storytelling, and attempts to use the best visual storytelling achievements to date as a springboard for further innovation. Above all, it is a story, so enjoy!

VIRTUAL MEDIA AND SACRED IMAGERY: USING THE ARTIFICIAL TO PORTRAY THE INEXPLICABLE

STUDENTS Jessica Aguero *Art*

ADVISORS Clayton Merrell *Art*

ROOM/TIME Connan / 12-2:30 pm

Many of my emotionally gratifying childhood memories took place within virtual worlds like video games, cartoons, and internet existences. With evidence that my nostalgic connection to these intangible media is a widespread condition, I endeavor to study the sentimental significance that the imagery of virtual worlds has to my generation by using it to visualize spiritual topics. I will create a series of paintings that explore the potential for escapist virtual media to represent such sacred ideas as death, the afterlife, the human mind, and God. To begin, I will conduct research on visual similarities across artwork from various religions traditions, as well as visual similarities across successful children's cartoons and video games, and discover how inexplicable phenomena such as death, dreams, and mental instability are visually rendered in both. Then, I will then combine the two types of imagery into paintings on canvas.

My goals are 1) to create visuals that are relatable and emotionally stimulating to audiences familiar with virtual media, 2) to offer alternatives to visualizing the sacred, and 3) to contribute to fieldwork on the idea of spirituality in contemporary art.

WEIGHT OF STUFF

STUDENTS Eunhee Kang *Art*

ADVISORS Susanne Slavik *Art*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

The nomadic existence can induce frustration or aspiration. Moving from place to place, whether shifting apartments in one city or among international metropolises, makes us question our state of belonging, the possessions and material goods that we may think define us. With each move, the notion of place becomes the space of temporary stay, and emotional connections with things diminish; their necessity is less certain, even if they do offer the comfort of familiarity. To address these absences, lost connections and inability to sustain emotional engagement, I focused on making a sculpture that is collapsible and unsustainable.

WILKINSBURG COMMUNITY ENGAGEMENT GARDENS

STUDENTS Lazae LaSpina *Art* | Danielle Parnes *Design*

ADVISORS Bob Bingham *Art*

ROOM/TIME Connan / 3-5 pm

The Community Engagement Gardens project planned three different types of permaculture gardens – and fully implemented two of these gardens – on two urban sites. Permaculture is a theory of ecological design, which seeks to develop sustainable human settlements and agriculture systems by attempting to model them on natural ecosystems. The aspects of permaculture we focused on with this project included organic gardening for local food production, and storm water management, at a Main Lot and a Sister Lot in Wilkinsburg Borough. The Main Lot features an Orchard Forest Garden with a Bioswale Rain Garden planned for the future. The Sister Lot welcomes residents into a Community Grazing Garden. The sites are now an ongoing research experiment in urban food production and will eventually include storm water management. As an avid organic gardener

and resident of Wilkinsburg, for Lazae this project was an exciting opportunity to deepen her level of commitment to her neighborhood. For Danielle, this was an opportunity to continue her exploration of the connection between design and social action, and apply the theoretical skills she had learned in the classroom.

DESIGN

CINE: ANALOG EXPERIENCES THROUGH SOFTGOODS

STUDENTS Lilian Kong *Design*

ADVISORS Bruce Hanington *Design*

ROOM/TIME Connan / 12-2:30 pm

In an era where everything is becoming digital, our perceptions of value have begun to change. Materials are less valued, and instead, the new value is experience. Digital has become the necessity, and ironically, with vintage-feel products, photography, clothing and so on, analog is becoming a luxury and analog interaction becomes novel. Even emerging areas of design, such as tangible interaction design, begin to bridge the digital space (which still exists mostly within the screen) with the physical space. My research project emphasizes the importance of analog experiences, but also aims to explore these two changing perceptions of value and the analog. The project will consist of a series of three softgood products - a bag, apparel, and footwear - that explore interaction through movement or changing states. The softgoods I create are analog objects, but I will change their value by integrating an analog interaction. In doing so, interacting with the softgood becomes not only a tactile or haptic experience, but a kinetic one as well.

COMMUNITY NARRATIVES: ENGAGING PEOPLE AND SPACE

STUDENTS Conrad Ennis *Design*

ADVISORS Dylan Vitone *Design*

ROOM/TIME Connan / 3-5 pm

How do we revitalize underdeveloped spaces and reinvigorate residential engagement in the community? Over our time spent in Pittsburgh, we have taken increasing interest in the distinct narratives tied to the city's communities. Influenced by the aesthetic and philosophical values of wabi sabi, the Japanese art of imperfection and impermanence, we will explore alternative approaches to redeveloping and revitalizing urban spaces around Pittsburgh. We are proposing a series of installations that encourage community dialogue and reveal the rich history of the neighborhoods we research. Our research and photographic documentation of each site will be compiled into an ethnographic narrative concerning the communities we worked with.

DESIGNING A CUSTOMIZABLE BAG SERVICE

STUDENTS Sijia Wang *Design*

ADVISORS Bruce Hanington *Design*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

The purpose of this project is to promote the healthy living of people with chronic illnesses like diabetes. According to the Centers for Disease Control and Prevention, there are 20.8 million diabetics in the US, with some not only struggling with social stigmas, but also with poverty and inactivity. Recently, a surge of new medical devices is being developed to combat the increasing numbers of diabetics in the US. Consumer electronics like the iPod and smart phones are modeled as references for smarter, more discreet, and more attractive insulin pumps. Unfortunately, individuals living in poverty are not able to afford the products that could alleviate some of the social problems caused by carrying medication. The ideal product for a diabetic should not be chosen based off price and availability, but rather by what can be seamlessly integrated into his or her daily life. Therefore, I want to develop low cost solutions that help remove the social stigma caused by the negative connotations of carrying a medical bag.

EDUCATION THROUGH EXPERIENCE

STUDENTS Morgan Fritz *Design*

ADVISORS Melissa Cicozi *Design*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Hekima Place is a non-profit organization based in Pittsburgh that supports an all-girl orphanage in Kiserian, Kenya. Kenya's education system is such that the girls are required to take one comprehensive test in each elementary school, middle school, and high school to determine their eligibility for further education. Retaining so much information with book learning alone is difficult, and doesn't accommodate different learning styles. My goal is to design a creative learning process for the girls in which information is conveyed in a hands on, intuitive form. I want the learning experience to focus on informing and building intuition instead of regurgitating information. Through my SURG project, I set out to introduce the girls to simple mechanics and reintroduce them to agriculture. Mechanics is a subject area almost entirely unexplored through their curriculum, despite its relevance in everyday life. I found that, if I can find a method to interest the girls in looking farther into subject matter they never thought to look into, it could easily translate to other subject areas they are studying by teaching them general exploration. I am using a radio to employ this concept. I worked with a volunteer of Hekima Place, Sarah Markwardt, who described some everyday interactions the girls in Hekima have with various mechanical tools. My focus fell on the radio through her story of the girls gathering around a single radio when they were allowed to use it, and listening to music together. In designing a radio for the girls that they will construct themselves, it will help them to further understand the simple mechanics, as well as foster group learning and peer teaching.

I hope to also explore a way of sparking the younger girls interest in agriculture. Agriculture plays a large cultural role in Kenya that the older girls appreciate, but has lost all intrigue to the younger generations. I would like to find a way to provide the girls with a clearer and faster work-and-reward timeline than agriculture can apply to hold their interest. The slow nature of plant growth makes it difficult for children to understand the cause and effect that takes place from all of the hard work required to farm crops. In creating a demonstration that will either form an appreciation of the art of agriculture, or a way to show its vital importance through a sped up demonstration, I hope to ignite an the currently lacking interest for the subject.

PARTICLE: COLLABORATIVE SPATIAL INFORMATION ORGANIZATION

STUDENTS Antonio Ono *Design* | Victor Song *Design*

ADVISORS Wayne Chung *Design*

ROOM/TIME Dowd / 3:00 pm

Particle is a platform-agnostic interface that allows users — either individually or in groups — to spatially organize structures of information based on relevancy. Based on a survey of how creative workers use analog and digital tools to work collaboratively, we developed an understanding of the kinds of mental models that result from the user of these tools. In contrast to current interfaces used for collaborative work, Particle allows for the organization of different kinds of content solely through manipulation of the visual variables of positioning and scale. Our interface takes advantage of the resiliency of users' cognitive map to allow for more intuitive organization and navigation of information.

PROJECT LOCI: TANGIBLE INTERACTIONS WITH INFORMATION SYSTEMS

STUDENTS Canute Haroldson *Mechanical Engineering* | Christopher Henley *Design* | Yaakov Lyubetsky *Design* | Ajay Ravindran *Computer Science*

ADVISORS Mark Baskinger *Design*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

There is no doubt that modern technology and access to vast amounts of information has helped enrich our lives throughout the past few decades. Unfortunately the most common way to access this information up to this point has been through screen based interfaces; in effect forcing people to divert the majority of their attention to the screen. Project Loci addresses this issue by developing a backpack that responds to external variables and relays that information to the user using tactile feedback. The backpack is location aware and makes use of large databases of crime statistics to warn the user of their locations danger level by tightening the bags straps, a metaphor for parental attachment. The bag also takes cues from the animal world by its ability to change texture and color in response to environments; a reference to chromatophores and deimatic displays. The design of this backpack offers an example of how a future of interconnected artifacts can allow users to move past the screen to develop a deeper emotional connection with products when accessing information.

THE EFFECT OF DIGITAL REPLICATION ON EMOTIONAL ATTACHMENT TO PHYSICAL OBJECTS

STUDENTS Christopher Ioffreda *Design* | Beth Katz *Electrical & Computer Engineering*

ADVISORS Aisling Kelliher *Design*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

This research examines the difference between owning an original possession versus owning a duplicate of the same object. This study compared the emotional attachment subjects felt to the original instance of an object versus a replica. This research was conducted to study the future application of moving physical possessions online with the ability to later 3D print exact replicas of that object.

WILKINSBURG COMMUNITY ENGAGEMENT GARDENS

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ADVISORS Bob Bingham *Art*

ROOM/TIME Connan / 3-5 pm

The Community Engagement Gardens project planned three different types of permaculture gardens – and fully implemented two of these gardens – on two urban sites. Permaculture is a theory of ecological design, which seeks to develop sustainable human settlements and agriculture systems by attempting to model them on natural ecosystems. The aspects of permaculture we focused on with this project included organic gardening for local food production, and storm water management, at a Main Lot and a Sister Lot in Wilkinsburg Borough. The Main Lot features an Orchard Forest Garden with a Bioswale Rain Garden planned for the future. The Sister Lot welcomes residents into a Community Grazing Garden. The sites are now an ongoing research experiment in urban food production and will eventually include storm water management. As an avid organic gardener and resident of Wilkinsburg, for Lazae this project was an exciting opportunity to deepen her level of commitment to her neighborhood. For Danielle, this was an opportunity to continue her exploration of the connection between design and social action, and apply the theoretical skills she had learned in the classroom.

DRAMA

BEYOND

STUDENTS Elias Diamond *Drama*

ADVISORS Wendy Arons *Drama*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

A play based on recorded interviews with people, that also includes some text from various other sources (Nietzsche, Rumi, the Bible, Kierkegaard, and some others). The subject of these interviews pertains to the big questions: why are we here, where are we going, what is reality, and what is truth. The play covers various topics such as God, religion, computer science, biology, politics, alien life, and psychedelic experience.

DANGER AREA MARKING USING A LOW-COST ROBOT COLONY

STUDENTS Julian Binder *Electrical & Computer Engineering* | Priyanka Deo *Computer Science* | Yuyang Guo *Computer Science* | Ruben Markowitz *Drama* | Thomas Mullins *Electrical & Computer Engineering* | Rachael Ortega *Mechanical Engineering* | Peyton Randolph *Computer Science* | Matthew Sebek *Electrical & Computer Engineering* | Brent Stryko *Electrical & Computer Engineering* | Patricia Xu *Materials Science Engineering* | Alexander Zirbel *Computer Science*

ADVISORS George Kantor *Robotics Institute*

ROOM/TIME Wright / 12:00 pm

One of the biggest challenges to developing countries are explosive remnants of war (ERWs). ERWs create a structural barrier to development and growth of the area long after war ends. The United Nations Mine Action Centre spends an enormous amount of effort conducting danger area marking (DAM) operations, with an

estimated 127 million land mines in as many as 88 countries. Currently, such operations are performed manually, at significant risk to human lives. The Colony Project proposes to create a low cost autonomous team of robots that can help humanitarian efforts to detect and remove these dangers.

IRON SHIRT PRODUCTIONS: SHORT FILMS SCREENING

STUDENTS Sean Groves *Drama* | Adam Hagenbuch *Drama* | Nicolas Hurt *Business Administration* | Lachlan McKinney *Drama* | Brian Morabito *Drama* | Rachel Piero *Drama* | Stephen Tonti *Drama*

ADVISORS Randy Kovitz *Drama*

ROOM/TIME McConomy Auditorium / 11:00 pm

The purpose of this project is to create 2 to 3 short films to be used as reels for graduating actors, directors, business students, artists, and designers. Utilizing the incredible talents of over a dozen CMU students in various disciplines, we hope to create films that will boost the professional careers of these students as well as establishing CMU as a major player in the Pittsburgh film world and beyond. For this event, we will be screening the films that we produce this semester.

REQUEST CONCERT FILM ADAPTATION SCREENING

STUDENTS Jamie Drutman *Drama* | Olivia Harris *Drama* | Nicolas Hurt *Business Administration* | Stephen Tonti *Drama*

ADVISORS Dick Block *Drama*

ROOM/TIME McConomy Auditorium / 11:30 pm

Jamie Drutman, a Senior directing major in the Carnegie Mellon University School of Drama, recently completed her Senior Thesis production: Franz Xavier Kroetz's Request Concert. The play is a monodrama about the day a woman decides to alter her predictable existence by committing suicide. Because of the positive response and the team's strong connection with the piece, they decided to pursue their next collaboration: bringing the spirit of the production to life in the form of a short film.

MUSIC

A MINOR IN BLUE

STUDENTS Julia Emmons *Music*

ADVISORS Natalie Ozeas *Music*

ROOM/TIME Connan / 12-2:30 pm

The objective of a minor in blue is to revive classical music through fashion. By designing an eight piece couture collection based off the first movement of Mendelssohn's second string quartet in a minor, the hope is that any audience will be able to better understand Mendelssohn's work, and begin to recognize the depth and brilliance of classical music as well as begin to understand how to listen to it. The clothes are designed to show the character, mood, and details of eight different sections of the quartet. As young musicians, it's frustrating to see our generations lack of interest in classical music. It's not enough to play perfectly anymore- it's time to

reach out to new audiences and support the revolution to revive classical music. By creating these eight looks, showing them at Lunar Gala, creating eight interactive cohesive exhibits to showcase and explain our work, and showing them at the Undergraduate Research Symposium, we are not only reaching out to new audiences, but hopefully inspiring people to take interest in classical music and pass on their appreciation to the generations to come.

MECHANICAL LOGIC

STUDENTS Spencer Barton *Electrical & Computer Engineering* | Connor Brem *Computer Science* | Steven Cunningham *Mechanical Engineering* | David Lu *Electrical & Computer Engineering* | Rudina Morina *Undecided* | Corinne Vassallo *Music*

ADVISORS James C. Hoe *Electrical & Computer Engineering*

ROOM/TIME Class of '87/12:20 pm (Oral Session)
Kirr Commons-1st Floor, Window side / 3-5 pm (Poster Session)

Boolean logic, the math of true/false or 1/0 values, forms the foundation of many important operations experienced in daily life. This project seeks to demystify basic Boolean logic through the use of mechanical logic gates as a teaching tool for high school students. We will construct a series of push-pull logic gates that will model basic Boolean math operations such as AND, OR, NOT and XOR (exclusive OR). Utilizing these units, we will then teach students the fundamentals of Boolean logic and demonstrate how powerful this concept can be. Through these education tools and lessons, we hope to interest high school students in Boolean logic and its application in electrical and computer engineering.

ON-LINE OPTICAL ORBIT DETERMINATION

STUDENTS Corinne Vassallo *Music*

ADVISORS William Whittaker *Robotics Institute*

ROOM/TIME Rangos 2&3/Sigma Xi Group 8 / 11:00 am

Autonomous vision-based pose estimation is critical technology for future missions to the Moon, Mars, and asteroids. The ability to precisely locate a spacecraft as it orbits, descends, and lands reduces historical landing ellipses from hundreds of km to hundreds of meters. Optical navigation during cruise reduces the need for radio navigation and communication with Earth, increasing autonomy and reducing cost. This research explores the use of on-line estimation for determining orbits from optical measurements. Batch mode estimates are typically highly accurate, but are slow to compute. On-line estimates are faster, but are traditionally considered to be less accurate. Preliminary results from this research indicate that on-line estimates can be as accurate as batch methods with much lower computation. The average position error for a 13,262 km altitude orbit with simulated measurement error of 0.1km is 0.6460 km. Future work will incorporate models of the lumpy lunar mass as well as a means for building maps on-line while localizing.

UNDECIDED

BUGGY TECHNOLOGY DEVELOPMENT

STUDENTS Gerald Carlson *Mechanical Engineering* | Kellen Chow *Mechanical Engineering* | Elise Everett *Computer Science* | Philip Garrison *Electrical & Computer Engineering* | Connor Hayes *Undecided* | Amy Hung *Mathematics* | Nathaniel Jeffries *Electrical & Computer Engineering* | Preston Ohta *Mechanical Engineering* | Glenn Philen *Mechanical Engineering* | Anibal Pichardo *Mechanical Engineering* | Rachael Schmitt *Undecided* | Guochen Shen *Mechanical Engineering* | James Snyder *Mechanical Engineering* | Patricia Xu *Materials Science Engineering* | Sophia Zikanova *Electrical & Computer Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The goal of this SURG is to improve the performance and safety of buggies (vehicles that compete in CMU's annual Sweepstakes races) by exploring modifications to existing technology as well as developing novel designs. This SURG, which will be focused on Mechanical Engineering design and analysis, will provide an excellent hands-on educational experience to all members involved.



CROSS-COLLEGE

BCSA (BACHELOR OF COMPUTER SCIENCE AND ARTS)

AUGMENTED REALITY INTERACTION WITH THE PAUSCH BRIDGE

STUDENTS Evan Shimizu *BCSA*

ADVISORS Kayvon Fatahalian *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

Augmented Reality Interaction with the Pausch Bridge seeks to provide a virtual interface on mobile devices that allows anyone to point their camera at the bridge and change the lighting, opening up new methods of interaction with the lighting system and opening up the bridge lighting to a larger part of the campus community. Using this interface, I've developed a virtual fingerpainting application where a user viewing the bridge through an iPad viewfinder can change the lighting by swiping their finger across the display. Changes are reflected in real time both on the viewfinder and on the bridge. This project brings together my interests as a Computer Science and Arts major and may inspire new interactive theater techniques and augmented reality usages.

CODE-RUNNER

STUDENTS Erica Lazrus *BCSA*

ADVISORS M. Stephanie Murray *BHA* | Paolo Pedercini *Art*

ROOM/TIME McKenna / 2:00 pm

Code-Runner is a demonstration of how video games can be used to teach sophisticated and complicated subject matter in an educational, engaging, and easily accessible manner, particularly in the medical field where there is a need for simulated reality. The product, which simulates the decision-making process of an emergency or Intensive Care Unit physician, has been a collaboration between myself and two physician partners. My role has been to abstract the real-world scenarios we select, discuss and analyze into program-mable game-play and interface design that can be easily updated and supplemented as new information is learned in the field.

DESCRIPTIVE GEOMETRY STUDY APPLICATION

STUDENTS Danuta Genser *BCSA*

ADVISORS Ramesh Krishnamurti *Architecture* | Kelly Lyons *Architecture* | M. Stephanie Murray *BHA*

ROOM/TIME Connan / 12-2:30 pm

62-175 Descriptive Geometry is a required first-year course in Architecture that students have continued to struggle with it since its reinstatement my freshmen year. Since taking the course, I've tried to address "what (tool) would help students learn the material?" The goal of my Capstone research was to create supplementary materials for self-study. From student feedback and initial research on learning methodology, I concentrated on building an integrated learning environment for students to test personal questions about, and interact directly and accurately with, the course material. The application is a digital representation of the physical process of solving three-dimensional problems in only two, mimicking the course conventions.

PARTICLE-BASED 3D MODELING TOOL

STUDENTS Paul Miller *BCSA*

ADVISORS Kayvon Fatahalian *Computer Science* | M. Stephanie Murray *BHA*

ROOM/TIME Connan / 3-5 pm

Much of the character and visual appeal of real-world 3D forms lies in their opulence of details, such as the small vines twisting around a venerable tree trunk. My BXA capstone project attempts to partially automate the creation of 3D models containing such details. I have designed a 3D modeling tool that defines geometry using particles which exert forces on each other. This approach allows visually appealing details to be created pseudorandomly, requiring less labor on the part of the artist. I will demonstrate the capabilities of this tool by creating a variety of models of trees.

BHA (BACHELOR OF HUMANITIES AND ARTS)

A PART OF (4)

STUDENTS Sarah Ceurvorst *BHA*

ADVISORS Joe Mannino *Art*

ROOM/TIME Connan / 3-5 pm

A Part Of (4) documents a work of performance art that visually depicts the challenges of cross-cultural communication and attempts at assimilation. It begs the question “Can you ever truly connect with different cultures than your own?” Stemming from theory on intercultural relations, this work adds an American female perspective that is currently lacking from the discourse of “otherness”, or opposition to one’s norm, in contemporary art.

Composed of a combination of video and prints, A Part Of (4) captures the artist’s poetic attempt to become a part of African American hair culture. In this piece, the artist is seen getting her hair sewn into the braids of an African American woman as though her hair were a sew-in weave. By the end of the video, the artist and the African American woman are fully connected, sharing a single mane of hair.

A Part of (4) was funded through a Small Undergraduate Research Grant from Carnegie Mellon University’s Undergraduate Research Office.

ANDROID GRIZZLY BEAR OF THE DEAD

STUDENTS Emma Olsen *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Peter / 2:00 pm

A look at the making of my senior project, a video game centered around a grizzly bear who gains sentience after being weaponized by scientists who add android parts to his body.

ANSWERS

STUDENTS Carolyn Supinka *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME McKenna / 12:40 pm

This collection of poems is focused on exploring poetry's role as both a question and an answer. In many ways poetry can embody both the quest for truth and the truth itself, and has the power to articulate many subtle truths while in the end raising just as many questions as it answers. I wrote a series of poems as 'answers' to questions posted on the site Yahoo! Answers, and posted these poems on the website itself as actual answers to the questions posed by anonymous submitters. This project allowed me to place poetry in a non-traditional space, and therefore provide a new reading experience to readers. It also allowed me to navigate, through my poems, so many people's innermost desires and questions, shared online with strangers.

BETWEEN THE PERSON AND THE PAGE

STUDENTS Carolyn Supinka *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME McKenna / 1:00 pm

Between the Person and the Page is a summary, explanation, and manifesto of the goals behind the intersection of my writing and my art, as told through the "House Of Your Dreams" project. Spanning an entire year, this project experimented with different media, themes, and spaces, and has culminated in revelations concerning our relationship with the written word, and how this relationship may be transformed and transcended through creating innovative 'reading' experiences.

DISCOVERING FLO FOX

STUDENTS Esther Michaels *BHA*

ADVISORS M. Stephanie Murray *BHA* | Dylan Vitone *Design*

ROOM/TIME Connan/12-2:30 pm

For this project I began the process of digitally archiving the negative collection of Flo Fox, a photographer from New York City. Flo was born blind in one eye, diagnosed with multiple sclerosis early in life, progressively lost her vision in the other eye and all mobility. She is now living in Visions, the building for the blind and uses an electronic wheelchair with 24 hour care. Despite these challenges, Flo's story is much more than any issue with her physical health. After driving to New York every weekend to meet with her and pick up negatives, I began to compile not only an archive of her work, but one of her life.

EARLY LIFE SOCIAL TRANSITIONS AND HEALTH AND WELL-BEING IN YOUNG ADULTS

STUDENTS Rachel Johnson *Psychology* | Yu Zhao *BHA*

ADVISORS Vicki Helgeson *Psychology*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

This project uses a new measure that is currently being developed with the intent to accurately measure social connectedness through the life course, and investigate preliminary connections between social connectedness and health and well-being outcomes. The measure has previously been used for participants

age 35 and up. In this project, the measure was altered to apply to 18-25 year olds and was used to look for preliminary connections between early life social transitions and health and well-being. Validity of the measure for this population was tested, as well as using the preliminary measure to investigate a person's level of anxiety, as related to his or her social connectedness throughout the life course and level of desire for control.

ETHICS OF SPRAWL

STUDENTS Benjamin Pattison-Gordon *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

Low-density housing contributes to sprawling suburban construction, with significant environmental, social, and economic concerns. Given the impact of sprawl and the state of the world today, is it justifiable to continue designing and building single-family, free-standing houses? This important element of ethical concern in the architectural and building professions is explored through reasoned argument.

EXTENDING ANTHROPOLOGY: VISUAL RESEARCH PRACTICES AND NEW MEDIA PRESENTATION

STUDENTS Courtney Wittekind *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Pake / 1:20 pm

Throughout its disciplinary history, anthropology has been preoccupied by the visual. Visual objects— whether artifacts, drawings, photographs, or videos— have been collected by anthropologists since the discipline's early emergence, however, a lack of analytical frameworks and approaches regarding the theoretical and conceptual utility of the visual persists. Archives of anthropological images remain unseen and unused, and the visual, when included in an anthropological product, tends to be purely illustrative, rather than considered theoretically in its own right. As David MacDougall writes, "Anthropology has had no lack of interest in the visual; its problem has always been what to do with it" (1997:276).

In this presentation, I will explore the ways in which anthropology as a whole can benefit from alternative methods, objectives, and approaches tied the visual, with a particular emphasis on how visual materials can be presented in conjunction with more traditional anthropological analyses. I will argue that simply translating a sentence and word-based anthropology into imagery is counterproductive, as visual anthropology will never succeed at either copying or substituting texts. Rather, I propose a presentation method that takes advantage of the technological strides made in the past decade to highlight the strengths intrinsic to visual anthropology; specifically nonlinearity, transparency, multi-vocality, and collaborative creation and production. Drawing on text and image-based content of my own work, I will explore how research that employs both verbal and visual methods may be presented in a way that does not graft past models onto new terrain, but rather commits to a different method of communication.

FROM ASHES TO ART: A CONSIDERATION OF THE FUNERARY RITES GIVEN TO PEOPLE WITH HIV/AIDS IN THAILAND

STUDENTS Sarah Ceurvorst *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Pake / 12:00 pm

In Thailand, as in many countries around the world, HIV/AIDS is seen as a dirty disease that conceptualizes the body as shameful. The funerary rites given to the HIV infected body after death can teach us a lot about how Thai culture views the disease because funerary rites are a reflection and reinforcement of cultural norms and social values. Using the Buddhist temple and HIV hospice of Wat Prah Baht Nam Phu as a case study, I will explore the ways that funerary rites can serve to bolster stigma against HIV/AIDS and how they can serve to combat it.

FUNES THE MEMORIOUS, A VISUAL TRANSLATION

STUDENTS Molly Cook *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Connan / 3-5 pm

In between linguistic translations there exists a field of missed connections, distorted meanings, and overlooked elements. Translation is often a process of simplification, elimination, and interpretation rather than the assumed creation of an equivalent to the original. My work translates texts and narrates stories, combining words and imagery in ways that attempt to reveal the complicated process of converting one language into another.

In translating Jorge Luis Borge's *Funes el Memorioso*, or *Funes the Memorious*, I attempt to visually narrate the story to an English speaking audience while using visual imagery to compensate for the losses and complications in translation. *Funes*, the main character, is a being who is incapable of forgetting even the simplest details of his life, even when it leads him to his own demise. In the same manner, my translations strive to maintain all the semantic purity of the original story.

It reaches across textual, visual and linguistic boundaries, striving for integration and compensation for losses in translation between English and Spanish. Since the nature of language is often fleeting, elusive and resistant to fixed meaning, my process can seem impossible but takes delight in the effort.

HOW LIGHT AND DIMENSION EFFECT EMOTIONAL PERCEPTION OF SPACE

STUDENTS Aimee Van Varick *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

Proof that size doesn't matter (and lighting does). A psychology survey that gauges the emotional reaction and comfort level in different sized spaces in three levels of light. Architecture has been under the assumption recently that open spaces are welcoming and comfortable but this research shows that the light levels in a space matter more than its dimensions.

IMAGES THROUGH SCREENS

STUDENTS Sejal Popat *BHA*

ADVISORS Martin Prekop *Art*

ROOM/TIME Connan / 3-5 pm

This series of paintings deals with images we encounter through screens (i.e. internet, film, applications etc.) I'm interested in how electronic devices mediate and frame experiences on the internet and in various applications (i.e. Skype, Youtube, Google). In each of the paintings the screen/window that frames the experience is key to the composition and content of the piece.

IMPRINT

STUDENTS Taylor Preston *BHA* | Samantha Ward *BHA* | Minnar Xie *BHA*

ADVISORS James Daniels *English*

ROOM/TIME Connan / 12-2:30 pm

With the money that we received from SURG, we have created an arts, literary, and music zine that showcases the excellent creative student work on campus.

LIFE STORIES FROM VERBAL TO VISUAL: PARTICIPATORY ARTS-BASED PRACTICES AND THE ANTHROPOLOGY OF CHILDHOOD

STUDENTS Courtney Wittekind *BHA*

ADVISORS Judith Schachter *History*

ROOM/TIME Pake / 12:20 pm

In recent decades, the anthropology of childhood, within a context of enhanced international advocacy for the rights of children, has recast children as subjects fully worthy of study, in possession of agency, and able to interpret their social and political surroundings. Attempts at applying life story methodologies commonly used with adult subjects to children, however, have fallen short, producing an onslaught of texts that uncritically quote the child's "voice" without consideration of means of engagement nor production of these representations (James, 2007: 261). In this presentation, summarizing my DC Senior Honors Thesis paper, I will argue for an alternative method to the life story approach in child-focused ethnography; one that is grounded in visual participatory practices and that builds upon, but does not replicate, life story methods used with adult subjects. Drawing on ethnographic research completed with child and adult subjects in Thailand and Burma, I will make a case for participatory research methodologies that are tailored specifically to children and the unique processes by which they conceive of, and communicate about, their world.

LIGHTING THE PATH TO COLLEGE: HOW CAN A DECISION TOOL HELP GUIDANCE COUNSELORS BETTER SUPPORT THE HIGHER EDUCATION SEARCH AND APPLICATION PROCESS?

STUDENTS Sarah Read *BHA*

ADVISORS M. Stephanie Murray *BHA* | Peter Scupelli *Design*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

In the current state of the economy, a bachelors degree is becoming increasingly more important. As college entry rates soar, they are not being met with an equal rise in the rate of college completion. This inequality gap

between entry and completion is growing, disadvantaging low-income and minority students for whom higher education was not previously accessible.

Several databases and web applications exist to help students evaluate colleges and take control of their educational search. Unfortunately, many of these websites are fairly unknown to the users for which they would be most helpful. Prompted by the recent influx of information directed towards students, I began to look at the role high school guidance counselors play in helping students get to college. As most high school guidance counselors are tasked with advising hundreds of students, I speculated about and designed around how a tool could allow counselors to advise students quickly and efficiently.

MAKING CONNECTIONS BETWEEN THE DESIGN OF IMPORTANT AMENITIES, HOMELESSNESS AND EMPOWERMENT

STUDENTS Prisca Ohito *BHA*

ADVISORS M. Stephanie Murray *BHA* | Judith Schachter *History*

ROOM/TIME Wright / 12:40 pm

During an oral presentation, I will discuss the general topics of privacy, control, and space for homeless individuals using the specific examples of the case study at the East End Cooperative Ministries (EECM) in East Liberty, Pittsburgh. The work relies on earlier research that showed how social constructs like privacy and control may mean very different things to homeless and other dispossessed individuals when in certain private spaces, like bathrooms. This work used the ethnography of a particular homeless shelter in East Liberty to develop an argument for how decisions to make certain spaces and important amenities in those spaces in a homeless shelter may impact the quality of the homeless guests' life. This knowledge is important because architects and designers building spaces and amenities for homeless individuals may need to understand these differences to better serve those individuals. Finally, at this presentation, I will explain why this research project avoided art-oriented solutions and used a more relevant ethnography.

MUSICALS TO MARX: MUSIC AND SOUND IN JEAN-LUC GODARD'S 1960'S

STUDENTS Matthew Zurcher *BHA*

ADVISORS Jeffrey Hinkelman *University Libraries* | David Shumway *English*

ROOM/TIME Wright / 1:00 pm

Much has been said about Jean-Luc Godard's remarkable visual maturation during his first decade of filmmaking, but what of his sound? The notorious filmmaker's most impressive creative burst occurred between 1959's "A bout de souffle" and 1967's "Weekend." In 8 years, he revolutionized the way people hear movies. This research traces his sonic development from the early attempts at Hollywood revisionism to the careful chaos of his Marxist masterpiece.

NEEDLE FELTING AS HEALING

STUDENTS Jillian Goodwyn *BHA*

ADVISORS Sharon Carver *Psychology* | M. Stephanie Murray *BHA*

ROOM/TIME Dowd / 3:20 pm

In combining my background in both Fine Art and Psychology, I am teaching a needle felting class designed for individuals with Body-Focused Repetitive Disorders (BFRBs). I have had trichotillomania, a severe hair-pulling

BFRB, for 8 years. However, the art of needle felting has been a catalyst of healing for this disorder. I seek to share needle felting with other individuals with similar disorders, providing them with both the technique and the tools to begin the healing process. For my Meeting of the Minds presentation, I will review the basic research fueling my project, the weekly progress of the felting class, and the results and outcomes of the class.

PARENTAL SELF-EFFICACY IN FIRST-TIME EXPECTANT MOTHERS

STUDENTS Molly Swartz *BHA*

ADVISORS Brooke Feeney *Psychology*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

The transition to parenthood is a significant one. Links have been drawn between prenatal parental self-efficacy and postpartum attachment, postpartum self-efficacy, parenting behaviors, and marital quality in first-time parents. However, the literature concerning parental self-efficacy has relied on somewhat ill-defined constructs and inconsistent measures, especially when incorporating relationship quality. Aiming to correct for these inconsistencies, this correlational study uses established measures of relationship support and quality in combination with a more thorough measure of parental self-efficacy. An online sample of first time expectant mothers between the ages of 22 and 45 is used. Variables include romantic relationship quality, support seeking and receiving within the romantic relationship, general self-efficacy, parental self-efficacy (using both domain- and task-specific measures), general attachment style, labor and delivery expectancies, and previous child/infant care experience. The study hypothesizes that romantic relationship quality and support receiving help to build a sense of parental self-efficacy in first time expectant mothers by contributing to perceptions of general self-efficacy.

PROMOTING PERFORMANCE: THE LANGUAGE AND IDENTITY OF THE PITTSBURGH NEW MUSIC ENSEMBLE

STUDENTS Joshua Levitin *BHA*

ADVISORS Robert Fallon *Music* | M. Stephanie Murray *BHA*

ROOM/TIME Peter / 4:00 pm

Musicians in classical music tend to value music making over music advocacy. The role of words in the large ecosystem of tools for promoting music is often thought of as a distraction, and is thus ignored. While this viewpoint is satisfying to musicians with available performance opportunities, it fails for musicians who no longer have those opportunities. By examining the rhetoric of the Pittsburgh New Music Ensemble (PNME), I show how an understanding of discourse can foster a positive attitude towards a musical genre unfamiliar to most classical music audiences. The primary question I address in this paper is: How does language work as a tool for promoting and developing performance? I also address the following questions: How does feedback from music critics and the public influence PNME? Is there a rhetoric that naturally defines PNME or does PNME shift its rhetoric to fit its persuasive goals? How do these linguistic choices influence the larger culture and performance of new music?

I begin by showing that PNME has crafted an identity from rhetoric that promotes new music as friendly, welcoming, exciting, and equal to the mainstream, contrary to the way audiences testify hearing it. I use critical theory in discourse analysis and rhetorical stylistics to show how the Ensemble's constructed ethos and rhetorical choices fit their persuasive goals. Nearly forty years of newspaper clippings, press releases, concert brochures, and regularly updated blog posts, which date from the founding of PNME in 1976, reflect a history

of new music and its impact on the current state of the Ensemble. While discourse analysis contributes to our understanding the bigger picture of language and culture, my nonprofit identity analysis contributes to our understanding the use of language in a specific context, working as a vital and nuanced contributor to PNME and consequently to the performance of new music in general.

THE ACCURACY OF MENTAL REPRESENTATIONS OF ENVIRONMENTS BASED ON HAPTIC INPUT

STUDENTS Rachel Franz *BHA* | Siyan Zhao *Psychology*

ADVISORS Roberta Klatzky *Psychology*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

The purpose of the study is to explore how accurately tactile input can be converted to mental spatial representations and if there are any factors that influence accuracy. Participants felt several tactile maps while blindfolded and were asked a few questions regarding the map they explored. They were then asked to reproduce the tactile map. We predicted that when people thought of spatial relationships relative to their body, their perception of space would be less accurate.

THE ARTS AND ENTERTAINMENT INDUSTRY IN CONTEMPORARY CHINA

STUDENTS Melody Lu *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

Before China's rapid economic growth, there were not as many opportunities for the Chinese people to immerse themselves in the arts; however, China now has some of the world's best museums, conservatories, and concert venues. Without question, it is vital to understand the arts and entertainment industry in contemporary China because many believe that the country's huge economy and consumer population will determine the future of these industries.

THE BRERA DECK

STUDENTS Alexander de Ronde *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Connan / 12-2:30 pm

Italian luxury brands are renowned for creating the illusion of a glamorous and exclusive lifestyle – a dream factor – by producing lines of clothing and accessories suited for a particular type of individual. The “Miu Miu girl” is notably different than Versace’s “Medusa woman”; they differ in personality-type and aesthetic preference. In result, brand allegiances and the way an individual decides to dress is not only representative of their sense of style, but also suggests aspects of their character. This project aims to investigate the ways in which these brands are constructed by positing imagined versions of identities and presenting them as fortunes.

Within the city of Milan, the fashion headquarters of Italy, there is an area called Brera noted for its community of psychics and witches. Inspired by the ancient tarot deck most commonly used by these witches, the Brera deck commentates on this relationship between fashion consumer and brand image. The deck of cards features depictions of handcrafted miniature dresses, made to resemble the signature styles of various Italian designers. By expressing preference for a type of garment, a reading by the Brera deck gives the participant insight into their present and future life.

THE HOUSE OF TILDEN: GAY AND LESBIAN SOCIAL CLUBS OF 1960S PITTSBURGH

STUDENTS Harrison Apple *BHA*

ADVISORS Timothy Haggerty *Humanities Scholars Program* | M. Stephanie Murray *BHA*

ROOM/TIME Wright / 3:20 pm

The historiography of gay and lesbian subculture, particularly related to “bar culture” poses a particular relationship between the generally organized crime run establishment and the exploited patron, up until the millennial moment of subcultural revolution, taking particular media attention by the close of the 1960s. Through fieldwork and archival research, my presentation will complicate this narrative pertaining to Pittsburgh’s particular history involving the rise to prominence of a particular gay steward of a series of gay and lesbian social clubs, his relationship to the world of organized crime / casual corruption, and his influence on contemporary GLBT life in Pittsburgh.

THE SATYR’S DAUGHTER

STUDENTS Claire Sullivan *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Connan / 3-5 pm

My consumption and research of various literary titles ranging from the 19th-20th century, in the genres of weird, horror, and fantasy fiction, has culminated in a series of drawings in which I have interpreted the life cycle of a central character from the 1894 novella “The Great God Pan” by Arthur Machen. In creating this series, I have explored the themes of sexuality and sexual freedom, oppression, and fantasy versus reality - these themes are both extrapolated from the source material as well as stemming from my own reaction to the story and characters.

WINDOWBOX - TEACHING AND LEARNING THROUGH GAME MECHANICS

STUDENTS Gina Smith *BHA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Pake / 4:00 pm

WindowBox is an exploration of both teaching and learning in a game environment. In the game, a player can learn about the areas of the brain and how the brain sends and receives information.

Much of what we know about the brain comes from examining what happens when things aren’t working correctly – when there is damage, missing pieces or crossed wires. By studying how the brain works when things are not going quite as planned, we can understand how a healthy brains functions.

My game is based off of this premise. The interface is based off of lesion studies, and explores both well and poorly functioning minds. The player takes the role of young woman who possesses the power to manipulate brains. She can activate and inhibit different areas of the minds of those around her, and though trial and error, the player learns about the various lobes of the brain and what happens when things go wrong.

BIOLOGY AND PSYCHOLOGY

CHARACTERIZING THE TRAFFICKING OF MU-OPIOID RECEPTOR UPON LIGAND ACTIVATION

STUDENTS Isaac Shamie *Biology and Psychology*

ADVISORS Manojkumar Puthenveed *Biological Sciences*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

Opioid analgesics are the most powerful and the main class of analgesics that serve to relieve the body of pain. The mu opioid receptor is also a major target of addictive drugs, such as morphine and heroin. The hypothesized molecular basis of the addictive and pain relief pathway is rooted in the kinetics of receptor trafficking through endocytosis and recycling of the receptor back to the membrane. An allelic mutation in the mu-opioid receptor, A118G (corresponds to the A112G allele in the mouse), correlates with the phenotype of higher tendency to opiate addiction. So what causes heroin and morphine addiction, and why is there a difference between the normal and mutated receptor? Molecular differences will be analyzed between the wild type MOR and the A118G mutated MOR. Specifically, the receptor recycling rate will be visualized using a ratiometric fluorescence assay. Understanding these differences between the wild type and mutated receptor could facilitate the development of novel treatments to oppose the addictive pathways of certain drugs.

EXAMINING AGENCY AND COMMUNION THEMES IN OLDER COUPLES' PERSONAL GOALS

STUDENTS Priscilla Kim *Psychology* | Sook Yee Leung *Psychology, Chatham University* | John Ra *Biology and Psychology*

ADVISORS Brooke Feeney *Psychology* | Vicki Helgeson *Psychology*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

The goals of this study were to determine the extent to which older subjects' earlier life experiences influenced their present-day goals, to relate subjects' agentic and communal goals to various personality traits and gender, and to determine whether a relation exists between having agentic and/or communal goals and well being. Couples over the age of 65 completed measures of personality and life satisfaction in separate rooms and were also asked to list up to 10 goals that they would like to accomplish over the coming year that did not require their spouse's assistance. Each goal was then coded by two trained, independent coders for its primary type (e.g. travel, relationships, finance, etc.) and characteristics. We focused primarily on the themes of agency and communion in the couples' goals. We predict that earlier life experiences will be related to the types of goals set in older age. For example, we hypothesize that people who had more agentic lives (i.e., high agency occupations) will have more communal goals, and people who had more communal lives (i.e., raised children and/or high communion occupations) will have more agentic goals. We also hypothesize that males will express more communal goals while females will express more agentic goals. Last, we predict a positive relation between the number of agentic goals expressed and well being.

PRIMING GESTURES WITH RELATED SOUNDS

STUDENTS Nicolas Zuniga-Penarand *Biology and Psychology*

ADVISORS Laurie Heller *Psychology*

ROOM/TIME Dowd / 12:40 pm

We aimed to study the priming of manual actions by naturally and artificially associated sounds. Previous studies have reported on related cross-modal priming, such as of manual actions by visual stimuli (Brass et al. 2000) (Masson et al. 2011). Castielle et al. (2010) demonstrated that recorded response sounds could be used to elicit affordances for reach-to-grasp actions. In addition, neuroimaging studies (Aziz-Zadeh, 2004) have shown that listening to sounds of human actions activates motor networks in the brain, and suggest that priming a manual action by playing a corresponding sound (i.e. auditory-motor priming) should be possible. Similar studies have begun to identify the neurological system underlying this priming effect as possibly being independent of semantic representations (Bourquit et al, 2013) and modality-specific representations, but yet involving long-term memories (Tucker & Ellis, 2003).

This oral presentation discusses a series of three experiments and several variants that explored auditory-motor priming. In these experiments, subjects were first trained to associate a sound A to a manual action A, and a sound B to a manual action B. After training, subjects heard the sound A or B as a prime, followed by a directional command, such as “left” or “right” in most of the experiments, indicating which of the two actions to perform. Primes and directions varied independently, so movement accuracy and reaction time were measured as congruent, incongruent, or null (no prime) trials. The presence of auditory-motor priming between these primes and actions was predicted to cause facilitation or shorter reaction time in congruent trials, and inhibition or longer RTs in incongruent trials. Experiment 1 used natural sound-action pairings: scrapes and taps. A priming effect was observed. Experiment 2 determined whether, for priming to occur, the sound-motor association must be reinforced throughout the experiment. This was accomplished by preventing subjects from hearing any sounds they were creating by their response actions. To test whether the sound-motor associations must have existed previously, or could be arbitrarily created within the experimental session, Experiment 3 used arbitrary gesture-sound associations by pairing button presses with tones of varying frequencies.

Though experiment 1 showed a priming effect by comparing RTs in congruent vs. incongruent trials, experiment 2 evinced no such effect. Finally, the successful use of artificial sound-action pairings to create the priming effect in experiment 3 demonstrates that auditory-motor priming can be produced by recently learned sound-action pairings. Future studies may explore the limits of what sound-action pairs can be learned and what conditions allow for the modality-specific sound stimuli to draw on the theorized modality-independent relationships between the primes and responses in long-term memory.

THE INVESTIGATION OF THE ROLE OF HEDGEHOG IN NEURAL PATTERNING OF PATIRIA MINIATA LARVAE

STUDENTS Annette Ko *Chemical Engineering* | Lazar Lalone *Biology and Psychology* | Sowmya Yennam *Biological Sciences*

ADVISORS Veronica Hinman *Biological Sciences*

ROOM/TIME Dowd / 4:00 pm

During embryogenesis, the cells of embryos undergo rapid division and differentiation to eventually lead to the development of an adult organism. Throughout this process, much genetic signaling occurs that collectively determines the later function of these early cells. The pathways responsible for this signaling are often specific to a species, but cases have also been found in which the same gene appears to have similar function across

species, suggesting evolutionary relatedness between organisms. One such conserved gene is Sonic Hedgehog (Hh), which is responsible for patterning the nervous system of humans, but has also been found in *Patiria miniata*, sea stars. Such a similarity between vertebrates and sea stars is not unexpected, as both are deuterostomes and undergo similar embryonic development, but research has not been conducted on the extent of this similarity. In this project, we will work to better characterize the neural patterning in sea star embryos, investigate the possible role of Hedgehog in the formation of the invertebrate nervous system, and then compare this to Hh expression in humans. To do this, we will knockdown Hedgehog using Hedgehog morpholino antisense oligomer (morpholino) and observe its effect on motor and sensory neurons via *in situ* hybridization. The gene knockdown will also be performed with cyclopamine to cross-check the effect of morpholino and to investigate how Hedgehog knockdown affects neural patterning in embryos at different stages of development. It is expected that in addition to humans and sea stars both expressing Hh in neural development, a similar patterning mechanism may exist as well. If this is the case, this research could give insight to the evolution between these organisms as well as neural development in humans, which could be particularly useful for better characterizing and treating neurological diseases which often interrupt these genetic pathways.

BSA (BACHELOR OF SCIENCE AND ARTS)

BEAUTIFUL ORGANS: SELLING HEALTH

STUDENTS Shephaly Soni *BSA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Connan / 3-5 pm

Through my artistic abilities and my passion for health care, I plan to create a reinvented version of advertisements for beautiful organs. While it seems as if American culture is entirely consumed with physical appearance and its up keep, the culture lacks the basic health initiative behind the internal appearance. Advertising requires the audience to have a need that must be filled. The current audience is extremely compartmentalized, and the need is constantly concerning their external appearance. The audience in my case is everyone: anyone who has a body, a heart, muscles, a brain, and so on. This project's objective is to have wide spread appeal: there is no specific body type that is excluded. My goal is to merely push the notion of your internal network being beautiful. In order to create the need, I must create a standard; this standard will be based upon certain factors concerning health (i.e. BMI, fat percentage, risk factors) and how these factors affect the physical appearance of one's internal organs. This idea will be manifested in a series of large photographs combined with oil paintings, juxtaposing the differences in neglect and care of one's body.

ENGAGED LEARNING: THE INTERSECTION OF SCIENCE AND ART

STUDENTS Caroline Colombo *BSA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

Over the past year, I have extensively studied how museumgoers take in visual information. I have explored how viewers understand concepts within museum exhibits and art objects in order to discover new ways that artists and designers can provoke stimulating and intellectually inquisitive responses. Ultimately, I hope to produce new ways of approaching exhibit design to communicate beauty in both aesthetic form and scientific origins/information.

ILLUSTRATING BIOLOGICAL PROCESSES THROUGH ANIMATION

STUDENTS Michael Julian *BSA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Connan / 12-2:30 pm

Life is made possible by countless dynamic, complex processes working in conjunction with one another. Research in the field of Biology is focused on learning all we can about these mechanisms, how they work, why they break and ultimately how we can fix, change or use them. However in trying to teach others about them we are hindered by the fact that they occur on a scale that we are often unable to directly observe. For this reason I have sought to create animations of biological processes that help present them in such a way that they could be easily understood as well as be intrinsically beautiful as nature intended, educational and yet pleasing to watch.

MARKETING INSPIRATION: A VIRAL CALL TO ACTION

STUDENTS Sankalp Bhatnagar *BSA*

ADVISORS M. Stephanie Murray *BHA* | Dylan Vitone *Design*

ROOM/TIME Rangos 2&3/Sigma Xi Group 9 / 10:37 am

Throughout our undergraduate career, my generation often lacks sufficient motivation to live out our college experience to the fullest, sacrificing extracurricular or even off-campus city-wide opportunities that could foster our passions in pursuit of an expected obligation to succeed solely academically in college, inevitably limiting our own potential to grow and define our own individual identities; more often than not, we fail to explore new opportunities and the distinctive persona of our surrounding city--ultimately ending up going through our college career unsatisfied with the memories we've made and experiences we've had.

For this reason, I developed and launched a motivational campaign utilizing viral marketing techniques to inspire my generation to live a more fulfilling life during our time in college, taking advantage of our campus identity, the city culture, and various distinct opportunities that await them should they seek to live inspired lives.

PLANTS OF THE FUTURE

STUDENTS Mary Tsang *BSA*

ADVISORS Joe Mannino *Art* | Ali Momeni *Art* | M. Stephanie Murray *BHA*

ROOM/TIME Peter / 3:00 pm

This project is inspired and motivated by the deforestation of Cusuco National Park, Honduras, the loss of an idealized landscape that is one of the best-suited environments for biodiversity. Hydroponics, the science of growing and sustaining plants using only water and light, is meant to be a solution where the soil disappeared from the development of a plant, and therefore “unchained” them from the earth. I envision these “post-natural” plants as organisms of the future. I have uprooted them from the degradation of the planet, and from tiny dormant seeds, they know nothing but pipe, metal, and fluorescent lights. They have never seen the sun, and yet they thrive more successfully than their mothers, fathers, and predecessors. In doing so, I ask: can I uproot them further? Can I design a system in which all components are portable, free, and self-sustaining? How much more can I liberate my plants from the earth that is the source of their destruction?

This inter-disciplinary project addresses today’s environmental issues through the artistic metaphor of scientific spectacle. By combining an aeroponic system, custom-blown glass vessels, and a six-foot satellite dish, this final piece is a symbolic reversal of one of the most primitive natural processes: the uptake of water by the roots of plants as they blossom towards the sun and sky. All are encouraged to experience this sculpture in the Miller Gallery from May 4th to May 18th.

THE FORMATION OF ESTERS AND OTHER BYPRODUCTS DURING BEER FERMENTATION: THE EFFECT OF YEAST STRAIN AND PITCHING RATE

STUDENTS Emily Henderson *BSA*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

In the fermentation stage of beer brewing, the yeast’s anaerobic metabolism of sugars produces not only ethanol, but also many by-products that are responsible for the flavor of the beer. Some of these flavor compounds include diacetyl, dimethyl sulfide, esters, and vicinal diketones. The purpose of this research was to better understand the relationship between the flavor profile of beer and its chemical composition. Of the flavor compounds, esters are the largest and most pleasing group, so the first of two experiments involved the brewing of an English Special Bitter (ESB), a beer known for its strong ester profile. The wort was split into two batches and each batch fermented with a different yeast strain. The second experiment involved the effect of yeast pitching rate on the flavor of the beer. The taste tests indicate several notable differences as a result of the yeast variation. This project emphasizes the importance of using chemical analysis to ensure beer quality and consistency.

SCIENCE AND HUMANITIES SCHOLARS

A GPU ACCELERATED CORRELATION FUNCTION FOR LARGE COSMOLOGICAL DATASETS

STUDENTS Eric Chandler *Science and Humanities Scholars*

ADVISORS Shirley Chan Wan Ho *Physics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 10:48 am

In cosmology, the two-point correlation function measures the excess probability in the distribution of galaxies compared to a random distribution. The cosmological parameters governing the expansion of the universe predict its shape and a peak in the function corresponding to the baryon acoustic oscillations. The two-point correlation function is calculated on the SDSS DR9 dataset of approximately 200,000 galaxies. The correlation function is written in the CUDA programming language and run on an NVIDIA M2090 GPU processor to significantly reduce run-time compared to sequential or MPI code.

A NON-PARAMETRIC METHOD FOR INTERPOLATING TELESCOPE POINT-SPREAD FUNCTIONS

STUDENTS Kathryn McKeough *Science and Humanities Scholars*

ADVISORS Peter Freeman *Statistics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 10:00 am

As a consequence of Einstein's Theory of General Relativity, massive objects can bend the paths of photons travelling from distant galaxies to Earth. Therefore, the appearance of distant galaxies is distorted, or "sheared". What causes this shear is referred to as Weak Gravitational Lensing. The shear and spatial distribution of intervening masses can be statistically inferred by carefully modeling galaxy appearance. The observed appearances of the galaxies are also affected by a blurring introduced by the atmosphere and the telescope. This blurring, whose mathematical formulation is called the Point Spread Function (PSF), further distorts the appearances of distant galaxies. The PSF must be modeled in order to better understand it as a source of systematic error in shear estimation. Stars are point sources that allow one to estimate the PSF at specific locations by modeling the variation of the PSFs of noisy star images. Simulated data provided by GRavitational lEnsing Accuracy Testing (GREAT) challenges allow one to test algorithms that predict the PSF at arbitrary locations in an image. In this poster, we present an algorithm for estimating PSFs at galaxy locations that is based on a nonlinear dimension reduction technique, diffusion map, which allows us to model how the PSF shape varies across an image.

AESTHETIC POSITIONING: LOCATING GLOBAL FEMINISMS IN THE WORK OF FEMALE JAPANESE ARTISTS

STUDENTS Jena Tegeler *Science and Humanities Scholars*

ADVISORS Yoshihiro Yasuhara *Modern Languages*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The impulse to define a narrow and essentialized Japanese or female identity within artworks produced by Japanese female artists is pervasive among curators and art historians. This paper instead suggests a diverse body of artistic production that speaks to conceptions of feminism much more heterogeneously and broadly conceived. In this way, it questions historical patterns of artistic analysis and presentation, and expands

current understandings of global feminisms.

Using original analysis of the artworks of contemporary artists Miwa Yanagi, Aya Takano, Tabaimo, Tomoko Sawada, and Mariko Mori, and an examination of post-colonial feminist theory, I elucidate distinct and diverse methods of agency employed by these artists. The artists may be read as engaging Western traditions of feminism--pushing against what the West encodes as local patriarchal forces such as strict gender roles, the notion of the self-sacrificing female figure, and the historic exclusion of women from the realm of fine art. Pushing further, the paper suggests that the artists are challenging constraints that go beyond issues of gender, from pressures of conformity and subcultural politics within Japan, to the global art world's tendency to discuss Japanese female artists only in relation to *kawaii* (cute) aesthetics. I show how these artists are diversely positioned within the micro and macro worlds around them, turning personal experience into global cultural dialogue through visual expression. Although the works respond to a commonality in local social landscapes, histories, and artistic traditions, they resist hegemonic forces that promote racialized or gendered worldviews.

ANALYSIS OF PHOSPHORYLATION OF APC2 IN THE DROSOPHILA SYNCYTIAL EMBRYO

STUDENTS Kelly Shibuya *Science and Humanities Scholars*

ADVISORS Brooke McCartney *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 2 / 10:00 am

The colon cancer tumor suppressor, Adenomatous polyposis coli (APC), is a multifunctional protein that is involved in Wnt signaling, where it participates in the destruction complex that is responsible for the degradation of β -catenin, which prevents tumor formation. However, APC also plays a role in the organization of the cytoskeleton. We are investigating the role of APC on β -catenin expression and the actin cytoskeleton in order to further discover links between APC and tumor development. Like humans, *Drosophila* have two APC isoforms that are highly conserved. The *Drosophila* syncytial embryo provides an excellent model system to study cytoskeletal events due to the dynamic nature of the cytoskeleton during this time of development. Previously, it has been shown that APC2 localizes to these actin furrows, and loss of APC2 activity (APC2 null) leads to furrow extension defects and overexpression of β -catenin. Additionally, APC proteins are highly phosphorylated, a mechanism commonly used to regulate protein functions. Previous results indicated that the phosphorylation of APC2s' 20 amino acid repeats (20Rs) plays a role in regulating APC2 activity during furrow formation. It has also been shown that phosphorylation of APC increases binding affinity for β -catenin to target β -catenin for degradation. In this study, we are investigating the role of the kinases, GSK3 and AKT, in regulating APC2 activity in regards to actin furrow formation, APC2 localization, and β -catenin expression in the *Drosophila* syncytial embryo. GSK3 and AKT are known kinases in the APC phosphorylation pathway that participate in Wnt signaling. This study provides a better understanding of how phosphorylation of APC2 regulates its activity in the *Drosophila* syncytial embryo.

BiLASSO REGRESSION

STUDENTS Madeleine Clute *Science and Humanities Scholars*

ADVISORS Aarti Singh *Machine Learning*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

The poster will cover the motivation for and implementation of a new type of regression--BiLASSO, which attempts to mimic the LASSO regression, but for higher dimension problems. Poster will detail successes and failures of the algorithm.

CAN I HAVE A SEAT?: A STUDY OF AVAILABLE SEATING IN THE UNIVERSITY CENTER

STUDENTS Allison Ma *Social & Decision Sciences* | Adams Rosales *Business Administration* | Jennifer Soong *Science and Humanities Scholars* | Sam Zhang *Computer Science* | He Zhu *Mathematics*

ADVISORS Trent Gaugler *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

The second floor of the University Center provides a convenient spot for students to meet and study, but is often full. This survey investigates the problem of the insufficient amount tables and seating in the poolside, gym, and main area of the second floor. Data on a variety of variables, such as table usage and foot traffic, will be collected by observation and analyzed. Utilizing the results of the data analysis and considering a variety of solutions for a more efficient use of chairs and tables, a recommendation will be written as to how to optimally meet the needs of students.

CHICK EMBRYO EXTRACT AND EPIGENETIC REGULATION OF OSTEOSARCOMA STEM CELLS

STUDENTS Riddhima Agarwal *Science and Humanities Scholars*

ADVISOR Kurt Weiss *University of Pittsburgh*

ROOM/TIME Rangos 2&3/Sigma Xi Group 1 / 10:25 am

It is widely accepted that cancer has genetic and epigenetic origins. The idea of epigenetic reprogramming of cancer cells by the embryonic microenvironment possesses potential interest from the prospect of both basic science and potential therapeutic strategies. Chick Embryo Extract (CEE) has been used for the cultivation of some stem cells, and has been shown in previous studies to be necessary for the successful expansion of highly regenerative muscle-derived stem cells (MDSCs). CEE has also been demonstrated to facilitate DNA demethylation. The current study was conducted to compare the status of DNA methylation in both highly metastatic and less metastatic osteosarcoma (OS) cells, and investigate whether CEE may affect the epigenetic regulation of tumor suppresser genes and thus change the metastatic phenotype of highly metastatic osteosarcoma cells. Our current results suggest that the methylation status of tumor suppressor genes (p16, p53 and E-Cadherin) is significantly greater in highly metastatic mouse OS K7M2 cells, in comparison with less metastatic mouse OS K12 cells. CEE treatment of K7M2 cells caused demethylation of p16, p53 and E-Cadherin genes, upregulated their expression, and resulted in the reversion of metastatic phenotypes in highly metastatic OS cells. (Stem Cell Research Center, Department of Orthopaedic Surgery, University of Pittsburgh, Pittsburgh, PA 15219)

COMPARING COMPUTER-BASED INSTRUCTIONAL METHODS FOR CHINESE CHARACTER LEARNING

STUDENTS Like Li *Science and Humanities Scholars*

ADVISORS Brian MacWhinney *Psychology*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The present project aims to design a computer-based tutor that promotes the robust learning of Chinese characters for Chinese as a foreign language (CFL) learners. While much previous research has focused on the teaching of Chinese characters based on semantic radicals and phonetic components, these instructional methods can only be applied to a subset of characters. In this project, we aim to determine which general methods are effective in teaching all Chinese characters. Two experiments are designed to compare different

methods for teaching Chinese characters, with the aim to include the more effective methods in a final Chinese character tutor. In the first experiment, we compare the effectiveness of rote memorization tasks vs. writing/ alphabetic-typing tasks for learning Chinese characters. In the second experiment, we compare the effectiveness of learning Chinese characters individually vs. within the context of a meaningful sentence.

EARLY LIFE SOCIAL TRANSITIONS AND HEALTH AND WELL-BEING IN YOUNG ADULTS

STUDENTS Rachel Johnson *Science and Humanities Scholars* | Yu Zhao *BHA*

ADVISORS Vicki Helgeson *Psychology*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

This project uses a new measure that is currently being developed with the intent to accurately measure social connectedness through the life course, and investigate preliminary connections between social connectedness and health and well-being outcomes. The measure has previously been used for participants age 35 and up. In this project, the measure was altered to apply to 18-25 year olds and was used to look for preliminary connections between early life social transitions and health and well-being. Validity of the measure for this population was tested, as well as using the preliminary measure to investigate a person's level of anxiety, as related to his or her social connectedness throughout the life course and level of desire for control.

EFFECT OF ACTIN DESTABILIZING DRUGS ON RECYCLING OF BETA 2 ADRENERGIC RECEPTORS

STUDENTS Purumeh Nam *Science and Humanities Scholars*

ADVISORS Manojkumar Puthenveed *Biological Sciences*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

Signaling receptors on the cell membrane such as G-protein coupled receptors (GPCR) are 7-transmembrane domain receptors that induce cellular signal transduction and when activated – influencing a plethora of biological processes. When induced by an agonist, the receptor and its ligand enter the cell via a vesicle, which delivers them to an endosome. From the endosome, receptors can take different pathways. It can either go to the lysosome for degradation, travel to the Golgi apparatus for processing, or separate from its ligand and recycle back to the cell membrane via an offshoot of the endosome called tubule. Receptors such as nutrient receptors are continuously recycled back via bulk recycling, but not signaling receptors – for these, recycling is a longer, more regulated process, indicating that there is something other than bulk recycling that governs the phenomenon. If signal receptors recycle back to the membrane too quickly, it can have serious consequences such as heart failure, or even PTSD. One sort of such signaling GPCR, the beta-2 adrenergic receptor (b2AR), is the receptor for catecholamines such as epinephrine. It has been discovered that b2AR is stabilized by a scaffold of actin in tubules, and this actin scaffolding slows the release of tubules from endosomes – ultimately regulating signal receptor recycling. However, how the receptor engages with the actin in tubules is largely unknown. By treating cells with two different types of actin destabilizing drugs Latrunculin A and Cytochalasin D, the change of recycling was observed – to ultimately discern the impact of actin on sorting of signaling receptors.

ENTERACT

STUDENTS Zachary Auerbach *Science and Humanities Scholars* | Jiunn Haur Lim *Information Systems* | Anna Molosky *Information Systems* | Vivek Sainanee *Information Systems* | Wan Xin Teo *Science and Humanities Scholars*

ADVISORS Raja Sooriamurthi *Information Systems*

ROOM/TIME Rangos 2&3/Sigma Xi Group 9 / 11:00 am

Enteract.in is a mobile-friendly web app that allows presentations to become interactive. Presenters can ask questions, receive answers, and view charts that update instantaneously. This form of mobile polling will not only improve engagement during presentations, but can be expanded beyond the presentation to discover customer opinions.

INVASION OF CANDIDA ALBICANS HYPHAE INTO ELASTOMER

STUDENTS Tammy Ying *Science and Humanities Scholars*

ADVISORS Frederick Lanni *Biological Sciences*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

My research is aimed at understanding the invasion of yeast biofilm cells into cross linked elastomer. Wild-type and mutant strains of *C. albicans* will be grown and imaged to test the hypothesis that cell turgor pressure drives invasive hyphae (elongated chains of cells). Each type of biofilm will be assayed for cellular glycerol content (the putative osmolyte), and for total biomass. Cross link ratios will be varied systematically to find the modulus limit above which invasion is suppressed.

LOS TICOS Y LOS NICARAGÜENSES: ANTI-NICARAGUAN ATTITUDES IN COSTA RICA FROM THE 1980S TO THE PRESENT DAY

STUDENTS Vivian Chang *Science and Humanities Scholars*

ADVISORS John Soluri *History*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

Global immigration into Costa Rica has been spurred on by the receiving country's relative political peace (undisturbed as it was by the civil wars that rocked Central America in the twentieth century) and bountiful natural resources, giving it a high quality of life. However, many Costa Rican citizens have espoused anti-Nicaraguan views, especially derogatory stereotypes concerning Nicaraguan immigrants and their alleged effects on Costa Rica. In my project I will identify major stereotypes and misconceptions about Nicaraguans, determine the validity of these statements, and examine print media for possible influence on and contribution to anti-Nicaraguan attitudes.

PEPTIDE NUCLEIC ACID SYNTHESIS: SURF 2012

STUDENTS Stephanie Blotner *Science and Humanities Scholars*

ADVISORS Catalina Achim *Chemistry*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 11:25 am

Peptide nucleic acids (PNA) are being studied for molecular electronics and nanotechnology applications. Molecular switches could make possible molecule-based computation. PNA can be modified to suit the goal of building such a switch by replacing nucleobases with ligands. The goal of my summer SURF project was to

synthesize, purify, and characterize ligand-modified PNA with appropriate sequence of nucleobases and ligands. I have accomplished these goals by manual peptide synthesis, HPLC and MALDI-ToF mass spectrometry, respectively.

PITCH GENERALIZATION AND INTERVAL TRAINING IN STATISTICAL LEARNING

STUDENTS Amritha Mallikarjun *Science and Humanities Scholars*

ADVISORS Erik Thiessen *Psychology*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

Studies have shown that young infants who are given words in a certain affect or pitch cannot recall the word if it is presented in a different affect or pitch to them (Houston & Jusczyk, 2000, Singh et al., 2004). This makes word learning difficult, as infants cannot understand the same word spoken by one person when it is produced by a different speaker. Infants have been shown, however, to generalize words over multiple different affects if given words in happy, sad, angry and fearful tones (Singh, 2008). This study expands on Singh's work through an examination of adult bilingual and monolingual speakers' generalization of words given at a higher pitch to words at a lower pitch. In this statistical learning task, the single pitch condition features a steady high-pitched language followed by test words in a medium pitch. The varying pitch condition features an interleaved high pitch and low pitch language followed by the same medium pitch test words. This experiment will help us further understand how adults and infants can use the variation of input they receive to learn to generalize words.

PLAY AND PLAYFULNESS IN ADULT CLOSE RELATIONSHIPS

STUDENTS Alexandra McCluskey *Science and Humanities Scholars* | Jaclyn Ross *Psychology* | Meredith Van Vleet *Psychology*

ADVISORS Brooke Feeney *Psychology*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Does participation in play activities with one's partner have important personal and relational benefits? Eighty dating couples will be recruited from the Pittsburgh area to participate in several laboratory activities. After a distracter activity, participants will be assigned to one of three conditions: a play, serious or positive affect-induction condition. Couples in the play and serious conditions will participate in an interactive game together, but in the play condition, the experimenter will describe the task as "a fun activity" and tell participants to "relax and have fun". In the serious condition, the game will be described as a 'communications task' and couples will be told to "pay attention and try their best." Participants assigned to the positive affect-induction (control) condition will watch a comedic video in separate rooms. The effects of the play activity will be assessed with video recordings and subsequent questionnaires. We hypothesize that couples assigned to the play condition will report more positive perceptions of the activity, their partners and their relationships, and exhibit more positive affect and engagement during the activity. Both of us have obtained research experience by working as research assistants in the CMU Relationships Lab and by completing relevant course work. Thus, we are prepared to undertake this project, and our work will be closely supervised by Meredith Van Vleet, a PhD candidate in the Relationships Lab, and Dr. Brooke Feeney, our faculty mentor. We plan to share the results of the proposed study in a poster presentation at the Meeting of the Minds, and possibly in a journal publication.

PRIMING GESTURES WITH RELATED SOUNDS

STUDENTS Nicolas Zuniga-Penarand *Science and Humanities Scholars*

ADVISORS Laurie Heller *Psychology*

ROOM/TIME Dowd / 12:40 pm

We aimed to study the priming of manual actions by naturally and artificially associated sounds. Previous studies have reported on related cross-modal priming, such as of manual actions by visual stimuli (Brass et al. 2000) (Masson et al. 2011). Castielle et al. (2010) demonstrated that recorded response sounds could be used to elicit affordances for reach-to-grasp actions. In addition, neuroimaging studies (Aziz-Zadeh, 2004) have shown that listening to sounds of human actions activates motor networks in the brain, and suggest that priming a manual action by playing a corresponding sound (i.e. auditory-motor priming) should be possible. Similar studies have begun to identify the neurological system underlying this priming effect as possibly being independent of semantic representations (Bourquie et al, 2013) and modality-specific representations, but yet involving long-term memories (Tucker & Ellis, 2003).

This oral presentation discusses a series of three experiments and several variants that explored auditory-motor priming. In these experiments, subjects were first trained to associate a sound A to a manual action A, and a sound B to a manual action B. After training, subjects heard the sound A or B as a prime, followed by a directional command, such as “left” or “right” in most of the experiments, indicating which of the two actions to perform. Primes and directions varied independently, so movement accuracy and reaction time were measured as congruent, incongruent, or null (no prime) trials. The presence of auditory-motor priming between these primes and actions was predicted to cause facilitation or shorter reaction time in congruent trials, and inhibition or longer RTs in incongruent trials. Experiment 1 used natural sound-action pairings: scrapes and taps. A priming effect was observed. Experiment 2 determined whether, for priming to occur, the sound-motor association must be reinforced throughout the experiment. This was accomplished by preventing subjects from hearing any sounds they were creating by their response actions. To test whether the sound-motor associations must have existed previously, or could be arbitrarily created within the experimental session, Experiment 3 used arbitrary gesture-sound associations by pairing button presses with tones of varying frequencies.

Though experiment 1 showed a priming effect by comparing RTs in congruent vs. incongruent trials, experiment 2 evinced no such effect. Finally, the successful use of artificial sound-action pairings to create the priming effect in experiment 3 demonstrates that auditory-motor priming can be produced by recently learned sound-action pairings. Future studies may explore the limits of what sound-action pairs can be learned and what conditions allow for the modality-specific sound stimuli to draw on the theorized modality-independent relationships between the primes and responses in long-term memory.

SOCIAL SUPPORT FROM ROMANTIC PARTNERS VERSUS FRIENDS AS MODERATORS OF MORTALITY SALIENCE EFFECTS

STUDENTS Jessica Laubach *Science and Humanities Scholars*

ADVISORS Brooke Feeney *Psychology*

ROOM/TIME Wright / 1:40 pm

This study examines the differences between two types of close relationships (friends and romantic partners) in moderating responses to mortality salience. Prior research has shown that mortality salience increases worldview defense as a mechanism for managing the terror of death. It was predicted that social support from romantic partners (but not friends) would alleviate the need to defend one’s worldview in response to mortality

salience. Following a mortality salience or control prime, participants were given a standardized support note from their friend or romantic partner pertaining to a speech the participants believed they would have to give. Participants were then asked to rate their perceptions of the note and their partner, and rate their opinions of a pro-American and anti-American essay (as a measure of worldview defense). A two-way ANOVA revealed a significant interaction between mortality salience and source of social support for worldview defense. Following mortality salience, support from a romantic partner led to less worldview defense than support from a friend. Additionally, romantic partners were perceived as more supportive and more stressed than friends in both the mortality salience and control conditions. These findings suggest that romantic partners may provide a more effective buffer against existential-anxiety than friends and is consistent with predictions derived from terror management theory.

STOLEN BABIES IN SPAIN: HUMAN RIGHTS ABUSES AND POST-TRANSITIONAL JUSTICE

STUDENTS Kimberly Josephson *Science and Humanities Scholars*

ADVISORS Silvia Borzutzky *Social & Decision Sciences*

ROOM/TIME Wright / 2:00 pm

The 20th century has seen many countries transition to democracy, several following violent dictatorships. There is no one, clear solution of how to create a democracy out of a war-torn or oppressed nation; every conflict is unique. The field of transitional justice, however, provides a framework for how to address past injustices and move forward as a nation. While often applauded as a successful democracy, Spain's past has increasingly become a topic of discussion and calls into question its transition more than 30 years ago. Some of the nation's unresolved trauma dates back to the 1930s. As both political punishment and an attempt to purify the Spanish race, Franco's dictatorship oversaw the abduction of more than 40,000 infants and young children during the civil war and deep into the post-war era. As opposition to Franco's regime faded, so did these abductions. Yet from the 1950s through the early 1990s, many hospital workers and Church officials organized the abduction, trafficking, and illegal adoption of as many as 300,000 more children. Only within the last decade have these stories emerged and gained momentum, now beginning to stir local, national, and international attention. Organizations and government institutions, however, face unique challenges that impede the nation's ability to implement post-transitional justice. This paper analyzes Spain's democratic transition and transitional justice mechanisms as they pertain to these stolen children. This investigation constructs a more comprehensive overview of this little-known scandal and addresses future challenges and obligations for implementing post-transitional justice at the local, national, and international levels in Spain.

STUDENT PERCEPTIONS OF OTHER MAJORS/SCHOOLS AT CMU

STUDENTS Ronald Fudala *Economics and Statistics* | Like Li *Science and Humanities Scholars* | Nazym Satbekova *Statistics* | Kit Ying Wong *Economics and Statistics* | Aleksandr Zeltser *Business Administration*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

This topic is interesting because there is a large unspoken divide on campus. Many people understandably congregate in their majors to work on assignments and socialize but often times very distinct group forms in which the people on the inside almost exclusively do everything together. There are well known stereotypes for virtually every school from computer science and business, to drama. In addition, there are also different perceptions and stereotypes concerning the amount of workload for different majors. Now is a good time to do

this survey as understanding people's perceptions of other majors and their personalities and traits associated with it can provide some valuable insight as to why any social divide might exist. After a traumatic incident last year and general awareness of a stress culture at CMU, being able to provide a more socially nurturing and welcoming atmosphere would be beneficial towards the entire student body. Deans of the schools in question would be able to use this data to examine perceptions of how the rest of the school views their department and decide whether there are any negative aspects that could be fixed with a strategic change for the departments. The school can also take these opinions into consideration and try to instill and focus on the more positive aspects. The data can also be used to evaluate if the stereotypes are actually true. An interesting part of this type of survey is that fact that it can lead to many other beneficial research projects. In addition, administrators of specific programs can self-evaluate their departments' in light of the research to try to expand and enhance their program.

In this study, we would like to investigate the following questions:

1. In general, what are CMU students' perceptions of each college at CMU?
2. Are certain colleges/majors considered more difficult or stressful than others?
3. How do students rank their own colleges/majors in terms of difficulty? Do these rankings match the general perception?
4. How do students think the rest of the student body perceives their college/major? Do students feel positively/negatively about how others perceive their major?
5. How many hours per week do students in each college/major work? Do these results match their own perceptions of how difficult their major is? Do these results match the general ranking of major difficulty?

Our target population is the entire undergraduate student body currently attending CMU, and we wish to make inference to the undergraduate population at CMU. Each individual undergraduate student at CMU will be a unit in this population.

We plan to sample from the population of all undergraduate students that are listed in the CMU Master address book (C-Book). The sampling frame should be nearly identical to the target population. However, a possible source of coverage error could come from those students who entered or left CMU in the spring 2013 semester, after the address book had already been published. This error could be partially addressed with regard to students who no longer attend CMU but are listed in the address book. We can cross-check each student who is selected for the sample by using the search function in the CMU online directory, which is up-to-date and does not list any students who no longer attend CMU.

TARGETING GENETIC DISORDER AROUSED FROM UNSTABLE REPEAT EXPANSION WITH JANUS-BASED PEPTIDE NUCLEIC ACID (PNA) TRIPLET THROUGH NATIVE CHEMICAL LIGATION

STUDENTS Yidan Cong *Science and Humanities Scholars*

ADVISORS Danith Ly *Chemistry*

ROOM/TIME Peter / 1:00 pm

So far it has been found that more than 20 genetic disorders are associated with unstable expanded RNA repeats, including Huntington's disease (HD) and Myotonic dystrophy (DM1), just to name a few. Affected individuals have abnormal number of repeats which interact with crucial proteins and interfere with their functions. Currently, we focus on DM1, which arises from RNA triplet CUG expanded repeat. CUG repeat binds with protein MBNL, and in turn affects alternative splicing stage in protein synthesis process. Affected

individuals often have muscle defects. By targeting CUG triplet with matching Janus-based PNA GAC, MBNL is released from CUG and abnormal phenotype is reversed. Matrix-assisted laser desorption/ionization (MALDI) is used on GAC to test its half life. Quenching experiments and melting experiments are performed to confirm the binding of GAC with RNA CUG.

THE INVESTIGATION OF THE ROLE OF HEDGEHOG IN NEURAL PATTERNING OF PATIRIA MINIATA LARVAE

STUDENTS Annette Ko *Chemical Engineering* | Lazar Lalone *Science and Humanities Scholars* | Sowmya Yennam *Biological Sciences*

ADVISORS Veronica Hinman *Biological Sciences*

ROOM/TIME Dowd / 4:00 pm

During embryogenesis, the cells of embryos undergo rapid division and differentiation to eventually lead to the development of an adult organism. Throughout this process, much genetic signaling occurs that collectively determines the later function of these early cells. The pathways responsible for this signaling are often specific to a species, but cases have also been found in which the same gene appears to have similar function across species, suggesting evolutionary relatedness between organisms. One such conserved gene is Sonic Hedgehog (Hh), which is responsible for patterning the nervous system of humans, but has also been found in *Patiria miniata*, sea stars. Such a similarity between vertebrates and sea stars is not unexpected, as both are deuterostomes and undergo similar embryonic development, but research has not been conducted on the extent of this similarity. In this project, we will work to better characterize the neural patterning in sea star embryos, investigate the possible role of Hedgehog in the formation of the invertebrate nervous system, and then compare this to Hh expression in humans. To do this, we will knockdown Hedgehog using Hedgehog morpholino antisense oligomer (morpholino) and observe its effect on motor and sensory neurons via in situ hybridization. The gene knockdown will also be performed with cyclopamine to cross-check the effect of morpholino and to investigate how Hedgehog knockdown affects neural patterning in embryos at different stages of development. It is expected that in addition to humans and sea stars both expressing Hh in neural development, a similar patterning mechanism may exist as well. If this is the case, this research could give insight to the evolution between these organisms as well as neural development in humans, which could be particularly useful for better characterizing and treating neurological diseases which often interrupt these genetic pathways.

VOLUMETRIC STABILITY OF LIPID BILAYERS

STUDENTS Kelsey Hallinen *Science and Humanities Scholars*

ADVISORS John Nagle *Physics* | Stephanie Tristram-Nagle *Physics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 3 / 11:13 am

The gel phase of DPPC has been the best characterized lipid bilayer. It has therefore been alarming that recent publications have reported a gradual decrease in lipid molecular volume of DPPC multilamellar vesicle dispersions in the gel phase upon repeated thermal cycling between 10oC and 50oC using a commercial densimeter. The considerable size of this decrease would have significant implications for the physical chemistry of biomembranes. We have confirmed this phenomenon with the same densimeter model. By contrast, neutral buoyancy measurements performed with similar thermal cycling show no gradual change in lipid volume in the gel phase at 20oC. Remixing the lipid in the densimeter shows that the apparent volume decrease is an artifact.

We conclude that volumes obtained by neutral buoyancy measurements remain accurate and that gel phase DPPC bilayers exist in a volumetrically stable state.



DIETRICH COLLEGE OF HUMANITIES & SOCIAL SCIENCES

ECONOMICS

ANALYZING PSYCHOSTIMULANT USE IN THE CARNEGIE MELLON STUDENT POPULATION

STUDENTS Kevin Handerhan *Social & Decision Sciences* | Andrew Klein *Civil and Environmental Engineering* | Luke Racek *Economics* | Peter Satagaj *Mathematics* | Won Woo Sohn *Economics*

ADVISORS Trent Gaugler *Statistics* | Tracy Sweet *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

In general, performance-enhancing drugs are a sensitive and controversial issue. The most pervasive coverage of this in popular media deals with drugs used by professional and amateur athletes to improve their athletic performance. However, there is rarely coverage of so-called “academic” drugs, such as amphetamines, which are ubiquitous on college campuses in America. The use of these drugs, often without a legal prescription, is mysterious and students have many different opinions on the ethicality of their use and the potential benefits and risks one assumes when consuming them. This topic is particularly interesting at Carnegie Mellon because many Carnegie Mellon students believe that the university’s stressful and strenuous academic environment may incentivize, or even necessitate for some, the use of psychostimulants to maintain good course grades and secure a sound financial future. Studying the CMU student population’s relationship with psychostimulants, both legally and illegally consumed, through voluntary surveys may help us to discover revealing information about the state of the academic environment.

CHANGES IN PIRACY TRENDS AMONGST COLLEGE STUDENTS

STUDENTS Inez Foong *Information Systems* | Nikhil Kumar *Statistics* | Audris Wong *Economics* | Kevin Yang *Economics and Statistics* | Tadas Zolynas *Economics and Statistics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

We are studying changes in piracy habits amongst undergraduate students. Specifically, we would want to assess how often and in what volume do students pirate digital content and if their current behaviors differ from prior years. We will be conducting an online survey to assess these changes in piracy habits. The topic of piracy trends is interesting because we are interested in finding out whether student’s piracy habits have changed over the last 2-4 years, especially with the advent of Hulu, Netflix, Spotify, and other online streaming services. This type of survey would need to be conducted now to assess whether major players in the online streaming market have successfully (or unsuccessfully) deterred piracy in a key demographic. Additionally, we could potentially assess if the MPAA’s actions for reducing piracy have been successful.

CMU DEPRESSION STUDY

STUDENTS Sy Lampl *Economics* | Robert Mohen *Economics* | David Sandor *Economics* | Timothy Wood *Economics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

This topic is interesting because as a recent article in *The Tartan* pointed out, many CMU students suffer from depression or notice depression in others but do not know how to handle it. The article also suggests that the University does not take the necessary steps to help students deal with these prevalent emotional issues. The

stakes are high because in the worst cases, students have taken their own lives, which happened at the end of the fall semester. If this survey can show what groups of students are particularly vulnerable to these types of emotional problems, the university can more effectively help students struggling with depression and greatly reduce the risk of a self-inflicted tragedy like the one last fall from happening again.

This study seeks to answer the following questions:

- How stressful do students consider their lives at Carnegie Mellon?
- Does this stress affect other aspects of their lives?
- What variables are correlated with depression? Ex. Class year, GPA, major, college, gender
- How many CMU students consider themselves depressed compared to the general population and other universities?
- Do students know of outlets at the university to alleviate stress?
- How often have students been seriously concerned about a friend's emotional state? If and when they were, what did they do to help?

CMU SHUTTLE/ESCORT SERVICES SURVEY

STUDENTS Aleksandra Arkhangelska *Statistics* | Irene Kim *Economics* | Luis Marquina *Statistics* | Amy Stautz *Statistics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

Carnegie Mellon currently offers shuttle and escort services through the campus Police Department. This is a significant cost undertaken by the department for a service that is only partially utilized by students. The Vice Presidents and Police Chiefs are consistently questioning and evaluating the effectiveness and viability of this service. Few students are knowledgeable about these services, let alone utilize it to the highest capacity. There is also the need to critically evaluate the routes that these services follow and whether they are most preferred by students or optimize the resources available. The results of this survey could be used by the CMU administration and police departments to evaluate the use and allocation of funds as well as to decipher students' attitudes and knowledge about the transportation options available. Student Government periodically evaluates student attitudes on the student activity fees and consequently the results of our survey may be of interest to them as well.

EFFECT OF CHINESE "CHECKBOOK DIPLOMACY" ON OIL PRODUCTION IN ANGOLA, NIGERIA, AND SUDAN

STUDENTS Margaret Kowalski *Economics*

ADVISORS Elizabeth Kaske *Modern Languages*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

China's economic boom and incredible increase in energy consumption have recently prompted Beijing to explore Africa's abundant oil reserves. This paper considers whether or not China's policy of openly using economic aid and investment to curry diplomatic favor gives a strategic advantage to Chinese oil firms entering the market in Angola, Nigeria, and Sudan. Many Western companies are concerned that the link between China's foreign policy initiatives and its oil investments gives an edge to their Chinese competitors in the bidding process; as such, comparing changes in oil exported to China from various African nations over time and relating trends to large-scale investments in foreign aid and infrastructure development provides key insights to US policymakers. This paper explores the history of interaction between Angola, Nigeria, and Sudan

with China, Beijing's current policy initiatives in these countries, as well as the implications of "checkbook diplomacy." It contains an econometric analysis of the variables affecting oil production and exports from African nations to China.

EFFECT OF TEXTBOOK OWNERSHIP ON CLASS PERFORMANCE

STUDENTS Liting Chen *Business Administration* | Hijae Kim *Business Administration* | Weichao Kong *Economics* | Philip Lee *Social & Decision Sciences* | Nadyli Nunez *Economics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME McKenna / 3:00 pm

How does physical ownership of a required text for a class affect performance and perceived enjoyment in class? Participants will be cluster sampled from classes randomly sampled from each college.

INFORMATION OCCUPATION: EXPLORING INFORMATION DIFFUSION IN OCCUPY WALL STREET'S TWITTER NETWORK

STUDENTS Oliver Haimson *Economics*

ADVISORS Juergen Pfeffer *Institute for Software Research*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

Global social movements of 2011 like the Arab Spring and Occupy Wall Street were unprecedented in their use of social media as an organizing tool and communication technique. To further explore the role of mobile/social technologies in the Occupy Wall Street movement, I analyze information diffusion by means of social media. Specifically, I perform a network visualization and analysis of Twitter data sets and analyze Twitter volume over time to understand OWS' information practices. By understanding the nature of the OWS Twitter network and information diffusion patterns within that network, effective social media strategies for social movements can be identified and improved.

Methods include a network visualization and analysis of OWS tweets and retweets among a portion of the Occupy movement, an analysis of tweet volume compared with number of people present at an action over time, a study of sentiment among OWS tweets and comparison to mainstream media coverage, and an agent-based simulation.

My examinations of OWS Twitter data lead to a number of important findings. The network visualization and analysis suggests that a Twitter user can be influential and central in a network if she is (1) an information router and/or (2) an information source, and that the two are not mutually exclusive (The terms "information router" and "information source" come from Lotan et al., 2011). Combining Twitter volume with observations from on-site research, I find that Twitter activity occurs most often just before and after an action, and subsides during the most active times of on-site protest. Next, while the mainstream media's response to the Occupy protests was largely based on negative events and emotions, citizen journalism on Twitter was quick, abundant, and included more positive sentiment than negative. Finally, an agent-based simulation demonstrates the rapid diffusion of information that is possible with Twitter and other means of social media.

SCHOOL CHOICE: DIVERSITY CONSTRAINTS

STUDENTS Karthik Nagarajan *Economics*

ADVISORS Isa Hafalir *Economics*

ROOM/TIME Class of '87 / 1:20 pm

Controlled school choice policies are often implemented in the form of “hard” quotas on student types (e.g. race, gender, location). Results from literature show that the standard fairness property is not satisfied under such “hard” quotas. As a compromise between fairness and diversity restrictions, I employ a mixed interpretation of these quotas (in which the minimum quotas are “soft” and maximum quotas are “hard”) to formulate a modified version of the student-proposing deferred acceptance algorithm that satisfies the desired fairness property.

This algorithm also provides an improvement in controlled diversity over a purely “soft” quotas approach, but at the cost of non-wastefulness, reflecting the welfare-diversity trade-offs inherent in controlled school choice.

UNETHICAL DECISION MAKING: ANALYSIS OF RISK AND CHOICE

STUDENTS Alex Gerber *Economics* | Brent Heard *Economics* | Stanley Krasner *Economics*

ADVISORS Carol Goldberg *Economics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

We suggest that unethical behavior is a method of explaining certain types of market failure. Examples of such behavior can be witnessed in investment and portfolio management, as well as in environmental management and policy. Understanding incentives for unethical behavior and patterns of decisions is crucial for achieving more effective policy and regulation. By simulating this environment with a behavioral economics game, we seek to find evidence of this phenomenon. Subjects participate in a market experiment where we decouple influence from risk aversion and ethical consideration. Analyzing certainty equivalents of gambles that abstract away from ethical decisions and comparing them with certainty equivalent derived from gambles with ethics allows us to measure the presence or magnitude of these effects. A statistically significant difference in certainty equivalents will inform us of such a phenomenon. Having a deeper understanding of the influence of ethics in markets can lead to more effective regulation and legislation to minimize the effects of negative externalities in an economy.

WHERE ARE THEY NOW? ANALYZING GENDER DIFFERENCES IN EXECUTIVE EXIT PATTERNS

STUDENTS Oliver Haimson *Economics*

ADVISORS Limor Golan *Washington University in St. Louis* | Carol Goldberg *Economics*

ROOM/TIME Class of '87 / 2:00 pm

One of the main reasons that the representation of female executives is lower in top ranks relative to lower ranks is that female executives exit the market at a higher rate than male executives. In particular, one hypothesis is that discrimination against females exists in this market, while another hypothesis is that female executives exit more frequently for other reasons, such as family. This project aims to examine the reasons why female executives leave their positions at a significantly higher rate than male executives. While some explanations can be ruled out by observing promotion and compensation of executives who remain in the occupation, it is not possible to directly address issues of discrimination without observing the outcomes of executives after they leave.

To address this question, I research a data set of female and male executives, using databases and web searches to collect data on their exit reasons and next steps after exiting their positions. An analysis of the data finds that female exit reasons differ significantly from male exit reasons in several important ways. Female executives were found to be more likely to be fired, less likely to retire or resign, and more likely to move on to a public company than their male counterparts, even when controlling for human capital and job-related variables. While these results suggest the possibility of workplace discrimination against female executives, more research would be needed to argue this conclusively.

ECONOMICS AND STATISTICS

ABSENCE AND ACHIEVEMENT IN PITTSBURGH PUBLIC SCHOOLS

STUDENTS Zachary Branson *Economics and Statistics* | Shaina Mitchell *Mathematics* | Sarah Peko-Spicer *Economics and Statistics*

ADVISORS William Eddy *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

In recent years the Pittsburgh Public School system (PPS) has become increasingly aware of the poor attendance rate of students within the system. Some students do not come to school for a quarter or even half of the year. The directors of PPS find this phenomenon concerning since school attendance may largely affect academic achievement.

PPS is particularly worried about students who are missing class at least once a week, who PPS defines as “severely absent”. Many factors may influence student attendance, including socioeconomic status, the distance a student must travel to get to school, or the school to which a student is assigned. What are the characteristics of these severely absent students, and what causes them to miss school so often? Using statistical modeling and analysis such as logistic regression, we pinpointed some key factors that significantly relate to high absence rates. Furthermore, we determined some of the outcomes PPS should expect if the overall student absence rate decreases, especially for students who are severely absent. This research may suggest some new policies PPS could adopt to decrease student absence and thus increase academic achievement.

AN EVALUATION OF THE EFFECTIVENESS OF CAREER FAIRS AT CARNEGIE MELLON UNIVERSITY

STUDENTS Robert Eckels *Statistics* | Alex Klarfeld *Electrical & Computer Engineering* | Soham Sengupta *Economics and Statistics* | Shreepal Shah *Computer Science* | Jonathan Yu *Statistics*

ADVISORS Trent Gaugler *Statistics* | Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

A primary reason that many students come to Carnegie Mellon University is to improve their prospects of gaining better employment opportunities. The university provides various resources for students to be in touch with potential employers. The career fair is a prime example. Events such as the Employment Opportunity Conference, Business Opportunity Conference, and Technology Opportunity Conference are staples of the academic year. Through our research and analysis, we attempt to understand how effective career fairs are in

their purpose to match students with employers. In our research, we control for how qualified a student is and other aspects of the student, to see if career fairs really do help a student's job search. Our research focuses just on the success of undergraduate students.

CHANGES IN PIRACY TRENDS AMONGST COLLEGE STUDENTS

STUDENTS Inez Foong *Information Systems* | Nikhil Kumar *Statistics* | Audris Wong *Economics* | Kevin Yang *Economics and Statistics* | Tadas Zolynas *Economics and Statistics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

We are studying changes in piracy habits amongst undergraduate students. Specifically, we would want to assess how often and in what volume do students pirate digital content and if their current behaviors differ from prior years. We will be conducting an online survey to assess these changes in piracy habits. The topic of piracy trends is interesting because we are interested in finding out whether student's piracy habits have changed over the last 2-4 years, especially with the advent of Hulu, Netflix, Spotify, and other online streaming services. This type of survey would need to be conducted now to assess whether major players in the online streaming market have successfully (or unsuccessfully) deterred piracy in a key demographic. Additionally, we could potentially assess if the MPAA's actions for reducing piracy have been successful.

CMU CAMPUS BOOKSTORE SURVEY

STUDENTS Minsun Kang *Information Systems* | Jin Seok Kim *Economics and Statistics* | Yerin Yi *Economics and Statistics* | Deahan Yu *Economics and Statistics*

ADVISORS Trent Gaugler *Statistics* | Tracy Sweet *Statistics*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

The bookstore is the facility that represents the school not only to students who are attending, but also people who visit the school. Especially, for CMU students, bookstore is the most accessible mean to purchase textbooks, CMU apparels, and other stationeries. In fact, the bookstore has near monopoly on many students. For this reason, it is important that the campus bookstore gives satisfaction to its users and that the school continues to improve the bookstore. Therefore, we have decided to construct a survey on CMU students' satisfactory level on the campus bookstore and what aspects of the bookstore students find to be most inconvenient. From this survey, we aim to find out possible improvements that could be made. Since many students and faculties continue to use bookstore, any positive changes that can be made should be implemented as soon as possible. This survey would be conducted mostly among CMU undergraduates, graduates, staff, and faculty members.

ENTERACT

STUDENTS Zachary Auerbach *Information Systems* | Jiunn Haur Lim *Information Systems* | Anna Molosky *Information Systems* | Vivek Sainanee *Information Systems* | Wan Xin Teo *Economics and Statistics*

ADVISORS Raja Sooriamurthi *Information Systems*

ROOM/TIME Rangos 2&3/Sigma Xi Group 9 / 11:00 am

Enteract.in is a mobile-friendly web app that allows presentations to become interactive. Presenters can ask questions, receive answers, and view charts that update instantaneously. This form of mobile polling will not

only improve engagement during presentations, but can be expanded beyond the presentation to discover customer opinions.

NEURO-IMAGING OF THE BRAIN : EXAMINATION OF VARIANCE IN NEURAL STRUCTURE VIA TWO PHOTON LASER SCANNING MICROSCOP

STUDENTS Jinsub Hong *Economics and Statistics* | Kyongche Kang *Statistics* | Hannah Worrall *Economics and Statistics*

ADVISORS William Eddy *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

Our project deals with examining images from two-photon calcium imaging, a brain-imaging technique that allows for study of neuronal activity in hundreds of neurons and inherent brain structure and circuitry. As statisticians, we worked to apply various methods to better understand the effects of physical stimulation on the working brain. Currently there is no system to examine such brain images. As such, we explored methods to examine these images. Our data set had images of a rat's brain in two states. In the first state the rat is sedated and merely observed and in the other it is repeatedly simulated via electric shock. We first started by controlling for the movement of the brain to more accurately observe the physical characteristics of the brain. To examine the underlying structure of the brain, we analyzed how the variance of the brain images varied between pre and post stimulus by applying Levene's Test. Furthermore, we were able to measure how much the images were shifted to see the overall change in movement of the brain due to electric stimulus. Therefore, we were able to visually observe how the brain structure and variance change due to stimulus effects in rat brains.

PUBLIC PENSION FUND: ITS REDISTRIBUTIVE FUNCTION AND RETURN ON INVESTMENTS

STUDENTS Joon Su Min *Economics and Statistics*

ADVISORS Yaroslav Kryukov *Economics*

ROOM/TIME Class of '87 / 1:00 pm

The South Korean National Pension Service (NPS) is currently the fourth largest pension fund in the world in terms of its asset size. Despite of its success in expanding the magnitude of the fund, NPS is frequently debated by the public due to its coercive nature in monthly charges, social redistribution function, and its financial soundness. This paper examines the social redistributive scheme of the service and its financial soundness through analyzing NPS's investment strategies. First part of this paper analyzes the social redistribution scheme of the NPS service by simulating the pension payouts of different income brackets. Results show that the lowest income bracket pays 55.1% of what the highest income bracket pays in monthly charges, but receives 90.3% of the highest income bracket's pension payouts. While the numbers are demonstrating the social redistribution effect, absolute amounts of the pension payouts are doubtful to be helpful as a sole income source of the low income group. The second part of this paper analyzes the three main investment components of the NPS (bond, securities, alternative investments) to check if any particular field causes NPS to lose its investment returns. From 1988 to 2012, NPS had aggressively expanded its investment fields and due to that reason, many foreign equities are now under direct management of NPS or other consigned agency for the fund. However, the profitability of the portfolio has constantly decreased despite this diversification. Foreign stock is making up a big proportion of the current fund, but the aggressive increase in the amount of foreign security investment is showing high risk and low return. Going beyond the internal analysis of the NPS's investment strategy, this paper also compares the NPS's strategy and returns to other countries' main pension services'.

STUDENT PERCEPTIONS OF OTHER MAJORS/SCHOOLS AT CMU

STUDENTS Ronald Fudala *Economics and Statistics* | Like Li *Psychology* | Nazym Satbekova *Statistics* | Kit Ying Wong *Economics and Statistics* | Aleksandr Zeltser *Business Administration*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

This topic is interesting because there is a large unspoken divide on campus. Many people understandably congregate in their majors to work on assignments and socialize but often times very distinct group forms in which the people on the inside almost exclusively do everything together. There are well known stereotypes for virtually every school from computer science and business, to drama. In addition, there are also different perceptions and stereotypes concerning the amount of workload for different majors. Now is a good time to do this survey as understanding people's perceptions of other majors and their personalities and traits associated with it can provide some valuable insight as to why any social divide might exist. After a traumatic incident last year and general awareness of a stress culture at CMU, being able to provide a more socially nurturing and welcoming atmosphere would be beneficial towards the entire student body. Deans of the schools in question would be able to use this data to examine perceptions of how the rest of the school views their department and decide whether there are any negative aspects that could be fixed with a strategic change for the departments. The school can also take these opinions into consideration and try to instill and focus on the more positive aspects. The data can also be used to evaluate if the stereotypes are actually true. An interesting part of this type of survey is that fact that it can lead to many other beneficial research projects.

In addition, administrators of specific programs can self-evaluate their departments' in light of the research to try to expand and enhance their program.

In this study, we would like to investigate the following questions:

1. In general, what are CMU students' perceptions of each college at CMU?
2. Are certain colleges/majors considered more difficult or stressful than others?
3. How do students rank their own colleges/majors in terms of difficulty? Do these rankings match the general perception?
4. How do students think the rest of the student body perceives their college/major? Do students feel positively/negatively about how others perceive their major?
5. How many hours per week do students in each college/major work? Do these results match their own perceptions of how difficult their major is? Do these results match the general ranking of major difficulty?

Our target population is the entire undergraduate student body currently attending CMU, and we wish to make inference to the undergraduate population at CMU. Each individual undergraduate student at CMU will be a unit in this population.

We plan to sample from the population of all undergraduate students that are listed in the CMU Master address book (C-Book). The sampling frame should be nearly identical to the target population. However, a possible source of coverage error could come from those students who entered or left CMU in the spring 2013 semester, after the address book had already been published. This error could be partially addressed with regard to students who no longer attend CMU but are listed in the address book. We can cross-check each student who is selected for the sample by using the search function in the CMU online directory, which is up-to-date and does not list any students who no longer attend CMU.

THE RELATIONSHIP BETWEEN THE UNEMPLOYMENT RATE AND THE BIRTH RATE IN KOREA

STUDENTS Jungmoon Jang *Economics and Statistics*

ADVISORS Yaroslav Kryukov *Economics*

ROOM/TIME Dowd / 4:40 pm

Through this research, I have looked at the relationship between the unemployment rate and the birth rate with a focus in Korea. For past few decades, despite the high volume of students obtaining undergraduate degrees, the unemployment rate has constantly increased, bringing about a critical social issue. On the other hand, families have been giving birth to fewer children or no child at all despite the government's efforts to financially aid parents to raise their children. Because of this phenomenon, a new term called 'Sampo generation' has emerged, describing people in their 20s and 30s giving up on three things since they can't economically support themselves: dating, marriage, and giving birth. It has been hypothesized that since the unemployment rate is high, more people are having fewer kids as a consequence because it costs money and time to raise kids which parents in nowadays can't afford with their own incomes. Believing there are many other factors behind this issue, I have selected other variables such as political perspectives, income levels, and education levels of parents etc. from the Korean Statistical Information Service between 1990 and 2011 to include in a panel data-set. I have discovered that there is a negative relationship between birth rate and unemployment. In addition, parents' education levels, political perspectives, activity rates, and income levels are also significant variables.

ENGLISH

A FANTASY NOVELLA

STUDENTS Mark Slabinski *English*

ADVISORS Gerard Klug *Entertainment Technology Center*

ROOM/TIME Peter / 12:00 pm

This project is a fantasy novella that represents the culmination of lessons learned about technique, story construction and genre writing. It is a character-driven story, dealing with normal people who are unexpectedly thrust into extraordinary (and alien) circumstances.

AUTONOMY IN PATIENTS WITH TYPE I DIABETES

STUDENTS Abigail Daughtrey *English*

ADVISORS Vicki Helgeson *Psychology*

ROOM/TIME Peter / 3:20 pm

This project explores the transition of diabetes care responsibilities from parents to children in adolescence. Transition styles and trends have been tested against health outcomes and compared across demographics.

CROSS WORDS: A FEATURE-LENGTH SCREENPLAY

STUDENTS Magdalen Silberman *English*

ADVISORS Jane Bernstein *English*

ROOM/TIME McConomy Auditorium / 10:00 am

When Blair Cohen loses her father and her job on the same day, she is forced to confront her broken relationship with her mother—not to mention deal with the rest of her family—while cooped up with all of them for the seven days of her dad’s shiva. A story about the many ways family can drive you crazy and why you love them anyway.

DANCING AT THE EDGE: WRITING ABOUT PERFORMANCE

STUDENTS Olivia London *English*

ADVISORS Jane Bernstein *English* | Jane McCafferty *English*

ROOM/TIME McConomy Auditorium / 10:30 am

Performance in general, and dance more specifically, significantly affect people on a personal and cultural level. By putting one’s self on the edge, or transferring from audience member to participant, one becomes a performer either in a formal or informal capacity. This transition into being a performer happens both instantaneously (for example, going from behind stage to onstage) and over a long period of time (as in developing and growing as a performer). As both a writer and dancer, I am exploring this transition, or edge, through creative writing and examining how one writes about the act of performance. By seeking out performance experiences, I am broadening my understanding of what it is to be a performer and how performing can influence writing or vice versa. Through creative non-fiction writing I examine how performance affects the course of my own life on and off the stage.

FREELANCING ROUND THE ‘BURGH

STUDENTS Paul Carboni *English*

ADVISORS Sharon Dilworth *English*

ROOM/TIME McKenna / 3:40 pm

What is it like to be a freelance writer in college? Paul Carboni details his experiences related to writing, finding work, and making a student’s living from freelancing all while balancing a CMU course load.

GENDER PERFORMANCE OF GENETIC POETICS

STUDENTS Samantha Dickinson *English*

ADVISORS Melissa Ragon *Art*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

Traditionally, a poet relays a certain awareness or experience through language to evoke a specific emotional response and a geneticist manipulates hereditary material. Rapid advances concerning DNA as a medium are increasingly merging these roles. Christian Bök, a prominent experimental Canadian poet, states that “a poem might soon resemble a weird genre of science fiction, and a poet might become a breed of technician working in a linguistic laboratory.” According to the National Human Genome Institute, the costs of producing raw, unassembled DNA sequence data, such as what might be used to archive data, have dropped from \$10,000 per

million base pairs of DNA in 2001 to about 10 cents per million base pairs in 2012. Although DNA certainly transcends the time and space limitations of print and digital means of information storage, it complicates the reality in which we live and communicate. My goal is to explore how language performs gender roles in the form of a genetically engineered poem. My research project looks at how Christian Bök as a poet-geneticist manipulates the DNA of the bacterium *Deinococcus radiodurans* in a semantically purposeful way for performance of his poem, *The Xenotext* which I claim exploits the artificiality of traditional notions of gender. Understanding the gender connotations underlying this instance of performative language will lead to a better understanding of gender ideologies and roles.

GIRLS JUST WANT TO HAVE FUN: NEWS COVERAGE OF THE WASHINGTON, D.C. SLUTWALK

STUDENTS Anna Walsh *English*

ADVISORS Necia Werner *English*

ROOM/TIME McKenna / 12:00 pm

On Jan. 24, 2011, a Toronto police officer told a group of law students at York University, “women should avoid dressing like sluts in order not to be victimized.” His comments ended up sparking a movement called the SlutWalk, in which grassroots organizers in cities across the world organized marches to protest victim-blaming and rape culture. The marches’ attention-grabbing name and associated rhetoric has sparked plenty of commentary in the media, but there has not yet been much academic research into this unique contemporary feminist movement. This thesis analyzes three different news articles that cover a Washington, D.C. SlutWalk that occurred in August 2011, asking specifically: How do news organizations frame contemporary feminism in journalism coverage? Also, how well do news organizations cover issues of sexual assault? Utilizing analytical tools from rhetoric, feminism, and journalism, this thesis uses the news coverage of this particular event as a case study to show where journalism coverage continues to misconstrue feminist goals and improperly frame sexual assault and survivors of sexual assault.

GROWING PAINS AT THE END OF THE WORLD: A COLLECTION OF SPECULATIVE AND REALISTIC FICTION

STUDENTS Julia Pattison-Gordon *English*

ADVISORS James Daniels *English*

ROOM/TIME Dowd / 1:20 pm

Growing Pains at the End of the World, is a collection of realistic and speculative fiction stories about young characters redefining how they relate to the world.

In *Warrior II* NASA announces that in seven years, aliens may arrive on Earth to kill humanity. The story follows Cam, a middle school student bullied by his older stepbrother, and Mr. Harrison, the new teacher, as they attempt to combat the chaos and panic unfolding around them.

Never Land’s Captives follows two boys starting puberty as they struggle with restrictive parents and teachers who seem to be trying to keep them from growing up.

Bonds that Break is set twenty-six years after diseases and a collapse of the collective unconscious brought about an apocalypse. Now the unconscious is repairing itself, resulting in special mental abilities for Lager, a conjoined twin who struggles with deep-seated fears of abandonment after his brother proposes surgical separation.

A fourth story, *Moving*, focuses on a young couple attempting to navigate their changing relationship. Tensions build as one partner copes with guilt over her ex-girlfriend's suicide and the other struggles to make the world acknowledge her existence.

These stories explore themes of loneliness, individuality and community, masks, repression, mortality, external validation, impermanence, and the desire to deify

IRONY AND TRUTH IN T.S. ELIOT'S "THE LOVE SONG OF J. ALFRED PRUFROCK."

STUDENTS Divya Krishnan *English*

ADVISORS James Daniels *English*

ROOM/TIME Dowd / 2:00 pm

In "The Love Song of J. Alfred Prufrock," Eliot conducts a poetic search, fueled by despair, for cohesion and truth within the muddled streams of consciousness. He employs irony, often derived from absurdity, to reach past the fragmentation of the human experience and explore a sort of metaphysical journey within the realm of personal dysfunction. Although the poem is titled, "The Love Song of J. Alfred Prufrock," implying a light-hearted or celebratory poem addressed to the speaker's beloved, the epigraph is from Dante's *Inferno* and quotes a man condemned to the depths of hell. Consequently, Eliot sets the tone for an irony that arises from the conflict between the somewhat ethereal nature of a love song and the agony of hell. With ironic effect, Prufrock uses the medium of the former to address the immobilized themes of the latter.

PERSONAL IS POLITICAL IS PERSONAL

STUDENTS Anna Walsh *English*

ADVISORS James Daniels *English*

ROOM/TIME Pake / 3:20 pm

"Personal is Political is Personal" is a creative nonfiction piece that explores the ways in which polarized political views can affect family relationships. It documents a mother-daughter relationship and the strain caused by their very different political perspectives. Through this specific relationship, the piece explores larger topics, such as the increased polarization in contemporary American politics, and the ways that extreme political views can develop; the challenges of dealing with political differences within a family; and the varying complexities of mother-daughter relationships.

PRESENTING A "JOURNEYMAN'S COMPANION"

STUDENTS Marisa Hughes *English*

ADVISORS Terrance Hayes *English*

ROOM/TIME Peter / 3:40 pm

I will read from my book-length poetry manuscript, tentatively titled "Journeyman's Companion." By attending to my advisor's expert advice, I found my heart in the work of following my obsessions in my creative practice: ethics, mastery, love, empathy, mysticism, reason and intuition, human character and expression, signification and representation, pain and process, necessity, possibility, agency, and epistemics. One of the fruits of my creative practice while working on my senior honor's thesis was this collection of problems.

SEARCHING FOR ME: DISCOVERING THE SELF THROUGH AN EXPLORATION OF RELIGION AND RACE

STUDENTS Jordan Stephenson *English*

ADVISORS James Daniels *English*

ROOM/TIME Wright / 1:20 pm

A collection of personal essays about religion and race.

THE ART OF GIVING: AN ANALYSIS OF ARTS ORGANIZATIONS, THEIR OUTREACH PROGRAMS, AND HOW THEY ARE FUNDED

STUDENTS Irene Tai *English*

ADVISORS David Kaufer *English*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

Over the past twenty years, federal, state, and local governments have increased total public arts funding by a total of 12 percent (though the funding patterns on each level vary). Despite this rate of growth, the future of arts funding on a federal, state, and local level remains uncertain, and very small compared to other government expenditures. The purpose of this study is to investigate the special challenges that confront fundraising in the arts, the work of large federal agencies to address these challenges, and the extent to which local organizations do or do not rely on this information in their fundraising.

The first component of the study samples the scholarly literature that evaluates and ranks the role of the arts within an overall framework of social need. I will examine the main findings of this literature and its relationship to existing social appeals for arts funding undertaken by large federal organizations, such as the NEA. The second portion of the study will involve conducting semi-structured interviews of managers in each of the four primary fields of arts management—visual art, dance, theater, and music—in the Washington, D.C. area, where federal, state, and local funders support the arts, and investigating how organizations use their outreach programs to not only give back to their local communities, but also raise funds for programming and other expenses.

My research objectives are to understand the extent to which agencies at all levels incorporate the latest and best research on the societal value of arts funding. I also want to understand the extent to which the research covers the arts scene with a “one-size-fits-all” approach or whether it differentiates across the spectrum of arts and the extent to which local agencies are making use of this differentiation (if it exists) or relying on their own creative marketing strategies.

THE GHOST SHIP SOCIETY: EXPERIMENTATION WITH DIGITAL PUBLICATION

STUDENTS Micaela Dudley *English*

ADVISORS Necia Werner *English*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

In the past decade, the publishing industry has gone through many major changes. The rise of digital content has caused book publishers, journalists, and creative writers to feel the intense industrial pressure to adapt to digital platforms. The industry is in a state of enormous and exciting transition, but we have yet to set a standard for the ways in which we acquire and produce information. This project is dedicated to exploring the expanding intersection between the humanities and technology in industry. Through the construction and

operation of a digital publication, one can experiment with content production, marketing plans, and the use of social media to discover just what makes a digital publication successful.

UNDERWHELMING

STUDENTS Louis Lamanna *English*

ADVISORS Yona Harvey *English*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

A collection of minimal poems.

VIDEO GAMES AS A DEDICATED ART FORM

STUDENTS Zachary Betka *English*

ADVISORS Sharon Dilworth *English*

ROOM/TIME Wright / 4:00 pm

Video Games as a budding entertainment medium have undergone many growing pains over the course of their short time in the spotlight. Now, a year after they were ruled protected under the first amendment, we look at the where the medium is, where it came from, and where it is going. In a historical sense the industry has followed the same trajectory as film, indeed it even takes terminology from the industry. Yet the fact that Video Games are one of the first interactive entertainment mediums gives it unique challenges of its own. We'll talk about how video games have pulled from fiction, playwriting, and film to understand how story is conveyed, and how good narrative in games is both a combination of these mediums as well as a departure from them. Finally we'll look at a game currently in development, showing to an outside perspective how this all comes together to form the new artistic medium that is the Video Game.

ETHICS, HISTORY & PUBLIC POLICY

FROM OCEAN HILL-BROWNSVILLE TO PITTSBURGH'S PARENT NATION: A STUDY IN THE EVOLUTION OF PARENT AND COMMUNITY INVOLVEMENT AND ENGAGEMENT IN SCHOOLS

STUDENTS Linda Timko *Ethics, History & Public Policy*

ADVISORS Steven Schlossman *History*

ROOM/TIME Pake / 1:40 pm

This presentation will explore the history of parent involvement/engagement in schools, focusing especially on the interaction of parents, communities, and schools in the twentieth century through the present day. The Ocean Hill-Brownsville Strike of 1968, as an extreme example of the Community Control Movement of the 1960's and 70's, will serve as a main comparison to the methods of parent involvement/engagement today. Parent Nation, a parent organization in Pittsburgh Public Schools, will be used to demonstrate how issues and methods affecting parents and schools are addressed in a modern context. I will argue that while Ocean Hill-Brownsville serves as an extreme example of community involvement/engagement in schools with an emphasis on ethnic tension not seen in PPS, PPS and Ocean Hill-Brownsville illuminate the need for stronger school-initiated community engagement and serve as robust examples of the issues facing parent, communities, and schools.

HISTORY

ABORTION AND THE CONSTITUTION: FINDING AND MAINTAINING THE RIGHT TO PRIVACY

STUDENTS Ashlyn Clark *History*

ADVISORS Joseph Devine *History*

ROOM/TIME Peter / 1:20 pm

The ruling of *Roe v. Wade* established abortion rights and acted as a lightning rod for criticism of the Supreme Court. Many argued that the Court's essential act of establishing privacy as a constitutionally protected right, one that included protections against banning abortions, was an overreach of judicial power. This paper examines the evolution of privacy as a constitutionally protected right and its invocation in the ruling of *Roe v. Wade*. The paper traces the legal concept of privacy as it evolved into how it is generally understood today, resting on key interpretations of the Fifth, Ninth, and Fourteenth Amendments. The paper also briefly explores the challenges to *Roe v. Wade*, how they have affected the precedents set in the *Roe v. Wade* case, and what the later rulings imply about the acceptance of privacy as a constitutionally protected right. This paper works to prove that as privacy as a constitutionally protected right became an increasingly accepted legal concept, that right of privacy as it was understood in the ruling of *Roe v. Wade* did contain protections against unreasonable regulations such as a ban on abortion, and thus was not an overreach of judicial power. The outrage against the ruling and privacy as a concept after *Roe* is rather a reaction against substantive due process, not necessarily privacy as a constitutionally protected right.

AESTHETIC POSITIONING: LOCATING GLOBAL FEMINISMS IN THE WORK OF FEMALE JAPANESE ARTISTS

STUDENTS Jena Tegeler *History*

ADVISORS Yoshihiro Yasuhara *Modern Languages*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The impulse to define a narrow and essentialized Japanese or female identity within artworks produced by Japanese female artists is pervasive among curators and art historians. This paper instead suggests a diverse body of artistic production that speaks to conceptions of feminism much more heterogeneously and broadly conceived. In this way, it questions historical patterns of artistic analysis and presentation, and expands current understandings of global feminisms.

Using original analysis of the artworks of contemporary artists Miwa Yanagi, Aya Takano, Tabaimo, Tomoko Sawada, and Mariko Mori, and an examination of post-colonial feminist theory, I elucidate distinct and diverse methods of agency employed by these artists. The artists may be read as engaging Western traditions of feminism--pushing against what the West encodes as local patriarchal forces such as strict gender roles, the notion of the self-sacrificing female figure, and the historic exclusion of women from the realm of fine art. Pushing further, the paper suggests that the artists are challenging constraints that go beyond issues of gender, from pressures of conformity and subcultural politics within Japan, to the global art world's tendency to discuss Japanese female artists only in relation to *kawaii* (cute) aesthetics. I show how these artists are diversely positioned within the micro and macro worlds around them, turning personal experience into global cultural dialogue through visual expression. Although the works respond to a commonality in local social landscapes, histories, and artistic traditions, they resist hegemonic forces that promote racialized or gendered worldviews.

AN ANALYSIS OF SOCIALIZED MEDICINE ADVOCACY ACROSS TIME: FIGHTING THE “LONG DEFEAT” FOR UNIVERSAL HEALTH CARE

STUDENTS Elisabeth Arndt *History*

ADVISORS Caroline Acker *History*

ROOM/TIME Peter / 1:40 pm

This thesis is based upon the premise that access to health care is a fundamental human right and should never be dictated by profit, class, gender, or national identity. Given the quixotism of this objective for universal health care coverage, I am studying the works of the most prominent proponents of socialized healthcare—Rudolf Virchow, Henry E. Sigerist, and Paul Farmer. According to the White House, approximately 18% of our GDP is currently spent on healthcare—a cost that is only expected to rise if we cannot change our fee-for-service healthcare system today that prioritizes medical costs for treating disease over preventative services maintaining public health. Given this status quo, why would a socialized healthcare system—which would incentivize the maintenance of health—be desirable, if even possible? I am trying to answer this question by exploring the reasoning upon which Virchow, Sigerist, and Farmer based their beliefs. Although each of these physicians lived in different time periods, they all agreed that healthcare is a public good that should not be excluded from those who cannot afford it.

BLACK WOMAN’S ORAL HISTORY PROJECT: A FORGOTTEN HISTORY, A FORGOTTEN VOICE

STUDENTS Kimberly Miller *History*

ADVISORS Nico Slate *History*

ROOM/TIME Dowd / 1:00 pm

My thesis explores the complex dynamics of Black Womanism/feminism of the Civil Rights and Black Power movement in the United States, along with their relationship to Black men and their white female counterparts. I delve deep into the unique histories of African American women since the inception of the nation, relying on primary accounts from slavery that heavily influence the black woman’s experience in the decades to come after emancipation. Highlighting the vast differences in backgrounds, I juxtapose the Black woman’s experience, goals, motives to that of White women in regards to feminism, as well as the relation of Black men to Black women. I am arguing whether White feminists or Black men were more helpful in the cause of Black women empowerment. My research suggests that Black feminists/womanists relationship with White feminist was more of cooperation and partnership toward common goals irrespective of specific black women’s goals. Black men were, although exclusionary at times of the leadership of black women, did positively impact the lives of black women more than white women who shared the bond of womanhood. Subsequently, my research suggests race was more a unifying factor than gender for womanists, as the advancements made by Black Civil Rights organizations headed by men progressed black women’s economic and social opportunities considerably.

BRINGING PUBLIC AWARENESS TO THE ISSUE OF DOMESTIC VIOLENCE

STUDENTS Jiwon Ha *History*

ADVISORS Charlee Brodsky *Design*

ROOM/TIME Connan / 12-2:30 pm

In this project, I am going to direct and produce a photo essay that will bring more public awareness to the issue of domestic violence in Pittsburgh. This project is motivated by two major problems in the public awareness

of domestic violence: 1) the lacking or often distorted public perception of the victims of domestic violence, and 2) the limited awareness of the help available for the victims. By producing a photo essay of the battered women who had suffered from abuses but are in process of recovery, this project will be a stepping stone for bringing more accurate and more pressing public awareness to the issue of domestic violence in Pittsburgh. An effective visual presentation of victims' stories will make an emotional appeal to the general audience and thus will contribute to making a society that is more responsive to the issue. Also, the major portion of the photo essay will deal with the practical help which the victims have received from a non-profit organization, thereby getting the future victims informed of more options. For the content of the essay, I will interview 2-3 women who have found a refuge at Women's Center and Shelter of Greater Pittsburgh. I am planning to hold 8-10 weekly interview/photograph sessions in a period of three months, and with the interviews and photos from those sessions, I am going to write and layout a photo essay at the length of at least 16 pages.

ELUSIVE VISIBILITY: THE STATE OF FEMALE ATHLETES IN SOLOLÁ, GUATEMALA

STUDENTS Ava Murphey *History*

ADVISORS Karen Faulk *History*

ROOM/TIME Pake / 1:00 pm

Women and their involvement in sports in Latin America represent a vastly understudied realm. My research looks specifically at female athletes in the western highlands of Guatemala and the challenges that embody their existence as women in a traditionally male-dominated social activity. Inhibitions such as the lack of federal aid, resources, and public support coupled with contradictions in culturally informed concepts of machismo and indigeneity provide the framework for an extremely complex and dynamic reality for women and their interaction with sport. My analysis focuses on the interplay between these various factors and the tensions created within in order to critically expose the underdevelopment of women's sport participation in Guatemala and, thus, the elusive nature of the female athletes' visibility.

HEART OF CAUTIOUS: AN ANALYSIS OF POST-CONFLICT STATE BUILDING IN RWANDA

STUDENTS Sara Faradji *History*

ADVISORS Richard Maddox *History*

ROOM/TIME McKenna / 4:00 pm

When one imagines the small African nation of Rwanda, it is difficult not to think of the brutal genocide that occurred there nearly twenty years ago. While the nation may be trying its best to redesign a new image for itself, it is clear that the genocide has left a lasting mark on Rwanda's history and has strongly influenced international and scholarly perceptions of the country for decades.

Upon my visit to Kigali, Rwanda in the summer of 2012, I was surprised to find that the images of the Rwandan people that resonated with me most were not reminders of the genocide but the dedicated efforts of children and young adults who had begun to appreciate Western cosmopolitanism in unique ways. This was evidenced in their acquisition of English from a young age, their motivation to pursue technological education, and their love of American pop culture. Furthermore, I noticed that the ethnic conflict that ravaged the nation not even twenty years ago was completely invisible or at least well hidden today. Nonetheless, I found that the atrocities of the genocide and the militarized aftermath were still represented to an extent in the Rwandan culture, whether it was through museum displays, drama exercises, school textbooks, or press releases. In my honors thesis, I demonstrate how the Rwandan state is seeking to overcome its violent past by establishing a

“post-ethnic” society that, with the help of Western powers, is becoming integrated into the globalized economy. The building of this “pseudo-technocracy”, while effectively shadowing the atrocities of the past, could also potentially place Rwanda in a controversial position because of its highly militarized local environment, continued alliance with Western countries, and secret reliance on conflict minerals in neighboring Congo.

HOW THE DEVELOPMENT OF THE EUROPEAN UNION HAS AFFECTED FRENCH NATIONALISM & IMMIGRATION POLICY

STUDENTS Ema Woodward *History*

ADVISORS Richard Maddox *History*

ROOM/TIME McKenna / 4:20 pm

Since the end of the Second World War, France has evolved dramatically in terms of its nationalism and immigration policy. Even more apparent during this era is its involvement in developing what is now the European Union. With the current economic crisis that many Euro Zone countries face, many question the legitimacy of establishing the EU in the first place. Issues of nationalism and immigration policy have resurfaced, as nation-states struggle not only to survive economically, but also to maintain their unique cultural identities as the EU continues to expand.

My thesis will focus on how France’s involvement in the EU and the current economic crisis have changed the notion of French nationalism as well as its current immigration policy. More specifically, I will compare this historical evolution with contemporary public opinion. From this research, I hope to illuminate how the evolution of French national identity compares to how the French people perceive of this identity today.

IN THE SHADOW OF SEDUCTION: THE UNSUNG CAREER OF FREDRIC WERTHAM

STUDENTS Benjamin Klahr *History*

ADVISORS Steven Schlossman *History*

ROOM/TIME Pake / 4:40 pm

Frederic Wertham was a German-trained psychiatrist who achieved considerable fame in the United States between the 1930s and 1960s, principally through his books, articles, public speaking, and expert testimony in criminal courts and before Congressional committees. He is generally remembered today as an arch-conservative who exacerbated the Red Scare of the 1950s by his extreme attacks on comic books as corrupters of the young, especially in his best-selling book, *The Seduction of the Innocent* (1954). This paper argues for a more rounded and appreciative assessment of Wertham’s liberal as well as conservative contributions to cultural and political discourse. It also argues for recognition of the pioneering contributions he made -- as both a theorist and clinical practitioner -- in forthrightly addressing issues of racial discrimination in American society, and in calling attention to the cultural sources of pervasive violence in American society.

PUBLIC EDUCATION AND THE SHAPING OF RACIAL IDENTITY IN THE UNITED STATES AND BRAZIL: A COMPARATIVE STUDY

STUDENTS Christian Aponte *History*

ADVISORS John Soluri *History*

ROOM/TIME Peter / 4:20 pm

This project examines and compares the relationships between public education and the shaping of racial

identity for persons of African descent in the United States and Brazil. It consists of a comparative historical summary and analysis of educational practices, policies and landmark court cases regarding those of African descent in these two countries, as well as an ethnographic service-oriented project.

QUEERING CHINESE COMRADES! THROUGH THE LENS OF CUI ZI'EN

STUDENTS Audrey Tse *History*

ADVISORS Elizabeth Kaske *Modern Languages*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

In the past two decades, tongzhi culture, activism, and identity has increased its presence in mainstream China despite institutional discrimination. But how are queers in China 'coming out' into mainstream Chinese culture using cinema? Individuals, groups, and activists are using film and the subsequent formed communities to create, and create/ recreate/rectify preconceived conceptions of homosexuality or 'deviants' from sexual norms. My thesis work focuses on the films of director, activist, and writer, Cui Zi'En. His nine queer films and active discourses beginning from the early 1990s serve as a dynamic repertoire in which queer Chinese culture can be deconstructed to compose a more cohesive representation of Chinese sexuality.

THE GLOBALIZATION OF RENEWABLE ENERGY IN PUERTO RICO

STUDENTS Marielle Saums *History*

ADVISORS John Soluri *History*

ROOM/TIME Wright / 4:40 pm

This project examines the globalization of renewable energy in Puerto Rico, and its implications for defining and implementing truly sustainable strategies in contemporary society. Puerto Rico is experiencing an energy crisis due to the soaring process of imported fossil fuels, which are the primary source of power for electricity generation. There is currently a resurgence of alternative energy advocacy as the island begins to reform its current energy policies. This study examines how hydropower, solar, and wind energy technologies have been incorporated into Puerto Rico's revised energy portfolio.

THE STATE OF FREEDOM AT THE AMERICAN CENTENNIAL: POLITICAL, SOCIAL AND ECONOMIC SHORTCOMINGS IN THE GOAL OF INDIVIDUAL FREEDOM IN 1876, AS MEASURED AGAINST THE GOALS OF THE DECLARATION OF INDEPENDENCE

STUDENTS Fernando Torre Santiago *History*

ADVISORS Laurie Eisenberg *History*

ROOM/TIME Class of '87 / 12:00 pm

The nature of the historical problem studied in this work is both legalistic and ethical, since I am asking if as the US celebrated its Centennial in 1876 American citizens actually enjoyed the freedoms embodied in the Declaration of Independence. The nature of my research is social history. My sources include both primary sources, including legislative records and documents, as well as books on relevant topics, such as the Reconstruction period and the initial movement for Women Rights. My conclusion is that although in 1876 many Americans enjoyed the freedoms embodied in the Declaration of Independence, the realities of life for many Americans, especially African Americans and women, in the areas of political enfranchisement, social acceptance, and economic opportunity.

INFORMATION SYSTEMS

BIOMETRIC IMAGE PROCESSING

STUDENTS Christian Reyes *Information Systems*

ADVISORS Luis A Von Ahn *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

Techniques for converting raw biometric images into useable data.

CHANGES IN PIRACY TRENDS AMONGST COLLEGE STUDENTS

STUDENTS Inez Foong *Information Systems* | Nikhil Kumar *Statistics* | Audris Wong *Economics* | Kevin Yang *Economics and Statistics* | Tadas Zolynas *Economics and Statistics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

We are studying changes in piracy habits amongst undergraduate students. Specifically, we would want to assess how often and in what volume do students pirate digital content and if their current behaviors differ from prior years. We will be conducting an online survey to assess these changes in piracy habits. The topic of piracy trends is interesting because we are interested in finding out whether student's piracy habits have changed over the last 2-4 years, especially with the advent of Hulu, Netflix, Spotify, and other online streaming services. This type of survey would need to be conducted now to assess whether major players in the online streaming market have successfully (or unsuccessfully) deterred piracy in a key demographic. Additionally, we could potentially assess if the MPAA's actions for reducing piracy have been successful.

CMU CAMPUS BOOKSTORE SURVEY

STUDENTS Minsun Kang *Information Systems* | Jin Seok Kim *Economics and Statistics* | Yerin Yi *Economics and Statistics* | Deahan Yu *Economics and Statistics*

ADVISORS Trent Gaugler *Statistics* | Tracy Sweet *Statistics*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

The bookstore is the facility that represents the school not only to students who are attending, but also people who visit the school. Especially, for CMU students, bookstore is the most accessible mean to purchase textbooks, CMU apparels, and other stationeries. In fact, the bookstore has near monopoly on many students. For this reason, it is important that the campus bookstore gives satisfaction to its users and that the school continues to improve the bookstore. Therefore, we have decided to construct a survey on CMU students' satisfactory level on the campus bookstore and what aspects of the bookstore students find to be most inconvenient. From this survey, we aim to find out possible improvements that could be made. Since many students and faculties continue to use bookstore, any positive changes that can be made should be implemented as soon as possible. This survey would be conducted mostly among CMU undergraduates, graduates, staff, and faculty members.

EDUCATIONAL WEBSITE FOR DEVELOPING COUNTRIES

STUDENTS Duncan McIsaac *Information Systems*

ADVISORS Randy Weinberg *Information Systems*

ROOM/TIME Peter / 12:20 pm

I was planning on creating a team and the website but accepted a job offer at a similar company this summer. This made me want to spend the grant on some expensive design software I wouldn't necessarily have the opportunity to buy otherwise.

ENTERACT

STUDENTS Zachary Auerbach *Information Systems* | Jiunn Haur Lim *Information Systems* | Anna Molosky *Information Systems* | Vivek Sainanee *Information Systems* | Wan Xin Teo *Economics and Statistics*

ADVISORS Raja Sooriamurthi *Information Systems*

ROOM/TIME Rangos 2&3/Sigma Xi Group 9 / 11:00 am

Enteract.in is a mobile-friendly web app that allows presentations to become interactive. Presenters can ask questions, receive answers, and view charts that update instantaneously. This form of mobile polling will not only improve engagement during presentations, but can be expanded beyond the presentation to discover customer opinions.

JE VOYAGE

STUDENTS Sheila Chan *Information Systems* | Rachel Crown *Information Systems* | Inez Foong *Information Systems* | Wei Shan Lim *Information Systems* | Adetunji Olojede *Information Systems*

ADVISORS Jeria Quesenberry *Information Systems*

ROOM/TIME Rangos 2&3/Sigma Xi Group 9 / 11:13 am

Our team has designed and developed a travel abroad web application that aims to present a place where users can contribute as well as find information about places abroad to which they have traveled or plan to travel.

POW WOW : AN AUTOMATED MEETING ROOM RESERVATION SYSTEM

STUDENTS Austin Bohn *Information Systems* | Michael Bove *Information Systems* | Patrick Dustmann *Information Systems* | Julie Eckstrom *Information Systems* | Yeon Soo Park *Information Systems*

ADVISORS Jeria Quesenberry *Information Systems*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

Large populations sharing common meeting spaces creates a high density of information. If not managed correctly, it can become confusing and oftentimes lead to gaps in information causing an inefficient use of time — something abhorred by people with busy schedules. Pow Wow is a system that is able to reduce the complexity of this information while maintaining accuracy, and creating an environment where information is shared easily within the organization. Pow Wow relies on both a web and mobile interface to provide the most access, with the system being web based and organic enough to be extremely portable. Pow Wow also considers the energy efficiency of a meeting room by automating the room's systems with the schedule of meetings in order to maximize the utility gained from the room.

RAVE REVIEWS

STUDENTS Myles Blodnick *Undecided* | Akash Khanolkar *Information Systems* | Aamer Rakla *Information Systems*

ADVISORS Randy Weinberg *Information Systems*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

Rave Reviews is a comprehensive feedback system that allows students to write reviews and opinions about various facilities in and around a University. These reviews of the school campus and surroundings will happen in real time and it is expected that these reviews will relate to daily and periodic changes at the University. Rave Reviews strives to act as a system of feedback that makes positive changes in daily and yearly campus life.

STOP USING PAPER: DEPLOYMENT OF A DIGITAL DATA COLLECTION SYSTEM IN A SPECIAL EDUCATION ENVIRONMENT.

STUDENTS Quintin Carlson *Social & Decision Sciences* | Kevin Schaefer *Information Systems*

ADVISORS Anind Dey *Human Computer Interaction Institute*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

In special education, and particularly with Autism Spectrum Disorder therapy, data collection is immensely valuable in determining the effectiveness of therapies. Currently, data collection at many schools is based on paper, including hand-graphed evaluations. There have been commercial efforts to digitize these data collection processes, but they have not achieved a high rate of adoption. Throughout the past six months, we have been developing Zephyr, in association with Carnegie Mellon University's Human-Computer Interaction Institute. This semester, we began initial user testing and the evaluation of Zephyr.

VELVETCALENDAR

STUDENTS Vivek Sainanee *Information Systems*

ADVISORS William Courtright *Business Administration*

ROOM/TIME Rangos 2&3/Sigma Xi Group 9 / 11:25 am

VelvetCalendar is a predictive calendar that predicts and recommends events that you may be interested in.

WEIGH TOO MUCH INFORMATION

STUDENTS Nolan Carroll *Information Systems*

ADVISORS Paul Fischbeck *Social & Decision Sciences* | Jeria Quesenberry *Information Systems*

ROOM/TIME Rangos 2&3/Sigma Xi Group 9 / 10:25 am

Weigh Too Much Information is a website to show individuals their standing among peers with regards to weight, age, and race and gender. The website offers tips to change health habits and achieve weight goals.

LINGUISTICS

ADJECTIVE ORDER IN ENGLISH: A SEMANTIC ACCOUNT WITH CROSS-LINGUISTIC APPLICATIONS

STUDENTS Enrica Rosato *Linguistics*

ADVISORS Thomas Werner *Philosophy*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

Which is more correct, the “big fat cat,” or the “fat big cat?” Why? What is the significance of altering the order of adjectives in English noun phrases, and how can we account for this significance? In this analysis, I develop a semantic theory that describes how adjectives are ordered before the noun in English, with adjectives that depict “intrinsic” properties closer to the noun, and adjectives that are “speaker relative” in a more distant position. The theory treats the adjectives as a series of restrictions placed on the set of properties for a noun, allowing for a change in adjective order to affect the way in which we conceptualize of what we describe. With this theory, I establish an underlying adjective order, based on semantic category, for English. I apply the theory cross-linguistically on a variety of languages from different families which appear to have a different treatment of adjectives than English; namely Italian, Sakha, Hebrew, and Welsh. My findings demonstrate that the theory is successful in describing what is perceived by native speakers as a “proper” adjective order in a diverse group of languages.

HOMOGENEITY OF LINGUISTIC FORMS: JAPANESE AND THE ACT OF REQUESTING A PEN

STUDENTS Alexander Webster *Linguistics*

ADVISORS Naoko Taguchi *Modern Languages*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

This paper serves to reevaluate the notion of a uniform native speaker. By distributing a questionnaire created by Beverly Hill, Sachiko Ide, Shoko Ikuta, Akiko Kawasaki, and Tsunao Ogino, I’ve polled a sample of native Japanese speakers, asking them to provide their intuitions on the act of requesting a pen in varied social situations. The findings of this study will provide evidence for or against the perceived uniformity of native speaker language, suggesting the necessity for further delving into the nature of linguist variation among native speakers. The task consists of two parts. The first part asks participants to rank the formality (here referred to as ‘carefulness’) of each request form. The second part provides the participants with a number of addressees and situations and asks them to insert the phrase from the previous part that they would use in each situation. The questionnaire was transcribed into Google Form, an online survey generator, and distributed via the internet and social networking to the participants. Participants in the study are all native Japanese speakers ranging from ages 16 to 46. In total, there were 30 participants: 20 male and 10 female. The responses have been tallied to reflect the relative density of answers for both part one and part two.

PATTERNS OF LIAISON USE (AND MISUSE) AMONG FRENCH LEARNERS

STUDENTS Nicholas Guesto *Linguistics*

ADVISORS Bonnie Youngs *Modern Languages*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

There is usually a gradual increase in proficiency among students learning a foreign language; however, the term “proficiency” can be relative to each learner. Some prefer to focus on expanding their vocabulary for a variety of conversational topics; some seek perfection in the grammatical structures and aspire for flawless syntax; others believe that mastering all the intricacies of native-like pronunciation is the most important aspect of speaking a language. Relating to this last characteristic, a prominent feature of French is liaison, briefly defined as the pronunciation of a normally-silent word-final letter. There are many more intricacies of the “correct” use of liaison, and there are also just as many rules regarding when liaison is prohibited. Adding even to that are some instances in which liaison is optional, where the speaker may or may not choose to liaise words, and neither choice is incorrect.

The data observed for this project will come from students currently studying in varying levels of French. The overall aim of this research is more practical than theoretical, seeking what “rules” beginner students are unaware of, and how consistent all students are with their use of the optional liaisons, among other objectives. The focus of group patterns over individual differences will ideally be useful for application in future classrooms.

PRESUPPOSITIONS IN CONVERSATION OR HAVE YOU STOPPED BEATING YOUR SPOUSE?

STUDENTS Anna Donohoe *Linguistics*

ADVISORS Thomas Werner *Philosophy*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

Why do conversations sometimes end with one or both participants wondering what went wrong? One phenomenon that contributes to such misunderstandings is the presupposition. A presupposition is a background belief or assumption that must be known or assumed by both parties in a conversation in order for its containing utterance to be relevant. Presuppositions have formulaic linguistic triggers—various types words and syntactic cues that signal the presence of a presupposition. These triggers can be used to the advantage of interlocutors who wish to deconstruct and analyze the presuppositions of an utterance. In this paper, the content of conversations is sorted into the individual and shared commitment stores of the interlocutors. The individual commitment store of each interlocutor contains all the propositions held by that person. Similarly, the shared commitment store contains all the propositions that both interlocutors have agreed upon or acquiesced to, whether voluntarily or otherwise. Presuppositions force content from the individual to the shared commitment store, sometimes involuntarily. The purpose of this analysis is to present tools to identify and understand presuppositions and presupposition triggers, to develop the ability to effectively respond to presuppositions accordingly, and finally to propose a method for removing objectionable content from the shared commitments store.

MODERN LANGUAGES

THE CREATIVE GENIUS AS “FAILURE”: THE LEGACY OF FEDERICO FELLINI IN WOODY ALLEN

STUDENTS Catherine Yu *Modern Languages*

ADVISORS Franco Sciannameo *BHA*

ROOM/TIME Wright / 3:40 pm

Cinema provides insight into the cultural atmosphere of its era; it reflects attitudes and mentalities of society at a point in time. The 1960s and 1980s were particularly important decades in the post-modern era, marking rapid changes in politics, technology, and the arts. Federico Fellini's *8 ½* (1963) is a post-modern masterpiece that places an artist's personal struggles in cultural-historical context. As a cornerstone of European cinema, it is highly referenced, studied, and analyzed by others. However, Woody Allen's homage to this film, *Stardust Memories* (1980) is perhaps the least recognized in his entire film repertoire. This thesis demonstrates the importance of history in both *8 ½* and *Stardust Memories*, as they mark the entrance and the height of the post-modern period. More importantly, it provides new perspective on the often over-looked *Stardust Memories*.

PHILOSOPHY

A SYNTACTIC AND PRAGMATIC EXAMINATION OF DISCOURSE PARTICLES IN MALAYSIAN ENGLISH AND SINGAPOREAN ENGLISH

STUDENTS Yi Low *Philosophy*

ADVISORS Thomas Werner *Philosophy*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

The discourse particles of Malaysian English (ME) and Singaporean English (SE) have been a subject of paramount interest for South East Asia linguists. The most prominent and well-researched particle is arguably 'lah,' but several other particles have received equal attention in terms of their etymology, their cultural and sociolinguistic significance, and their pragmatic contribution to utterances. There is, however, a disparity between the amount of research devoted to ME and SE, such that the vast majority of papers in extant literature focuses on dissecting SE particles. Since Singapore's separation from Malaysia in 1965, the two nations have diverged in their language policies and linguistic climate; a major distinction is the emphasis on the Malay language in Malaysia, but not in Singapore. This paper seeks to shed light on ME particles, offering a syntactic and pragmatic examination of the discourse particles by investigating the similarities and dissimilarities between SE and ME particles and particle clusters. The paper also proposes the existence of several discourse particles, 'ker,' 'kot,' and 'kan,' which are unique to ME, arguing that these particles originate from Malay. The comparative nature of this study is relevant to language contact and language variation, as well as Malaysian linguistics.

IS THIS WHAT IT FEELS LIKE?

STUDENTS Rebecca Warshofsky *Philosophy*

ADVISORS Sharon Dilworth *English*

ROOM/TIME Wright / 12:20 pm

This collection of short stories aims to explore the philosophical theme of how an individual ought to live in a world that has no inherent meaning. Together, the stories create a narrative arc that intends to show a journey through the initial rejection and eventual acceptance of values.

PSYCHOLOGY

ATTENTION MODULATION INFLUENCES CORTICAL PROCESSING OF ENVIRONMENTAL SOUNDS

STUDENTS Michael Kashaf *Psychology*

ADVISORS Laurie Heller *Psychology*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

Environmental sounds are characterized by a rich array of attributes. We report an fMRI study examining different features of environmental sounds. The design of the experiment consisted of alternately focusing participants' attention on the actions or materials that produced the presented sounds. Our results demonstrated that the identification of both of these features was associated with greater activity in the left inferior frontal sulcus, left intraparietal sulcus, and a cluster on the left supplementary motor area (pre-SMA) when compared with meaningless sounds. Among the meaningful sounds, identifying action was associated with greater activity in the inferior parietal gyrus whereas identifying material elicited greater bilateral activity in the occipital lobe. Shifting attention between action and material sound attributes was found to elicit differential activation of brain regions.

BiLASSO REGRESSION

STUDENTS Madeleine Clute *Psychology*

ADVISORS Aarti Singh *Machine Learning*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

The poster will cover the motivation for and implementation of a new type of regression--BiLASSO, which attempts to mimic the LASSO regression, but for higher dimension problems. Poster will detail successes and failures of the algorithm.

COMPARING COMPUTER-BASED INSTRUCTIONAL METHODS FOR CHINESE CHARACTER LEARNING

STUDENTS Like Li *Psychology*

ADVISORS Brian MacWhinney *Psychology*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The present project aims to design a computer-based tutor that promotes the robust learning of Chinese characters for Chinese as a foreign language (CFL) learners. While much previous research has focused on the teaching of Chinese characters based on semantic radicals and phonetic components, these instructional methods can only be applied to a subset of characters. In this project, we aim to determine which general methods are effective in teaching all Chinese characters. Two experiments are designed to compare different methods for teaching Chinese characters, with the aim to include the more effective methods in a final Chinese character tutor. In the first experiment, we compare the effectiveness of rote memorization tasks vs. writing/ alphabetic-typing tasks for learning Chinese characters. In the second experiment, we compare the effectiveness of learning Chinese characters individually vs. within the context of a meaningful sentence.

DOES PRACTICE REALLY MAKE PERFECT?: INDICATORS OF SIGHT-READING EXPERTISE IN BRASS MUSICIANS

STUDENTS Katherine Blakely *Psychology*

ADVISORS Marsha Lovett *Psychology*

ROOM/TIME Dowd / 12:00 pm

The study of experts and the acquisition of expertise have been widely studied. Many of these studies involve musicians and musical expertise, but deal mostly with pianists. This research re-examines the 2008 sight-reading study by Kopiez and Lee, studying brass musicians instead of pianists. The physical and mental demands of brass playing are quite different from piano playing. We investigated the process of expertise development in brass musicians. Part I was a sight-reading task, in which the participants were given music to sight-read on their major instrument. Part II was a test of component skills: (a) elementary cognitive skills, (b) general cognitive skills, and (c) performance-based skills. We predicted that those who perform better in component skill tests will also perform better in the sight-reading tests. Of primary interest are the similarities and differences between our indicators of expertise and those found by Kopiez and Lee, and the implications of those differences. A secondary interest is examining individual differences in approach to the sight-reading task, as measured by a retrospective interview. Our results will contribute to the development of a more generalized understanding of sight-reading expertise, and will be able to inform teaching methods at all levels of brass instrument instruction.

EARLY LIFE SOCIAL TRANSITIONS AND HEALTH AND WELL-BEING IN YOUNG ADULTS

STUDENTS Rachel Johnson *Psychology* | Yu Zhao *BHA*

ADVISORS Vicki Helgeson *Psychology*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

This project uses a new measure that is currently being developed with the intent to accurately measure social connectedness through the life course, and investigate preliminary connections between social connectedness and health and well-being outcomes. The measure has previously been used for participants age 35 and

up. In this project, the measure was altered to apply to 18-25 year olds and was used to look for preliminary connections between early life social transitions and health and well-being. Validity of the measure for this population was tested, as well as using the preliminary measure to investigate a person's level of anxiety, as related to his or her social connectedness throughout the life course and level of desire for control.

EFFECT OF ASSOCIATIVE AND SEMANTIC PRIMING ON INDUCTIVE GENERALIZATION IN CHILDREN

STUDENTS Siyan Zhao *Psychology*

ADVISORS Anna Fisher *Psychology*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Inductive generalization is an important tool for humans to explore the world. It involves trying to create general principles by starting with specific instances. Therefore, inductive generalization frees us from learning properties for every single object because we are able to hypothesize properties of unknown objects based on our knowledge. Considerable research has been conducted on inductive generalization. Some of this research indicates interesting patterns of inductive generalization in pre-school children: most four-year-old children can perform better in induction tasks if labels of similar semantic meaning co-occur in daily life (e.g., bunny-rabbit) compared to labels that do not co-occur (e.g., lamb-sheep). One possible explanation of this finding is associative priming – facilitation of a response from a previous stimulus for words that are frequently used together in daily life. To test this possibility, we will conduct priming studies with pre-school children. So far in the history of psychology, no priming studies have been done on pre-school children. However, to test our hypothesis, we will need to conduct experiments on pre-school children to examine the relation between performance on priming tasks and inductive reasoning tasks.

EFFECT OF DIFFERENCE IN MATE VALUE ON PERCEIVED LENGTH OF RELATIONSHIPS

STUDENTS Sarah Deiuliis *Psychology*

ADVISORS David Rakison *Psychology*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

This study is intended to investigate how differences in mate value of couple members, as presented in simulated dating advertisements, effect perception of the length of that relationship. To assess this topic, participants were presented with a number of simulated dating advertisements which they rated for “desirability” based on such traits as ambition, (physical) attractiveness, financial security, and age (youth). Participants then answered questions about the “couple” including how long they predicted the relationship would last.

EXAMINING AGENCY AND COMMUNION THEMES IN OLDER COUPLES' PERSONAL GOALS

STUDENTS Priscilla Kim *Psychology* | Sook Yee Leung *Psychology, Chatham University* | John Ra *Biology and Psychology*

ADVISORS Brooke Feeney *Psychology* | Vicki Helgeson *Psychology*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

The goals of this study were to determine the extent to which older subjects' earlier life experiences influenced their present-day goals, to relate subjects' agentic and communal goals to various personality traits and gender, and to determine whether a relation exists between having agentic and/or communal goals and well being.

Couples over the age of 65 completed measures of personality and life satisfaction in separate rooms and were also asked to list up to 10 goals that they would like to accomplish over the coming year that did not require their spouse's assistance. Each goal was then coded by two trained, independent coders for its primary type (e.g. travel, relationships, finance, etc.) and characteristics. We focused primarily on the themes of agency and communion in the couples' goals. We predict that earlier life experiences will be related to the types of goals set in older age. For example, we hypothesize that people who had more agentic lives (i.e., high agency occupations) will have more communal goals, and people who had more communal lives (i.e., raised children and/or high communion occupations) will have more agentic goals. We also hypothesize that males will express more communal goals while females will express more agentic goals. Last, we predict a positive relation between the number of agentic goals expressed and well being.

EXPLORING RACIAL AND ACADEMIC IDENTITY THROUGH A LITERATE PRACTICE: STRATEGIES OF SOUTH AFRICAN HIGH SCHOOL STUDENTS

STUDENTS Sara Mouhktar *Psychology*

ADVISORS Linda Flower *English*

ROOM/TIME McKenna / 3:20 pm

This project explores the racial and academic identities of South African high school students: how they plan, construct, and write a response to a prompt regarding racial definitions. I investigate: the historical, cultural, and academic contexts in which the students participate in a specific literate practice; the students' planning, discussion, and written responses to a given prompt; how their writing strategies impacted the decisions they made - as writers, students, and black South Africans. I will also examine whether what the students said and planned to do mapped on to their final written work – and if it didn't, what kind of knowledge representations could have accounted for it. Finally, I reflect on my own experience and perspective on culture and race in South Africa.

We see that there are many social, cultural and academic factors that influence the writing decisions a student makes. The fact that English is the students' second language, the instructor's assumptions and perceptions of how to orchestrate Collaborative Planning sessions, and the students' meta-knowledge, all impact this literate practice. On a cultural note, we see that students' identities are deeply rooted in South Africa's Apartheid period. We also observe that discussing, reflecting, and writing about one's own identity leads to new paths of self-understanding; it also paints a clearer picture of the steps a student takes in articulating him or herself.

FEMALE COMPETITION AND THE CONDITIONS IN WHICH FEMALES CHOOSE TO DEROGATE EACH OTHER

STUDENTS Honor Randall *Psychology*

ADVISORS Vicki Helgeson *Psychology*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

The study will focus on female competition and the group circumstances in which women will derogate each other. This study will investigate the way females react to each other's presence in a male dominated situation. Female participants will become acquainted with another female by viewing her Facebook© profile before they are to enter a male or female dominated social interaction. Participants will be asked to complete a survey in

which they judge the female whose profile they reviewed, rate themselves in similar domains, and complete a self-esteem inventory. The hypothesis is that women will be more likely to judge each other harshly in anticipation of entering a male dominated social situation compared to a female dominated situation. Negative effects are expected to be magnified if the participant has low self-esteem and if the participant perceives the other female as an upward comparison in terms of physical attractiveness to the opposite sex.

GENDER DIFFERENCES IN DEPRESSION, HELP SEEKING, AND RESTRICTIVE EMOTIONALITY

STUDENTS Joshua Swanson *Psychology*

ADVISORS Vicki Helgeson *Psychology*

ROOM/TIME Dowd / 12:20 pm

Research shows females are significantly more prone to depression than males, but it is not known to what extent this disparity is exaggerated by gender differences in the endorsement of depression. Undergraduates (n=100) are being tested to see if men and women report higher or lower levels of depressive symptoms if they think they are discussing their 'Well-Being' versus 'Depression.' It is predicted that men report lower levels of depressive symptoms in the 'Depression' condition and higher levels in the 'Well-Being' condition, due to the strong stigma depression carries for men. Masculinity is also predicted to mediate this difference as it affects participants' attitudes toward emotional expression. Women are predicted to report slightly higher levels in the 'Depression' condition as it conforms to the female gender role, characterized by high levels of emotion. Participants are also given a vignette of either a depressed male or female to see if there are sex differences in depression recognition and views on help-seeking. Based on prior research (Swami, 2012), participants are predicted to have better symptom recognition and express greater sympathy with the female vignette.

HOW THE PERCEPTION OF DEPRESSION CAN ERODE SUPPORT

STUDENTS Stephanie Chen *Psychology* | Jennifer Hirsch *Psychology* | Lisa Kim *Psychology*

ADVISORS Vicki Helgeson *Psychology*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

This project explored the relation between social support and depression and the factors that moderate this relation (gender and perception). Specifically, We examined how gender and perception of the support provider leads to an erosion of support for a person with depression over a short period of time. Measures at the beginning and end of an hour-long interaction with a depressed person (confederate) recorded fluctuations in support quality and perception. This research explored a few aspects of a newly developed model for understanding the relation between social support and depression.

MEASURING DEVELOPMENT OF SEMANTIC KNOWLEDGE IN PRESCHOOL CHILDREN

STUDENTS Wyatt D'Emilia *Psychology*

ADVISORS Anna Fisher *Psychology* | Layla Unger *Psychology*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

This study focuses on how children organize their knowledge. Previous research shows that only a small percentage of preschoolers can spontaneously make category-based inferences (Godwin, Matlen, & Fisher, 2011). Research also shows that as domain knowledge increases, children shift their focus from perceptual similarity to relational similarity (Rattermann & Gentner, 1998). Such results appear to show category-based

reasoning increasing with age and cognitive development. This study aims to examine the development of children's knowledge organization, which will help researchers to ultimately understand how children make inferences.

PAINTING WITH NATURAL SELECTION

STUDENTS Celine Berger *Psychology*

ADVISORS Patricia Maurides *Art*

ROOM/TIME Rangos 2&3/Sigma Xi Group 9 / 10:13 am

The question of evolution education is still relevant, as a recent Gallup poll indicating that roughly 40% of Americans hold an anti-evolutionary belief about the origin of humans. While there has been a decrease in the acceptance of a creationist viewpoint, the overall shift has been slight and the general perception on the origins of humans have remained generally the same as they were in the early 1980s. As children can adapt the opinions of their communities in time, it is important to reach the youth from a young age to ensure a basic understanding of the science of evolution. This project uses art and interactive new media technology as aids in teaching science. The goal was to develop an innovative teaching tool – Painting with Natural Selection, an interactive installation to teach young children in first and second grade about evolution. This tool is physically engaging and artistic, using new media software development. Focusing on science education and evolution and reproduction research, I gathered information to decide what gap in present knowledge the installation could help close. I surveyed children before and after interacting with the installation, attempting to find how much a child can actually learn from a five-minute interaction period with a simulation program.

PITCH GENERALIZATION AND INTERVAL TRAINING IN STATISTICAL LEARNING

STUDENTS Amritha Mallikarjun *Psychology*

ADVISORS Erik Thiessen *Psychology*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

Studies have shown that young infants who are given words in a certain affect or pitch cannot recall the word if it is presented in a different affect or pitch to them (Houston & Jusczyk, 2000, Singh et al., 2004). This makes word learning difficult, as infants cannot understand the same word spoken by one person when it is produced by a different speaker. Infants have been shown, however, to generalize words over multiple different affects if given words in happy, sad, angry and fearful tones (Singh, 2008). This study expands on Singh's work through an examination of adult bilingual and monolingual speakers' generalization of words given at a higher pitch to words at a lower pitch. In this statistical learning task, the single pitch condition features a steady high-pitched language followed by test words in a medium pitch. The varying pitch condition features an interleaved high pitch and low pitch language followed by the same medium pitch test words. This experiment will help us further understand how adults and infants can use the variation of input they receive to learn to generalize words.

PLAY AND PLAYFULNESS IN ADULT CLOSE RELATIONSHIPS

STUDENTS Alexandra McCluskey *Psychology* | Jaclyn Ross *Psychology* | Meredith Van Vleet *Psychology*

ADVISORS Brooke Feeney *Psychology*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Does participation in play activities with one's partner have important personal and relational benefits? Eighty dating couples will be recruited from the Pittsburgh area to participate in several laboratory activities. After a distracter activity, participants will be assigned to one of three conditions: a play, serious or positive affect-induction condition. Couples in the play and serious conditions will participate in an interactive game together, but in the play condition, the experimenter will describe the task as "a fun activity" and tell participants to "relax and have fun". In the serious condition, the game will be described as a 'communications task' and couples will be told to "pay attention and try their best." Participants assigned to the positive affect-induction (control) condition will watch a comedic video in separate rooms. The effects of the play activity will be assessed with video recordings and subsequent questionnaires. We hypothesize that couples assigned to the play condition will report more positive perceptions of the activity, their partners and their relationships, and exhibit more positive affect and engagement during the activity. Both of us have obtained research experience by working as research assistants in the CMU Relationships Lab and by completing relevant course work. Thus, we are prepared to undertake this project, and our work will be closely supervised by Meredith Van Vleet, a PhD candidate in the Relationships Lab, and Dr. Brooke Feeney, our faculty mentor. We plan to share the results of the proposed study in a poster presentation at the Meeting of the Minds, and possibly in a journal publication.

SECOND-ORDER CORRELATION LEARNING OF EXTERNAL AND INTERNAL ANIMAL PARTS WITH INFANTS AND YOUNG CHILDREN

STUDENTS Jennifer Patel *Psychology*

ADVISORS David Rakison *Psychology*

ROOM/TIME Peter / 4:40 pm

Previous research has shown that infants develop the capability to learn correlations among features in a category and non-category context as early as 10 months of age (Younger & Cohen, 1983). In a more recent study by Rakison and Yermolayeva (2011), it was found that 26-month-olds, but not 22-month-olds, are able to learn correlations between two pairs of features (e.g., P and Q, P and R) and generalize the learned associations to the features that were not presented together (e.g., Q and R). They labeled this ability second-order correlation learning. However, this previous study used stimuli that were not realistic and as such did not examine infants' ability to learn second-order correlations that they encounter in the real world. In the current experiments, I will test whether second-order correlation learning can be extended to more realistic stimuli. I will work with infants of 22 and 26 months in addition to children of 3 and 5 years. This novel study will examine whether or not infants and young children are able to learn about features that are indirectly correlated using images of animals and their varying internal and external parts. The results of this study will allow us to understand infants and young children's learning processes with regards to second-order correlations and how they make sense of the interconnected features of objects.

SOCIAL SUPPORT FROM ROMANTIC PARTNERS VERSUS FRIENDS AS MODERATORS OF MORTALITY SALIENCE EFFECTS

STUDENTS Jessica Laubach *Psychology*

ADVISORS Brooke Feeney *Psychology*

ROOM/TIME Wright / 1:40 pm

This study examines the differences between two types of close relationships (friends and romantic partners) in moderating responses to mortality salience. Prior research has shown that mortality salience increases worldview defense as a mechanism for managing the terror of death. It was predicted that social support from romantic partners (but not friends) would alleviate the need to defend one's worldview in response to mortality salience. Following a mortality salience or control prime, participants were given a standardized support note from their friend or romantic partner pertaining to a speech the participants believed they would have to give. Participants were then asked to rate their perceptions of the note and their partner, and rate their opinions of a pro-American and anti-American essay (as a measure of worldview defense). A two-way ANOVA revealed a significant interaction between mortality salience and source of social support for worldview defense. Following mortality salience, support from a romantic partner led to less worldview defense than support from a friend. Additionally, romantic partners were perceived as more supportive and more stressed than friends in both the mortality salience and control conditions. These findings suggest that romantic partners may provide a more effective buffer against existential-anxiety than friends and is consistent with predictions derived from terror management theory.

STUDENT PERCEPTIONS OF OTHER MAJORS/SCHOOLS AT CMU

STUDENTS Ronald Fudala *Economics and Statistics* | Like Li *Psychology* | Nazym Satbekova *Statistics* | Kit Ying Wong *Economics and Statistics* | Aleksandr Zeltser *Business Administration*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

This topic is interesting because there is a large unspoken divide on campus. Many people understandably congregate in their majors to work on assignments and socialize but often times very distinct group forms in which the people on the inside almost exclusively do everything together. There are well known stereotypes for virtually every school from computer science and business, to drama. In addition, there are also different perceptions and stereotypes concerning the amount of workload for different majors. Now is a good time to do this survey as understanding people's perceptions of other majors and their personalities and traits associated with it can provide some valuable insight as to why any social divide might exist. After a traumatic incident last year and general awareness of a stress culture at CMU, being able to provide a more socially nurturing and welcoming atmosphere would be beneficial towards the entire student body. Deans of the schools in question would be able to use this data to examine perceptions of how the rest of the school views their department and decide whether there are any negative aspects that could be fixed with a strategic change for the departments. The school can also take these opinions into consideration and try to instill and focus on the more positive aspects. The data can also be used to evaluate if the stereotypes are actually true. An interesting part of this type of survey is that fact that it can lead to many other beneficial research projects.

In addition, administrators of specific programs can self-evaluate their departments' in light of the research to try to expand and enhance their program.

In this study, we would like to investigate the following questions:

1. In general, what are CMU students' perceptions of each college at CMU?
2. Are certain colleges/majors considered more difficult or stressful than others?
3. How do students rank their own colleges/majors in terms of difficulty? Do these rankings match the general perception?
4. How do students think the rest of the student body perceives their college/major? Do students feel positively/negatively about how others perceive their major?
5. How many hours per week do students in each college/major work? Do these results match their own perceptions of how difficult their major is? Do these results match the general ranking of major difficulty?

Our target population is the entire undergraduate student body currently attending CMU, and we wish to make inference to the undergraduate population at CMU. Each individual undergraduate student at CMU will be a unit in this population. We plan to sample from the population of all undergraduate students that are listed in the CMU Master address book (C-Book). The sampling frame should be nearly identical to the target population. However, a possible source of coverage error could come from those students who entered or left CMU in the spring 2013 semester, after the address book had already been published. This error could be partially addressed with regard to students who no longer attend CMU but are listed in the address book. We can cross-check each student who is selected for the sample by using the search function in the CMU online directory, which is up-to-date and does not list any students who no longer attend CMU.

THE ACCURACY OF MENTAL REPRESENTATIONS OF ENVIRONMENTS BASED ON HAPTIC INPUT

STUDENTS Rachel Franz *BHA* | Siyan Zhao *Psychology*

ADVISORS Roberta Klatzky *Psychology*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

The purpose of the study is to explore how accurately tactile input can be converted to mental spatial representations and if there are any factors that influence accuracy. Participants felt several tactile maps while blindfolded and were asked a few questions regarding the map they explored. They were then asked to reproduce the tactile map. We predicted that when people thought of spatial relationships relative to their body, their perception of space would be less accurate.

THE RELATION OF GENDER AND PERCEPTION OF OTHERS FOR SUPPORT EROSION

STUDENTS Jennifer Hirsch *Psychology*

ADVISORS Vicki Helgeson *Psychology*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

Previous research in social support and depressive symptoms has found a relation between decreases in social support and increases in depressive symptoms, however a causal relation is unclear. The current study explored this causal relation and whether the relation depends on gender, something past research has not explored. Additionally, it explored the reported instances of social support from both the recipient and the provider perspective. Participants were pairs of same sex friends whom completed three measures about support requests, receipt, provision, and other support variables within that friendship over a six week period.

SOCIAL & DECISION SCIENCES

ACADEMIC AND SOCIAL LIFE OF CARNEGIE MELLON UNDERGRADUATES

STUDENTS Nicole Crimi *Statistics* | Michael McGinnis *Statistics* | Guhan Shastri *Social & Decision Sciences* | Jaime Trujillo *Statistics* | Julian Zhou *Statistics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

Following the tragedy of a Carnegie Mellon student's suicide last semester and an article on Mental Health at CMU posted on the Tartans forum, there has been heated discussion among the college community regarding issues such as stress level at CMU, students' psychological well-being, balance in the students' lifestyles, and so on. On the one hand, CMU has been known for its outstanding academic reputation, which, as we believe the majority of the Tartans would agree, should continue to be upheld in the future. On the other hand, the overall mental well-being of our students has increasingly become a concern for many of us because of the need to tackle the academic rigor at CMU, the level of which is also quite well-known, at the expense of rest, social life, and more. It is to this end that we wonder, is there any relationship between a CMU student's academic performance and other non-academic factors, for instance, social involvement? How much of the student population here has been able to find a good balance between academic and social life? The motivation behind choosing to focus on social involvement amongst other non-academic factors is anecdotal. Upon recalling his experience with spending time in social organizations on campus, one of our group members commented that he benefited tremendously from joining such organizations and was able to leave psychological therapy as a result of doing so. Our questions of interest thus include what relationship, if any, exists between a CMU student's academic performance, measured quantitatively in GPA, and his/ her social involvement on campus, measured in the number of hours spent in social organizations. In addition, we are interested in knowing how students' perceived life satisfaction could be associated, if at all, with their involvement in social organizations. Moreover, we wish to identify any confounding factors that may also affect students' academic performance and/ or life satisfaction significantly through our investigation.

ANALYZING PSYCHOSTIMULANT USE IN THE CARNEGIE MELLON STUDENT POPULATION

STUDENTS Kevin Handerhan *Social & Decision Sciences* | Andrew Klein *Civil and Environmental Engineering* | Luke Racek *Economics* | Peter Satagaj *Mathematics* | Won Woo Sohn *Economics*

ADVISORS Trent Gaugler *Statistics* | Tracy Sweet *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

In general, performance-enhancing drugs are a sensitive and controversial issue. The most pervasive coverage of this in popular media deals with drugs used by professional and amateur athletes to improve their athletic performance. However, there is rarely coverage of so-called "academic" drugs, such as amphetamines, which are ubiquitous on college campuses in America. The use of these drugs, often without a legal prescription, is mysterious and students have many different opinions on the ethicality of their use and the potential benefits and risks one assumes when consuming them. This topic is particularly interesting at Carnegie Mellon because many Carnegie Mellon students believe that the university's stressful and strenuous academic environment may incentivize, or even necessitate for some, the use of psychostimulants to maintain good course grades and secure a sound financial future. Studying the CMU student population's relationship with psychostimulants,

both legally and illegally consumed, through voluntary surveys may help us to discover revealing information about the state of the academic environment.

CAN I HAVE A SEAT?: A STUDY OF AVAILABLE SEATING IN THE UNIVERSITY CENTER

STUDENTS Allison Ma *Social & Decision Sciences* | Adams Rosales *Business Administration* | Jennifer Soong *Statistics* | Sam Zhang *Computer Science* | He Zhu *Mathematics*

ADVISORS Trent Gaugler *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

The second floor of the University Center provides a convenient spot for students to meet and study, but is often full. This survey investigates the problem of the insufficient amount tables and seating in the poolside, gym, and main area of the second floor. Data on a variety of variables, such as table usage and foot traffic, will be collected by observation and analyzed. Utilizing the results of the data analysis and considering a variety of solutions for a more efficient use of chairs and tables, a recommendation will be written as to how to optimally meet the needs of students.

DELIVERING RhBMP-2 THROUGH SODIUM ALGINATE HYDROGELS

STUDENTS Peeya Tak *Social & Decision Sciences*

ADVISORS Jeffrey Hollinger *Biological Sciences*

ROOM/TIME Wright / 4:20 pm

Health care providers are stressing the importance of developing regenerative therapies in favor of replacement procedures (the current status quo). Regenerative therapies are a cost-effective, promising solution to restore original form and function in wounded patients. Bone regeneration is of particular importance since bone transplants are high in demand, as they are the second most transplanted organs. To this goal, we propose that alginate hydrogels containing rhBMP-2 will induce bone formation at a defect site. Here, we determine the in vitro potential for achieving this goal. Hydrogels formed in transwell plates will release rhBMP-2 causing hMSCs to differentiate into osteoblasts. Osteogenic differentiation will be visualized using von Kossa staining and measured through an ALP assay normalized to DNA concentration using a PicoGreen assay.

EFFECT OF TEXTBOOK OWNERSHIP ON CLASS PERFORMANCE

STUDENTS Liting Chen *Business Administration* | Hijae Kim *Business Administration* | Weichao Kong *Economics* | Philip Lee *Social & Decision Sciences* | Nadyli Nunez *Economics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME McKenna / 3:00 pm

How does physical ownership of a required text for a class affect performance and perceived enjoyment in class? Participants will be cluster sampled from classes randomly sampled from each college.

STOLEN BABIES IN SPAIN: HUMAN RIGHTS ABUSES AND POST-TRANSITIONAL JUSTICE

STUDENTS Kimberly Josephson *Social & Decision Sciences*

ADVISORS Silvia Borzutzky *Social & Decision Sciences*

ROOM/TIME Wright / 2:00 pm

The 20th century has seen many countries transition to democracy, several following violent dictatorships. There is no one, clear solution of how to create a democracy out of a war-torn or oppressed nation; every conflict is unique. The field of transitional justice, however, provides a framework for how to address past injustices and move forward as a nation. While often applauded as a successful democracy, Spain's past has increasingly become a topic of discussion and calls into question its transition more than 30 years ago. Some of the nation's unresolved trauma dates back to the 1930s. As both political punishment and an attempt to purify the Spanish race, Franco's dictatorship oversaw the abduction of more than 40,000 infants and young children during the civil war and deep into the post-war era. As opposition to Franco's regime faded, so did these abductions. Yet from the 1950s through the early 1990s, many hospital workers and Church officials organized the abduction, trafficking, and illegal adoption of as many as 300,000 more children. Only within the last decade have these stories emerged and gained momentum, now beginning to stir local, national, and international attention. Organizations and government institutions, however, face unique challenges that impede the nation's ability to implement post-transitional justice. This paper analyzes Spain's democratic transition and transitional justice mechanisms as they pertain to these stolen children. This investigation constructs a more comprehensive overview of this little-known scandal and addresses future challenges and obligations for implementing post-transitional justice at the local, national, and international levels in Spain.

STOP USING PAPER: DEPLOYMENT OF A DIGITAL DATA COLLECTION SYSTEM IN A SPECIAL EDUCATION ENVIRONMENT.

STUDENTS Quintin Carlson *Social & Decision Sciences* | Kevin Schaefer *Information Systems*

ADVISORS Anind Dey *Human Computer Interaction Institute*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

In special education, and particularly with Autism Spectrum Disorder therapy, data collection is immensely valuable in determining the effectiveness of therapies. Currently, data collection at many schools is based on paper, including hand-graphed evaluations. There have been commercial efforts to digitize these data collection processes, but they have not achieved a high rate of adoption. Throughout the past six months, we have been developing Zephyr, in association with Carnegie Mellon University's Human-Computer Interaction Institute. This semester, we began initial user testing and the evaluation of Zephyr.

THE GOOD, THE BAD, AND THE UGLY: COMPARING SOUTH AFRICA'S TRUTH AND RECONCILIATION COMMISSION AND RWANDA'S GACACA COURTS

STUDENTS Eve Stoffel *Social & Decision Sciences*

ADVISORS Afeworki Paulos *Univesity Libraries*

ROOM/TIME Wright / 3:00 pm

This paper critically the Truth and Reconciliation Commission of South Africa (TRC) and Rwanda's Gacaca Courts in an attempt to analyze their outcomes. Both systems achieved some success in determining the truth and in providing a medium through which many dispossessed citizens could express themselves. Sadly, the

failures threaten to overshadow these victories, especially in the case of Rwanda. In both countries, ethnic divisions persist, neither economic nor gender parity have been achieved, and those who were willing to testify have received insufficient psychological support and consequently are at high risk of retraumatization. Full reconciliation remains a distant goal.

Additionally, there are many important differences between South Africa's Truth and Reconciliation Commission and Rwanda's Gacaca system that provide important insights into improving the efficacy of the truth and reconciliation commission model. Whereas the Gacaca courts refashioned a traditional mechanism of community conflict resolution to fit the needs of those in power, the TRC used the example of similar commissions in South America to craft a model suited to the particular societal and historical conditions within South Africa. The TRC's commissioners produced an inclusive national history and were given the power to grant amnesty to perpetrators of genocidal acts under certain specific circumstances. In contrast, those in charge of the Gacaca courts obstructed the creation of a Rwandan national narrative and were only deputized to grant sentence reductions. These practical differences are indicative of the larger ideological divide which separated the two institutions. The TRC took a more spiritual approach that promoted universal admission of guilt for apartheid-era crimes; the Gacaca courts took a prosecutorial approach that promoted a more dichotomous view of guilt and innocence. As the divergent societal outcomes in Rwanda and South Africa suggest that these institutional differences really matter, further analysis of this type is necessary to cure what continues to ail the truth and reconciliation commission model of transitional justice. Keywords: South Africa, Rwanda, genocide, transitional justice, truth, apartheid, reconciliation, women's rights.

THE ROAD TO REVOLT: THE DIFFERENT PATHS OF THE VILNA AND WARSAW GHETTOS

STUDENTS Zachary Stahl *Social & Decision Sciences*

ADVISORS Donna Harsch *History*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

By 1942, the Jews of the Warsaw ghetto in Poland were no longer under the false allusions that Jews were being deported to labor camps, they were no longer deceived into believing that their lives would be safe if they continued to work for the Nazis. Thus, the Warsaw ghetto held out against an onslaught of three thousand German troops for almost a month, in a valiant show of resistance in the face of tyranny. This group was unified in a common purpose, to revolt against their occupiers, to die on their own terms and to die honorably. However, this account of resistance within a Jewish ghetto is contrary to another tale, that of the Vilna ghetto in Lithuania, a city previously known as the "Jerusalem of Lithuania." It was here that Jews who wanted open revolt, or who wanted revolt of any kind, were met with skepticism and betrayal by the other inhabitants of the Vilna ghetto. Why was it that two ghettos, ghettos that were separated by less than 300 miles, were so different in their reaction to Nazi occupation? Why were the Jews of Warsaw spurred on to fight and resolved to die honorably, while the Jews of Vilna were seemingly persuaded into thinking that they would be spared, even as their friends and family were being hunted and killed around them? Was it the leadership of the Judenrat in the different ghettos? Were there harsher protocols implemented in the Warsaw ghetto that made resistance seem to be the only option? Or was it the socio-economic status of those encompassing the ghetto that altered how they perceived the situation at the time? These questions and many more are what I hope to discover over the course of my research and to answer the question—why the difference?.

STATISTICS

A NON-PARAMETRIC METHOD FOR INTERPOLATING TELESCOPE POINT-SPREAD FUNCTIONS

STUDENTS Kathryn McKeough *Statistics*

ADVISORS Peter Freeman *Statistics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 10:00 am

As a consequence of Einstein's Theory of General Relativity, massive objects can bend the paths of photons travelling from distant galaxies to Earth. Therefore, the appearance of distant galaxies is distorted, or "sheared". What causes this shear is referred to as Weak Gravitational Lensing. The shear and spatial distribution of intervening masses can be statistically inferred by carefully modeling galaxy appearance. The observed appearances of the galaxies are also affected by a blurring introduced by the atmosphere and the telescope. This blurring, whose mathematical formulation is called the Point Spread Function (PSF), further distorts the appearances of distant galaxies. The PSF must be modeled in order to better understand it as a source of systematic error in shear estimation. Stars are point sources that allow one to estimate the PSF at specific locations by modeling the variation of the PSFs of noisy star images. Simulated data provided by GRavitational lEnsing Accuracy Testing (GREAT) challenges allow one to test algorithms that predict the PSF at arbitrary locations in an image. In this poster, we present an algorithm for estimating PSFs at galaxy locations that is based on a nonlinear dimension reduction technique, diffusion map, which allows us to model how the PSF shape varies across an image.

ACADEMIC AND SOCIAL LIFE OF CARNEGIE MELLON UNDERGRADUATES

STUDENTS Nicole Crimi *Statistics* | Michael McGinnis *Statistics* | Guhan Shastri *Social & Decision Sciences* | Jaime Trujillo *Statistics* | Julian Zhou *Statistics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

Following the tragedy of a Carnegie Mellon student's suicide last semester and an article on Mental Health at CMU posted on the Tartans forum, there has been heated discussion among the college community regarding issues such as stress level at CMU, students' psychological well-being, balance in the students' lifestyles, and so on. On the one hand, CMU has been known for its outstanding academic reputation, which, as we believe the majority of the Tartans would agree, should continue to be upheld in the future. On the other hand, the overall mental well-being of our students has increasingly become a concern for many of us because of the need to tackle the academic rigor at CMU, the level of which is also quite well-known, at the expense of rest, social life, and more. It is to this end that we wonder, is there any relationship between a CMU student's academic performance and other non-academic factors, for instance, social involvement? How much of the student population here has been able to find a good balance between academic and social life? The motivation behind choosing to focus on social involvement amongst other non-academic factors is anecdotal. Upon recalling his experience with spending time in social organizations on campus, one of our group members commented that he benefited tremendously from joining such organizations and was able to leave psychological therapy as a result of doing so. Our questions of interest thus include what relationship, if any, exists between a CMU student's academic performance, measured quantitatively in GPA, and his/ her social involvement on campus, measured in the number of hours spent in social organizations. In addition, we are

interested in knowing how students' perceived life satisfaction could be associated, if at all, with their involvement in social organizations. Moreover, we wish to identify any confounding factors that may also affect students academic performance and/ or life satisfaction significantly through our investigation.

AN ALGORITHM FOR DISCOVERING MIMIC MODELS

STUDENTS Alexander Murray-Watters *Statistics*

ADVISORS Clark Glymour *Philosophy*

ROOM/TIME McKenna / 12:20 pm

Presents a new algorithm for the discovery of MIMIC models in data.

AN EVALUATION OF THE EFFECTIVENESS OF CAREER FAIRS AT CARNEGIE MELLON UNIVERSITY

STUDENTS Robert Eckels *Statistics* | Alex Klarfeld *Electrical & Computer Engineering* | Soham Sengupta *Economics and Statistics* | Shreepal Shah *Computer Science* | Jonathan Yu *Statistics*

ADVISORS Trent Gaugler *Statistics* | Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

A primary reason that many students come to Carnegie Mellon University is to improve their prospects of gaining better employment opportunities. The university provides various resources for students to be in touch with potential employers. The career fair is a prime example. Events such as the Employment Opportunity Conference, Business Opportunity Conference, and Technology Opportunity Conference are staples of the academic year. Through our research and analysis, we attempt to understand how effective career fairs are in their purpose to match students with employers. In our research, we control for how qualified a student is and other aspects of the student, to see if career fairs really do help a student's job search. Our research focuses just on the success of undergraduate students.

ARE YOU PAYING ATTENTION? UNDERSTANDING STUDENT ATTENTION ALLOCATION USING BAYESIAN MODELS

STUDENTS Elizabeth Lorenzi *Statistics*

ADVISORS Howard Seltman *Statistics*

ROOM/TIME McKenna / 1:20 pm

A mixed effects multinomial logistic model is useful in understanding a response variable with more than two outcomes and its relationship with covariates for nested data sets. Because of the nested structure of the data, using random intercepts is needed to adjust for the dependency within subgroups. This paper addresses this method while analyzing a psychological study performed by the Carnegie Mellon Psychology Department. The data is collected from local elementary schools to better understand the environmental effects that cause off task behavior in the classroom. Logistic multinomial models with Bayesian analysis are used to better understand what behavior and activity is responsible for making student's go off task in the classroom.

CAN I HAVE A SEAT?: A STUDY OF AVAILABLE SEATING IN THE UNIVERSITY CENTER

STUDENTS Allison Ma *Social & Decision Sciences* | Adams Rosales *Business Administration* | Jennifer Soong *Statistics* | Sam Zhang *Computer Science* | He Zhu *Mathematics*

ADVISORS Trent Gaugler *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

The second floor of the University Center provides a convenient spot for students to meet and study, but is often full. This survey investigates the problem of the insufficient amount tables and seating in the poolside, gym, and main area of the second floor. Data on a variety of variables, such as table usage and foot traffic, will be collected by observation and analyzed. Utilizing the results of the data analysis and considering a variety of solutions for a more efficient use of chairs and tables, a recommendation will be written as to how to optimally meet the needs of students.

CHANGES IN PIRACY TRENDS AMONGST COLLEGE STUDENTS

STUDENTS Inez Foong *Information Systems* | Nikhil Kumar *Statistics* | Audris Wong *Economics* | Kevin Yang *Economics and Statistics* | Tadas Zolynas *Economics and Statistics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

We are studying changes in piracy habits amongst undergraduate students. Specifically, we would want to assess how often and in what volume do students pirate digital content and if their current behaviors differ from prior years. We will be conducting an online survey to assess these changes in piracy habits. The topic of piracy trends is interesting because we are interested in finding out whether student's piracy habits have changed over the last 2-4 years, especially with the advent of Hulu, Netflix, Spotify, and other online streaming services. This type of survey would need to be conducted now to assess whether major players in the online streaming market have successfully (or unsuccessfully) deterred piracy in a key demographic. Additionally, we could potentially assess if the MPAA's actions for reducing piracy have been successful.

CMU SHUTTLE/ESCORT SERVICES SURVEY

STUDENTS Aleksandra Arkhangelska *Statistics* | Irene Kim *Economics* | Luis Marquina *Statistics* | Amy Stautz *Statistics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

Carnegie Mellon currently offers shuttle and escort services through the campus Police Department. This is a significant cost undertaken by the department for a service that is only partially utilized by students. The Vice Presidents and Police Chiefs are consistently questioning and evaluating the effectiveness and viability of this service. Few students are knowledgeable about these services, let alone utilize it to the highest capacity. There is also the need to critically evaluate the routes that these services follow and whether they are most preferred by students or optimize the resources available. The results of this survey could be used by the CMU administration and police departments to evaluate the use and allocation of funds as well as to decipher students' attitudes and knowledge about the transportation options available. Student Government periodically evaluates student attitudes on the student activity fees and consequently the results of our survey may be of interest to them as well.

ESTIMATING THE HUBBLE TELESCOPE ACS POINT SPREAD FUNCTION THROUGH STATISTICAL METHODS

STUDENTS Shiyao Gan *Business Administration* | Nicholas Thieme *Statistics* | Yunhao Yang *Electrical & Computer Engineering*

ADVISORS William Eddy *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

In this work we attempt to estimate the point spread function of the Hubble Telescope's Advanced Camera for Surveys; Wide Field Channel using images of (only) stars as an estimate of the PSF. We used two primary approaches, one using parametric statistical techniques from the exponential family, and another using a combination of non-parametric statistics (in the form of smoothing splines) combined with techniques from the field computer vision.

EXPLORATION OF OBSERVED BIRD POPULATION IN UNITED STATES

STUDENTS Jason Ha *Statistics* | Eun Ji Shim *Mathematics* | Jonathan Yu *Statistics*

ADVISORS William Eddy *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

Every year, the U.S. Geological Survey's Patuxent Wildlife Research Center and the Environment Canada's Canadian Wildlife Service collaborate on collecting observations of birds in North America from thousands of dedicated self-proclaimed birders in North America. This data set contains information on more than 700 known species, traffic, location, weather, and counts of observed birds on known routes.

Our group has conducted statistical analysis on the data set utilizing tools such as linear modeling and additive modeling. We then applied this method to all species and different regions to compare the change of the observed bird population per year.

NEURO-IMAGING OF THE BRAIN : EXAMINATION OF VARIANCE IN NEURAL STRUCTURE VIA TWO PHOTON LASER SCANNING MICROSCOP

STUDENTS Jinsub Hong *Economics and Statistics* | Kyongche Kang *Statistics* | Hannah Worrall *Economics and Statistics*

ADVISORS William Eddy *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

Our project deals with examining images from two-photon calcium imaging, a brain-imaging technique that allows for study of neuronal activity in hundreds of neurons and inherent brain structure and circuitry. As statisticians, we worked to apply various methods to better understand the effects of physical stimulation on the working brain. Currently there is no system to examine such brain images. As such, we explored methods to examine these images. Our data set had images of a rat's brain in two states. In the first state the rat is sedated and merely observed and in the other it is repeatedly stimulated via electric shock. We first started by controlling for the movement of the brain to more accurately observe the physical characteristics of the brain. To examine the underlying structure of the brain, we analyzed how the variance of the brain images varied between pre and post stimulus by applying Levene's Test. Furthermore, we were able to measure how much the images were shifted to see the overall change in movement of the brain due to electric stimulus. Therefore, we were able to visually observe how the brain structure and variance change due to stimulus effects in rat brains.

STAGEWISE REGRESSION AND THE LARS ALGORITHM

STUDENTS Eliot Knudsen *Statistics*

ADVISORS Ryan Tibshirani *Statistics*

ROOM/TIME Pake / 3:00 pm

In this project we explore stagewise regression as an alternative selection and estimation procedure to LASSO, ridge, and elastic net regressions. We begin by comparing stagewise with LASSO, which can both be viewed as modifications of the LARS algorithm. While these modifications may seem subtle (and indeed they yield identical solutions for certain restricted classes of predictor matrices), we make statements about how the solutions diverge for challenging predictor setups. Finally we offer empirical results and observations about how stagewise compares to LASSO and other related algorithms. We conclude that there are situations in which stagewise performs as well as LASSO and that the properties of its solutions can actually be preferable.

STUDENT PERCEPTIONS OF OTHER MAJORS/SCHOOLS AT CMU

STUDENTS Ronald Fudala *Economics and Statistics* | Like Li *Psychology* | Nazym Satbekova *Statistics* | Kit Ying Wong *Economics and Statistics* | Aleksandr Zeltser *Business Administration*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

This topic is interesting because there is a large unspoken divide on campus. Many people understandably congregate in their majors to work on assignments and socialize but often times very distinct group forms in which the people on the inside almost exclusively do everything together. There are well known stereotypes for virtually every school from computer science and business, to drama. In addition, there are also different perceptions and stereotypes concerning the amount of workload for different majors. Now is a good time to do this survey as understanding people's perceptions of other majors and their personalities and traits associated with it can provide some valuable insight as to why any social divide might exist. After a traumatic incident last year and general awareness of a stress culture at CMU, being able to provide a more socially nurturing and welcoming atmosphere would be beneficial towards the entire student body. Deans of the schools in question would be able to use this data to examine perceptions of how the rest of the school views their department and decide whether there are any negative aspects that could be fixed with a strategic change for the departments. The school can also take these opinions into consideration and try to instill and focus on the more positive aspects. The data can also be used to evaluate if the stereotypes are actually true. An interesting part of this type of survey is that fact that it can lead to many other beneficial research projects. In addition, administrators of specific programs can self-evaluate their departments' in light of the research to try to expand and enhance their program.

In this study, we would like to investigate the following questions:

1. In general, what are CMU students' perceptions of each college at CMU?
2. Are certain colleges/majors considered more difficult or stressful than others?
3. How do students rank their own colleges/majors in terms of difficulty? Do these rankings match the general perception?
4. How do students think the rest of the student body perceives their college/major? Do students feel positively/negatively about how others perceive their major?
5. How many hours per week do students in each college/major work? Do these results match their own perceptions of how difficult their major is? Do these results match the general ranking of major difficulty?

Our target population is the entire undergraduate student body currently attending CMU, and we wish to make inference to the undergraduate population at CMU. Each individual undergraduate student at CMU will be a unit in this population.

We plan to sample from the population of all undergraduate students that are listed in the CMU Master address book (C-Book). The sampling frame should be nearly identical to the target population. However, a possible source of coverage error could come from those students who entered or left CMU in the spring 2013 semester, after the address book had already been published. This error could be partially addressed with regard to students who no longer attend CMU but are listed in the address book. We can cross-check each student who is selected for the sample by using the search function in the CMU online directory, which is up-to-date and does not list any students who no longer attend CMU.

TROUBLE WITH THE CURVE: IDENTIFYING CLUSTERS OF MLB PITCHERS USING IMPROVED PITCH CLASSIFICATION TECHNIQUES

STUDENTS Michael Pane *Statistics*

ADVISORS Andrew Thomas *Statistics*

ROOM/TIME Pake / 3:40 pm

The PITCHf/x database, which records the location, velocity, and trajectory of every pitch thrown in Major League Baseball (MLB), has allowed the statistical analysis of MLB to flourish since its introduction in late 2006. Using PITCHf/x, pitches have been classified by hand, requiring considerable effort, or using neural network clustering and classification, which is often difficult to interpret. We use model-based clustering with a multivariate Gaussian mixture model and an adjusted Bayesian Information Criterion to determine the number of different clusters. We verify these results via cross validation, validation by prediction strength, and through visual inspection. Furthermore, we use our method to cluster pitchers into groups with similar characteristics via K-means clustering and the Fisher-wise criterion. Our method builds a strong foundation towards addressing many open MLB research questions, including preventing pitcher injury.

UNDECIDED

BUGGY TECHNOLOGY DEVELOPMENT

STUDENTS Gerald Carlson *Mechanical Engineering* | Kellen Chow *Mechanical Engineering* | Elise Everett *Computer Science* | Philip Garrison *Electrical & Computer Engineering* | Connor Hayes *Undecided* | Amy Hung *Mathematics* | Nathaniel Jeffries *Electrical & Computer Engineering* | Preston Ohta *Mechanical Engineering* | Glenn Philen *Mechanical Engineering* | Anibal Pichardo *Mechanical Engineering* | Rachael Schmitt *Undecided* | Guochen Shen *Mechanical Engineering* | James Snyder *Mechanical Engineering* | Patricia Xu *Materials Science Engineering* | Sophia Zikanova *Electrical & Computer Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The goal of this SURG is to improve the performance and safety of buggies (vehicles that compete in CMU's annual Sweepstakes races) by exploring modifications to existing technology as well as developing novel designs. This SURG, which will be focused on Mechanical Engineering design and analysis, will provide an excellent hands-on educational experience to all members involved.

RAVE REVIEWS

STUDENTS Myles Blodnick *Undecided* | Akash Khanolkar *Information Systems* | Aamer Rakla *Information Systems*

ADVISORS Randy Weinberg *Information Systems*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

Rave Reviews is a comprehensive feedback system that allows students to write reviews and opinions about various facilities in and around a University. These reviews of the school campus and surroundings will happen in real time and it is expected that these reviews will relate to daily and periodic changes at the University. Rave Reviews strives to act as a system of feedback that makes positive changes in daily and yearly campus life.



MELLON COLLEGE OF SCIENCE

BIOLOGICAL SCIENCES

19F MRI ASSESSMENT OF SYSTEMIC INFLAMMATION FOLLOWING TBI AND COMBINED TBI AND HEMORRHAGIC SHOCK IN MICE

STUDENTS Rachel Sewell *Biological Sciences*

ADVISORS Eric Ahrens *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 1 / 10:37 am

Traumatic brain injury (TBI) is one of the leading causes of mortality and morbidity in the United States, and has gained attention due to the conflicts in Iraq and Afghanistan. It is now understood that mortality is effectively doubled following a secondary insult. This research proposal plans to take advantage of the novel perfluoro-carbon-based MRI cell tracking agents, developed by Dr. Eric Ahrens, to look at systemic inflammatory involvement following experimental TBI and an imposed secondary insult of hypotension. With this contrast agent it is possible to label macrophages in situ and noninvasively detect the trafficking and accumulation of these labeled immune cells in vivo. This is due to the 19F MRI signal, not present naturally, which provides a unique marker for tracking these cells. Specifically, this study will quantify macrophage accumulation in a mouse model of TBI plus hemorrhagic shock (HS). Three groups of mice models will be used for this study: sham, controlled cortical impact (CCI at a velocity of 5m/sec and a depth of 1mm), and CCI + HS. Mice undergoing HS will sustain a shock period of 35 min with a mean arterial blood pressure (MABP) of 25-27 mmHg, followed by resuscitation until MABP is 70 mmHg. The mice will then be injected with V-sense (VS580H) 48 hours post injury. Mice will be imaged in 3D with 1H MRI for anatomical reference and 19F MRI to localize the fluorine-labeled macrophages. A fluorine reference standard will be imaged alongside the mice for quantification. Voxel Tracker is a program that will be used to quantify areas of 19F signal accumulation. Organs (brain, heart, liver, spleen, lung, etc.) will be excised and subjected to 19F NMR spectroscopy with a TFA reference standard. The V-sense signal will be integrated for each organ and compared to the in vivo MRI analysis.

ANALYSIS OF PHOSPHORYLATION OF APC2 IN THE DROSOPHILA SYNCYTIAL EMBRYO

STUDENTS Kelly Shibuya *Biological Sciences*

ADVISORS Brooke McCartney *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 2 / 10:00 am

The colon cancer tumor suppressor, Adenomatous polyposis coli (APC), is a multifunctional protein that is involved in Wnt signaling, where it participates in the destruction complex that is responsible for the degradation of β -catenin, which prevents tumor formation. However, APC also plays a role in the organization of the cytoskeleton. We are investigating the role of APC on β -catenin expression and the actin cytoskeleton in order to further discover links between APC and tumor development. Like humans, *Drosophila* have two APC isoforms that are highly conserved. The *Drosophila* syncytial embryo provides an excellent model system to study cytoskeletal events due to the dynamic nature of the cytoskeleton during this time of development. Previously, it has been shown that APC2 localizes to these actin furrows, and loss of APC2 activity (APC2 null) leads to furrow extension defects and overexpression of β -catenin. Additionally, APC proteins are highly phosphorylated, a mechanism commonly used to regulate protein functions. Previous results indicated that the phosphorylation of APC2s 20 amino acid repeats (20Rs) plays a role in regulating APC2 activity during furrow

formation. It has also been shown that phosphorylation of APC increases binding affinity for β -catenin to target β -catenin for degradation. In this study, we are investigating the role of the kinases, GSK3 and AKT, in regulating APC2 activity in regards to actin furrow formation, APC2 localization, and β -catenin expression in the Drosophila syncytial embryo. GSK3 and AKT are known kinases in the APC phosphorylation pathway that participate in Wnt signaling. This study provides a better understanding of how phosphorylation of APC2 regulates its activity in the Drosophila syncytial embryo.

ANALYSIS OF TRANSCRIPTION FACTORS IN THE PRESENCE OF IL-23 USING A HUMAN TH-17 CELL LINE

STUDENTS Katherine Forsyth *Biological Sciences*

ADVISOR Mandy McGeachy *University of Pittsburgh*

ROOM/TIME Rangos 2&3/Sigma Xi Group 2 / 10:13 am

TH-17 cells are a recently discovered subset of T helper cells that drive autoimmune inflammation. Interleukin 23 (IL-23) is crucial for the differentiation of pathogenic TH-17 cells. Furthermore, it has been shown previously by our lab to be important for cell-cycle progression. The research aims of this project were to first characterize a human T-cell lymphoma cell line in order to determine whether it could be used as a model of Th-17 cells. A Th-17 cell line would provide a useful parallel to primary T cells, which are difficult to culture and are often not a homogenous population. The secondary project aim was to characterize whether certain transcription factors were up-regulated in the presence of IL-23. First the cell line was confirmed to express important TH-17 markers by flow cytometry and IL-23 responsiveness was verified using the phospho STAT3 assay. Then expression of two different transcription factors, SOCS3 and tFDP-1 in differing cytokine environments was analyzed by Western Blot. We concluded that the cell line has many similar characteristics to TH-17 cells and will be useful in studying IL-23 responses and cytokine signaling pathways. Furthermore, preliminary data from western blot analysis showed trends of up-regulated SOCS3 and tFDP-1 in the presence of IL-23, however replication of these results is necessary. Future analysis will consist of co-immunoprecipitation tFDP-1 and SOCS3 and other transcription factors in differing cytokine environments and confirming up-regulation of these proteins at the RNA level.

ANALYZING THE DIFFERENCES BETWEEN APC1 AND APC 2 MUTANTS IN DROSOPHILA USING 2D DIGE

STUDENTS Amritha Parthasarathy *Biological Sciences*

ADVISORS Jonathan Minden *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 2 / 10:25 am

Adenomatous polyposis coli (APC) proteins are involved in many cellular functions, including microtubule binding, actin assembly and Wnt signaling. Vertebrates and insect possess two APC genes, APC1 and APC2. Mutations in APC1 are directly correlated with colon cancer. Though the Wnt signaling function of APC is relatively well understood, the mechanisms for how these proteins affect cellular behavior are not well understood. Both APC1 and APC2 are known to be slightly redundant in function. However, APC1 localizes to centromeres and microtubules, while APC2 localizes to the cell's cortex. In Drosophila embryos, mutations in APC1 and APC2 cause defects in early nuclear divisions. We performed proteomic screens of mutants null for APC1 and APC2 to detect protein changes between mutant and wild-type embryos and to detect common and

unique changes between APC1 and APC2 mutants. 2-Dimensional Difference Gel Electrophoresis (2D DIGE) was used to detect the candidate proteins. APC1 or APC2 mutant extracts and wild-type extracts were tagged with two different color fluorescent dyes and electrophoresed on the same 2D gel. The resulting 2D gels were fluorescently imaged with our Structured Illumination Gel Imager, which allows for the detection of extremely low abundance proteins. On their own, APC1 and APC2 mutants had many protein changes relative to wild-type embryos. Some of these changes were common to both APC1 and APC2 mutants, while others were unique to APC1 or APC2, indicating that APC1 and APC2 serve common as well as individual functions. We hope to identify the genes that encode these difference proteins by Mass Spectroscopy.

CHARACTERIZATION AND DEVELOPMENT OF HUMAN TEAR LIPOCALIN AS A FLUOROGEN ACTIVATING PROTEIN

STUDENTS Robert Alberstein *Biological Sciences*

ADVISORS Gordon Rule *Biological Sciences*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Fluorogen Activating Proteins (FAPs) bind and hold flexible conjugated dye molecules called fluorogens in a planar conformation, permitting the release of fluorescent light after excitation by laser. Previous work utilizing antibodies with these dyes has yielded success, though these successes have met with serious limitations. Human Tear Lipocalin (Tlc) is a small, 17.4 kDa lipid carrier protein consisting of a beta-barrel motif flanked on each end by hypervariable loops. The hydrophobicity of the fluorogens and the selectivity conferred by the hypervariable loops make Tlc a promising FAP candidate. Here we provide data revealing Tlc's innate ability to bind and activate the fluorogen Dimethyl Indole Red (DIR), as well as the viability of Tlc as a fusion construct for fluorescence tagging. Current and future work involves structural analysis and molecular docking simulations of the Tlc complex to guide site-directed mutagenesis of Tlc, performed with the goal of improving fluorogen affinity and selectivity.

CHICK EMBRYO EXTRACT AND EPIGENETIC REGULATION OF OSTEOSARCOMA STEM CELLS

STUDENTS Riddhima Agarwal *Biological Sciences*

ADVISOR Kurt Weiss *University of Pittsburgh*

ROOM/TIME Rangos 2&3/Sigma Xi Group 1 / 10:25 am

It is widely accepted that cancer has genetic and epigenetic origins. The idea of epigenetic reprogramming of cancer cells by the embryonic microenvironment possesses potential interest from the prospect of both basic science and potential therapeutic strategies. Chick Embryo Extract (CEE) has been used for the cultivation of some stem cells, and has been shown in previous studies to be necessary for the successful expansion of highly regenerative muscle-derived stem cells (MDSCs). CEE has also been demonstrated to facilitate DNA demethylation. The current study was conducted to compare the status of DNA methylation in both highly metastatic and less metastatic osteosarcoma (OS) cells, and investigate whether CEE may affect the epigenetic regulation of tumor suppresser genes and thus change the metastatic phenotype of highly metastatic osteosarcoma cells. Our current results suggest that the methylation status of tumor suppresser genes (p16, p53 and E-Cadherin) is significantly greater in highly metastatic mouse OS K7M2 cells, in comparison with less metastatic mouse OS K12 cells. CEE treatment of K7M2 cells caused demethylation of p16, p53 and E-Cadherin genes, upregulated their expression, and resulted in the reversion of metastatic phenotypes in highly metastatic OS cells. (Stem Cell Research Center, Department of Orthopaedic Surgery,

CURING SYMPTOMS OF DUCHENNE MUSCULAR DYSTROPHY THROUGH STEM CELL RESEARCH

STUDENTS Prerana Reddy *Biological Sciences*

ADVISOR Gharabeih Burhan *University of Pittsburgh*

ROOM/TIME Rangos 2&3/Sigma Xi Group 1 / 10:48 am

Duchenne muscular dystrophy is the most prevalent form of muscle dystrophy. The disorder is caused by a mutation in the dystrophin gene. Dystrophin is a protein found in muscle tissue and helps with muscle stability. The stem cells and muscle fibers of patients with this affliction contain nuclei with faulty DNA coding for mutated dystrophin. The project focuses on fusing human stem cells into mice that have been genetically altered to be compliant with human cells. The inserted human stem cells will contain normal nuclei that can code for working dystrophin. The amount of successful dystrophin grown in the mice muscle is then analyzed and compared between genders.

DISSECTING THE ACTIN LOCALIZATION METHODS OF APC2

STUDENTS Paige Davison *Biological Sciences*

ADVISORS Brooke McCartney *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 2 / 10:37 am

Adenomatous polyposis coli (APC) proteins regulate the actin and microtubule cytoskeletons, and negatively regulate the Wnt signaling pathway. Disruption of APC function initiates colorectal cancer in humans. While APC's role in Wnt signaling and microtubule function are well studied, the mechanisms by which APC proteins interact with and regulate the actin cytoskeleton are not well understood. APC2 localizes to actin in the *Drosophila* syncytial embryo, where together with the formin Diaphanous, it is required for the extension of actin pseudocleavage furrows that form during metaphase. To understand how APC2 promotes actin furrow extension, we are investigating the mechanisms that affect the localization of APC2 to the actin cortex. We had determined there is a coiled-coil within C30 which together with a domain near the Arm repeats is necessary and sufficient for cortical localization of APC2 in S2 cells. Because the Arm repeats of APC2 promote APC2's self-association and cortical localization, we predicted that self-association of APC2 via the Arm repeats may be necessary for cortical localization. Therefore we created a cassette containing a dimerization domain and the C30 region of APC2. We tested APC2's cortical localization in S2 cells to determine if the Arm repeats served a purpose besides dimerization for the localization of APC2 to the cortex.

EFFECT OF ACTIN DESTABILIZING DRUGS ON RECYCLING OF BETA 2 ADRENERGIC RECEPTORS

STUDENTS Purumeh Nam *Biological Sciences*

ADVISORS Manojkumar Puthenveed *Biological Sciences*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

Signaling receptors on the cell membrane such as G-protein coupled receptors (GPCR) are 7-transmembrane domain receptors that induce cellular signal transduction and when activated – influencing a plethora of biological processes. When induced by an agonist, the receptor and its ligand enter the cell via a vesicle, which delivers them to an endosome. From the endosome, receptors can take different pathways. It can either go to the lysosome for degradation, travel to the Golgi apparatus for processing, or separate from its ligand

and recycle back to the cell membrane via an offshoot of the endosome called tubule. Receptors such as nutrient receptors are continuously recycled back via bulk recycling, but not signaling receptors – for these, recycling is a longer, more regulated process, indicating that there is something other than bulk recycling that governs the phenomenon. If signal receptors recycle back to the membrane too quickly, it can have serious consequences such as heart failure, or even PTSD. One sort of such signaling GPCR, the beta-2 adrenergic receptor (b2AR), is the receptor for catecholamines such as epinephrine. It has been discovered that b2AR is stabilized by a scaffold of actin in tubules, and this actin scaffolding slows the release of tubules from endosomes – ultimately regulating signal receptor recycling. However, how the receptor engages with the actin in tubules is largely unknown. By treating cells with two different types of actin destabilizing drugs Latrunculin A and Cytochalasin D, the change of recycling was observed – to ultimately discern the impact of actin on sorting of signaling receptors.

INVASION OF CANDIDA ALBICANS HYPHAE INTO ELASTOMER

STUDENTS Tammy Ying *Biological Sciences*

ADVISORS Frederick Lanni *Biological Sciences*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

My research is aimed at understanding the invasion of yeast biofilm cells into cross linked elastomer. Wild-type and mutant strains of *C. albicans* will be grown and imaged to test the hypothesis that cell turgor pressure drives invasive hyphae (elongated chains of cells). Each type of biofilm will be assayed for cellular glycerol content (the putative osmolyte), and for total biomass. Cross link ratios will be varied systematically to find the modulus limit above which invasion is suppressed.

INVESTIGATION OF THE ROLE OF APC PROTEINS IN THE GERM LINE STEM CELL NICHE OF DROSOPHILA

STUDENTS Pu Fang Hung *Biological Sciences*

ADVISORS Brooke McCartney *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 2 / 10:48 am

APC proteins negatively regulates the Wnt signaling pathway. It acts as part of a complex protein, called the “destruction complex”, to target -catenin, the central transcriptional activator in the Wnt/Wingless signaling pathway, for degradation. For this reason, APC mutation is often linked to the development of colorectal cancer. However, APC proteins also play important roles in cytoskeletal function. While there is literature describing associations between APC proteins and the cytoskeleton, the function of APC in such association still lacks understanding. The project aims to elucidate the singular or combinatorial roles of APC1 and APC2 and in organizing the germline stem cell niche architecture. Preliminary data show that a mutation in APC2 disrupts the tissue architecture of localization of germline stem cells due to adhesion. This phenotype is similar to published observations of disrupted adhesion. We are interested in discovering the role of APC1 in germline stem cells and its possible collaboration with APC2 in niche architecture.

LOCALIZATION OF ALTERNATIVELY SPLICED STUNTED PROTEIN ISOFORMS AND THEIR ROLE IN AGING OF DROSOPHILA MELANOGASTER

STUDENTS Michael Platov *Biological Sciences*

ADVISORS A. Javier Lopez *Biological Sciences*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

The subunit of the mitochondrial F1-ATPase plays an important role in both energy metabolism and generation of reactive oxygen species (ROS) by coupling ATP synthesis to the proton gradient across the inner mitochondrial membrane that results from cellular respiration. The stunted (sun) gene in *Drosophila melanogaster* encodes the subunit in all tissues (except testes). Partial reduction of sun expression by mutation has been shown to extend lifespan by 35%. This could result from a reduction in oxidative stress tied to a decrease in ROS. However, the sun proteins have also been identified as potential ligands for the activation of a cell-surface G-protein coupled receptor (GPCR) encoded by the methuselah (mth) gene, a gene that plays a role in determining lifespan. Such an interaction would require the sun protein to also be available outside mitochondria, dissociated from the F1-ATPase. A study of age-dependent alternative splicing in *Drosophila* adults has revealed that inclusion of exon 2 in sun mRNAs declines steadily by over 50% during the 45-day lifespan. This results in a similar change in the ratio of short and long forms of the subunit, which differ at the C-terminus but share the methuselah-interacting domain. Protein domain comparison with the non-alternatively spliced subunit of cells from the testes suggests that the long sun isoform should attach stably to the F1 ATPase and improve its function, whereas the short form may not. The age-dependent change in the ratio of sun isoforms could thus influence the aging process by altering the efficiency of F1 ATPase function (and production of ROS) or by changing the proportion of sun protein that can be available outside of mitochondria to serve as a ligand for the methuselah receptor protein. The purpose of this research project will be to test whether the alternative sun protein isoforms differ in bonding association with the F1 ATPase and/or localization to mitochondria versus other cellular compartments, where they might act as methuselah ligands.

PAN-ERBB INHIBITION POTENTIATES BRAF INHIBITORS FOR MELANOMA TREATMENT

STUDENTS Kathryn Supko *Biological Sciences*

ADVISOR Dr. Jill Siegfried *Hillman Cancer Center*

ROOM/TIME Rangos 2&3/Sigma Xi Group 1 / 11:37 am

The BRAF inhibitor vemurafenib is currently used for treating patients with BRAF V600E mutant melanoma. However, the responses to vemurafenib are only partial with relatively short durations due to the emergence of subsequent drug resistance. Recent evidence suggests that activation of EGFR/erbB signaling may be one mechanism responsible for the development of BRAF inhibitor resistance. In this study, we examined whether targeting both BRAF and erbB signaling provided enhanced anti-tumor activity in BRAF mutant melanoma. We found that differential levels of erbB2, erbB3, and truncated erbB4 were expressed in BRAF wildtype and mutant melanoma cell lines. We examined the expression of ErbB family members in 14 different human melanoma cell lines (MEL-526, M14, UPCI-MEL 527.1 and 11 SK-MEL cells). EGFR was expressed in 5 of the cell lines examined (35.7 %). ErbB2 was present in 13 lines (92.9 %); ErbB3 was found in 12 lines (85.7 %); and ErbB4 was found in all the cell lines. Furthermore, individual cell lines had a particular dominant form of ErbB protein. This differential expression pattern of ErbB family proteins was also seen in melanoma tissues from patients. Out of 14 melanoma cases examined by immunohistochemistry, 8 samples (61.5 %) were positive for ErbB1 and ErbB4 expression while ErbB2 was detected in 11 samples (84.6 %). We found that Neuregulin 3 (500 - 76,500

pg/ml) and Neuregulin 4 (26-300 pg/ml), which activate ErbB3 and/or ErbB4, are the major ErbB ligands released by the human melanoma cell lines. TGF and Amphiregulin, which mainly bind to EGFR, were released in relatively lower levels by the majority of the cell lines, but high levels of these ligands were distinctly found in individual cell lines. Among all the cell lines examined, HB-EGF was barely undetectable. Multi-erbB targeting with the irreversible tyrosine kinase inhibitor canertinib exerted a more effective growth inhibitory effect in both BRAF wildtype (IC50: 4.37-6.37 M) and mutant melanoma cells (IC50: 3.98 and 7.21 M) compared to single- or dual-erbB targeting inhibitors. We also found that canertinib could enhance the anti-tumor effects of vemurafenib in the BRAF mutant melanoma cells in vitro. For the first time, we have demonstrated that a novel combined inhibition strategy targeting both BRAF and erbB signaling is potentially beneficial for treating BRAF V600E mutant melanoma.

PHYLOGENETIC RECONSTRUCTION OF DOMAIN SHUFFLING IN THE MAGUK PROTEIN FAMILY

STUDENTS Katherine Siewert *Biological Sciences*

ADVISORS Dannie Durand *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 2 / 11:13 am

Many proteins have complex, modular architectures made up of different building blocks, or domains. A protein domain is a peptide sequence that encodes a specific three-dimensional shape and is found in the context of many different proteins. The domain content of a protein can change over time due to deletions, insertions and duplications of domains within the protein's architecture, a process called domain shuffling. As domains are shuffled over time, their sequences mutate, providing evidence of their evolutionary history. To obtain a better understanding of evolution by domain-shuffling and its functional results, I am studying the history of domain shuffling in the membrane-associate guanylate kinase (MAGUK) protein family, which is involved in the formation and regulation of cell junctions. To do this, I am using standard phylogenetic techniques, as well as algorithms developed in the Durand laboratory that infer relationships between domains found in different proteins and species. Using this approach, I have developed a hypothesis for the co-evolutionary history of domains found in the MAGUK protein family. This hypothesis suggests that domain shuffling may have caused novel complex formation mechanisms in early metazoans.

PHYLOGENOMIC ANALYSIS OF TUMORIGENESIS USING BREAST CANCER CELLS

STUDENTS Titas Banerjee *Biological Sciences*

ADVISORS Russell Schwartz *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 2 / 11:25 am

The aim of this project is to gain better insight into potential treatments and diagnostics of cancers. For the year 2013 alone, the American Cancer Society predicts that almost 1.6 thousand Americans would lose their lives to cancer per day and more than 1.66 million cases would be diagnosed throughout the year. These statistics are strikingly high and a great cause for concern. Early detection and treatments are still the best measures against cancer. As such, it is important to refine our methods for properly identifying, classifying, and treating cancer. Although many distinct combinations of mutations can in theory lead to the phenotype of tumor growth, genetic studies of tumors have suggested that there are actually a few roughly equivalent sequences of mutations, known as progression pathways, which most cancers follow. One hope of better identifying the common progression pathways is to apply phylogenetics, or the inference of evolutionary trees, to tumor cells at various stages of progression. This project is aimed at analyzing functional classes of genes

appearing in tumor phylogenies to better understand their roles in terms of modeling tumor development and to facilitate statistical analysis of tumor phylogenies. These methods were applied to a study of breast cancer tumor data. Raw data was processed to detect tumor progression markers and organize them into phylogenies. The resulting tumor phylogenies were analyzed for common patterns of tumor progression to determine the key mutational events that may lead to cancer progression. The results so far seem to indicate that certain categories of mutations tend to occur earlier in the progression pathways while others occur later.

ROLE OF PRA1 IN ADHERENCE AND BIOFILM FORMATION IN CANDIDA ALBICANS

STUDENTS Abigail Simmons *Biological Sciences*

ADVISORS Aaron Mitchell *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 1 / 11:13 am

Candida albicans is a major fungal pathogen in humans, responsible for thousands of lethal infections every year. Infections often result from biofilm formations on tissues and implanted medical devices, thus understanding the genetic mechanisms of biofilm formation is relevant to human health. PH Regulated Antigen 1 (Pra1) is a cell surface protein which is upregulated in many adherence defective protein kinase deletion mutants and in the adherence defective BCR1 transcription factor deletion mutant. Overexpression of Pra1 in a wildtype background leads to reduced adherence and a biofilm formation defect. These data indicate that pra1 may be an important regulator of biofilm formation. Over the past year, I created a pra1 homozygous deletion mutant and assayed adherence and biofilm formation in that mutant. In addition I am making a series of double deletion mutants in which PRA1 and an adherence related pyruvate kinase have both been removed in order to determine if deleting PRA1 restores biofilm formation in these mutants.

SHIGA TOXIN - GPP130 BINDING AND GPP130 MANGANESE TREATMENT RECOVERY

STUDENTS William Yoo *Biological Sciences*

ADVISORS Adam Linstedt *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 2 / 11:00 am

Bacterial infections that produce shiga toxin effect more than 150 million people every year. Because treatments are limited due to the ineffectiveness of antibiotics, more than one million deaths are reported yearly. Shiga toxin is the most common cause of food borne epidemics such as the recent E. coli outbreak in Germany that infected 3700 people and resulted in 45 deaths. Although mostly not fatal, complications such a "hemorrhagic colitis, Hemolytic Uremic Syndrome (HUS), or postdiarrheal thrombotic thrombocytopenic purpura (TTP) can occur in up to 10% of cases ". These infections are especially common in third world countries where sanitary water and food are rare.

Manganese, a common supplement like calcium, has been found to have a profound effect on shiga toxicity. Doses of manganese in cells have been found to make them immune to shiga toxin through the protein trafficking pathway of GPP130. Manganese can be cheap and easy to transport when water, food or medical attention is not readily available. Therefore the use of manganese in addition to antibiotics may lead to an effective treatment of these bacterial infections and prevent thousands of deaths yearly.

This study attempts to identify the binding site between Shiga toxin and GPP130 and also determine the recovery of GPP130 after treating cells with manganese.

SINGLE-MOLECULE STUDIES ON LOOP-LOOP KISSING INTERACTIONS IN GUANINE-SENSING RIBOSWITCH

STUDENTS Vishnu Chandra *Biological Sciences*

ADVISORS Maumita Mandal *Chemistry*

ROOM/TIME Rangos 2&3/Sigma Xi Group 1 / 11:00 am

Riboswitches are conserved domains in mRNA capable of binding metabolites. Normally present in the 5' untranslated region (UTR) in certain mRNAs in bacteria and plants, these structural elements bind to the metabolites in the ligand-binding domain and thereby resulting in an allosteric rearrangement of the nearby gene expression platform to control genetic expression. It has been reported that in *Bacillus subtilis*, the 5'-UTR of xpt-pbuX mRNA which encodes for purine transporter, binds to guanine with a $K_D \sim 5$ nM. Upon binding, the expression platform undergoes conformational change to form transcription terminator structure and thus, turns OFF the gene expression. The ligand binding domain of the guanine riboswitch, also referred as G-box, reveals a very intricate binding mechanism. Specific molecular recognition features include a core domain formed by the junction of three stem-loop (P1, P2 and P3) structures. The end loops L2 and L3 form a kissing interaction that has been shown to play an important role in stabilizing the core structure. Mutations that independently disrupt the kissing interaction of the stem loops resulted in loss of ligand binding function. While the high resolution crystal structure provides details of the three-dimensional structure of the guanine-responsive domain, the kinetics and the thermodynamics of the kissing hairpin interactions between the loop domains are of special interest.

We used dual beam optical tweezers to gain understanding into the allosteric mechanism of the ligand-induced conformational changes. The studies included the force dependence of the various structural domains and the kinetics of kissing interaction in single- molecules of this riboswitch. When mutations were introduced into the loop-loop regions of the RNA construct, the kinetics of the kissing loop formation and ligand binding ability were both altered. The mutations that directly affected Watson-crick base pairing between the L2 and L3 loops (G37A, G37A/C61U, G38A) abolished formation of the kissing loop interactions at physiological Mg^{2+} conditions, but retained the ligand-binding at a higher guanine concentrations. The mutation on the loop closing residues A59G/U67C left the long-range kissing interaction intact, but the kinetics of folding was significantly decreased. Based on the findings we propose that the stability gained from the additional hydrogen bond decreases the flexibility of the core junction region, and thereby effective folding.

THE EFFECTS OF TYPE 1 INTERFERON TREATMENT ON DENDRITIC CELL-MEDIATED AUTOPHAGY

STUDENTS Jesse Payton *Biological Sciences*

ADVISORS Mary Braun *Biological Sciences* | Michael Lotze *University of Pittsburgh Cancer Institute*

ROOM/TIME Rangos 2&3/Sigma Xi Group 3 / 11:37 am

Cancer is the second leading cause of death in the United States. Despite this, our knowledge of how cancers arise in the setting of chronic inflammation, how they interact with the immune system, and how to modify them is limited. Our data suggest that certain immune cells can induce autophagy in cancer cells, allowing them to survive nutrient depletion and resist current cancer therapies. Understanding how the immune system regulates autophagy may allow us to create more effective cancer therapies. Cell-cell interactions, changes in autophagy, and cellular distress were assessed through imaging cytometry. Mouse cancer cells were

co-cultured with different immune effectors or treated with interferon type 1. Immunofluorescence staining was used to quantify and localize LC3, assessing autophagic flux. Cellular distress was assessed through measurements of HMGB1. Immune effectors were both positively and negatively selected through the use of magnetic kits. Immune effectors were also matured from murine hematopoietic stem cells through the use of GM-CSF, IL-4, LPS and MCSF. Type 1 interferon treatment increased autophagic flux at concentrations that are therapeutically viable. It also appeared to increase autophagy induction by dendritic cells beyond what it could accomplish by itself. Macrophages did not alter autophagic flux. Both wild type and HMGB1 knockout NK cells activated with IL-2 were able to significantly increase autophagy in mouse pancreatic and colorectal cell lines. Investigating the mechanisms of autophagic modulation by dendritic cells, NK cells, and interferon type 1 may allow us to inhibit it and improve current cancer therapies.

THE INVESTIGATION OF THE ROLE OF HEDGEHOG IN NEURAL PATTERNING OF PATIRIA MINIATA LARVAE

STUDENTS Annette Ko *Chemical Engineering* | Lazar Lalone *Biology and Psychology* | Sowmya Yennam *Biological Sciences*

ADVISORS Veronica Hinman *Biological Sciences*

ROOM/TIME Dowd / 4:00 pm

During embryogenesis, the cells of embryos undergo rapid division and differentiation to eventually lead to the development of an adult organism. Throughout this process, much genetic signaling occurs that collectively determines the later function of these early cells. The pathways responsible for this signaling are often specific to a species, but cases have also been found in which the same gene appears to have similar function across species, suggesting evolutionary relatedness between organisms. One such conserved gene is Sonic Hedgehog (Hh), which is responsible for patterning the nervous system of humans, but has also been found in *Patiria miniata*, sea stars. Such a similarity between vertebrates and sea stars is not unexpected, as both are deuterostomes and undergo similar embryonic development, but research has not been conducted on the extent of this similarity. In this project, we will work to better characterize the neural patterning in sea star embryos, investigate the possible role of Hedgehog in the formation of the invertebrate nervous system, and then compare this to Hh expression in humans. To do this, we will knockdown Hedgehog using Hedgehog morpholino antisense oligomer (morpholino) and observe its effect on motor and sensory neurons via *in situ* hybridization. The gene knockdown will also be performed with cyclopamine to cross-check the effect of morpholino and to investigate how Hedgehog knockdown affects neural patterning in embryos at different stages of development. It is expected that in addition to humans and sea stars both expressing Hh in neural development, a similar patterning mechanism may exist as well. If this is the case, this research could give insight to the evolution between these organisms as well as neural development in humans, which could be particularly useful for better characterizing and treating neurological diseases which often interrupt these genetic pathways.

TRUNCATION, CLONING, AND EXPRESSION OF DEBRANCHING ENZYME

STUDENTS Diane Koeller *Biological Sciences*

ADVISORS Mary Braun *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 3 / 11:25 am

During pre-mRNA splicing, introns can form a loop, known as a lariat. Debranching enzyme (DBR) is a 45kDa, Mn²⁺ dependent protein that cleaves the 2'-5' phosphodiester bond at the branch point of intron lariats,

linearizing the introns. Studying DBR is important because introns cannot be processed or degraded in the lariat form, debranching is necessary for the processing of snoRNA and miRNA, and the protein plays an important role in retrotransposition. A greater understanding of the structure of DBR could lead to a better understanding of the debranching mechanism and the high substrate specificity of the enzyme. X-ray crystallography of DBR would provide a large amount of information on the structure of the enzyme. Generally, the smaller the protein, the easier it is to crystallize. Therefore, several PCR-mediated truncations of yeast DBR were made and expressed in bacteria. Different truncations were made at different locations based on sequence homology between the DBR gene sequences of different yeast species. However, the proteins appeared to misfold and aggregate, making them difficult to purify because they would pellet out of solution. There were several attempts made to decrease misfolding and increase yield of the protein including tagging the truncated protein with GST, which is a large protein that is easily expressed in bacteria, and modifying the induction procedure. Currently, the research is focusing on expressing DBR from different species in yeast instead of bacteria in hopes of increasing the yield of the protein.

CHEMISTRY

EMISSION PROPERTIES OF AGGREGATES OF POLYTHIOPHENE AND SEXITHIOPHENE

STUDENTS Diane Devi *Chemistry* | Janice Kim *Chemistry*

ADVISORS Linda Peteanu *Chemistry*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The focus of this project is to study the emission properties of polythiophene and sexithiophene. Polythiophene and sexithiophene are organic molecules that can be used in organic light-emitting diode (OLED) technology because of their stability, processability and electrical and optical properties. Currently, crystalline silicon is used for conventional OLED technology. However, organic molecules were found to be cheaper, lighter in weight, more flexible and more environmental-friendly. When organic molecules are processed into thin films in order to create OLED screens, they associate strongly with one another and form structures called aggregates. Using a variety of optical techniques, we analyze the impact of aggregation on the electronic properties of these materials with the goal of gaining a greater degree control over their properties in thin films.

GRAFTING-ONTO STRATEGIES FOR LIGNIN-POLYMER HYBRIDS

STUDENTS Amer Al-Khouja *Chemistry*

ADVISORS Newell Washburn *Chemistry*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 10:25 am

The preparation of lignin-graft-polystyrene copolymers was attempted using a variety of methods. Two methods involved the controlled synthesis of polystyrene from styrene via atom-transfer radical polymerization (ATRP) using ethyl-2-bromoisobutyrate (EBiB) as the initiator to leave a terminal bromine on the polymer. Lignin was then modified in one of two ways. It was either deprotonated using sodium hydroxide to yield a phenoxide, or it was oxidized with sodium periodate to yield an ortho-quinone. Formation of the graft copolymer from the phenoxide was expected via SN2 displacement of the terminal bromine on the polymer by the nucleophilic species.

Graft copolymer formed from the o-quinone was attempted from the reaction of Grignard-modified bromine-terminated polystyrene on one of the quinone carbonyls. The third method employed the click reaction, copper-catalyzed Huisgen cycloaddition. The polystyrene homopolymer prepared via ATRP was functionalized terminally with an azide, while lignin hydroxyl groups were functionalized to alkyne groups. Resultant products and grafting efficiency were characterized by ¹H NMR and GPC. This research highlights the tradeoffs between coupling efficiency and reaction complexity, and cost in preparing these novel materials based on renewable resources.

IMPROVING THE STABILITY AND SOLUBILITY OF PNA USING MINIPEG

STUDENTS Jack Li *Chemical Engineering* | Robert Wu *Chemistry*

ADVISORS Danith Ly *Chemistry*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 11:13 am

Peptide nucleic acids (PNAs) are nucleic acid analogs with the added benefit of thermal stability and resistance to enzyme degradation that utilize natural base pairs to bind to natural nucleic acid targets. This makes them the ideal tool in the development of therapeutics, reagents in molecular biology, and diagnostics. This project focuses on modifying natural nucleobases with minipeg groups and then coupling them to PNA in hopes of improving solubility of PNA molecules and potentially increasing their binding strength.

PEPTIDE NUCLEIC ACID SYNTHESIS: SURF 2012

STUDENTS Stephanie Blotner *Chemistry*

ADVISORS Catalina Achim *Chemistry*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 11:25 am

Peptide nucleic acids (PNA) are being studied for molecular electronics and nanotechnology applications. Molecular switches could make possible molecule-based computation. PNA can be modified to suit the goal of building such a switch by replacing nucleobases with ligands. The goal of my summer SURF project was to synthesize, purify, and characterize ligand-modified PNA with appropriate sequence of nucleobases and ligands. I have accomplished these goals by manual peptide synthesis, HPLC and MALDI-ToF mass spectrometry, respectively.

PHOTBLEACHING MECHANISMS OF SINGLE CHAIN VARIABLE FRAGMENT PROTEINS AND FLUOROGENIC DYES

STUDENTS Ting-Yu Wang *Chemistry*

ADVISORS Bruce Armitage *Chemistry*

ROOM/TIME Rangos 2&3/Sigma Xi Group 3 / 10:00 am

The goal of this research project is to determine the photobleaching mechanisms of dye-protein fluoromolecules as well as to compare the patterns through which these biocomplexes degrade. It is known that fluorescence is not infinite, and the goal is to observe if the decrease in fluorescence of fluoromolecules upon irradiation is due to the damage of the protein, the single chain variable fragment (scFv), or the fluorogenic dyes including TO, TOPRO-1, TOPRO-3, YOPRO-1, DIR, CNDIR and OTB. The structures of these dyes are also observed to determine the effects they have on the stability of these dye molecules. Green Fluorescence Protein (GFP) was previously used for bioimaging processes, but this new technique, which involves the use of scFvs and fluoro-

genic dyes, allows for the tagging of multiple different proteins simultaneously by using dyes that fluoresce at different wavelengths. This in turn produces biocomplexes that emits multiple colors.

SEARCHING FOR PHOTOSTABILITY ENHANCEMENT IN GENETICALLY-EXPRESSED PROTEIN/FLUORESCENT DYE COMPLEXES

STUDENTS Victor Mann *Chemistry*

ADVISORS Marcel Bruchez *Chemistry*

ROOM/TIME Rangos 2&3/Sigma Xi Group 3 / 10:13 am

Fluorescence spectroscopy is an invaluable tool for live cell imaging, and the discovery of genetically-encoded fluoromolecules such as green fluorescent protein (GFP) have transformed the field. Fluorogen-activating peptides (FAPs) are proteins that bind to dye molecules and emit fluorescence, and it is possible to modify the spectral and chemical properties of the fluoromolecule by modifying the dye or the protein. In this project, the library of yeast clones was exposed to various popular fluorescent single molecule dyes, and flow cytometry was used to gradually engineer the population to enrich in FAPs that enhance photobrightness.

SELF-ASSEMBLY AND STRENGTH TOUGHENING OF POLYMER-GRAFTED NANOPARTICLE THIN FILMS DUE TO HOMOPOLYMER ADDITION

STUDENTS Sangita Sharma *Materials Science Engineering* | Zachary Urbach *Chemistry*

ADVISORS Michael Bockstaller *Materials Science Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 11:37 am

Polymer-Grafted nanoparticles have unique self-assembly properties and structures. There is a trade off however between ordering of particles and mechanical strength of the thin films that are formed. By introducing free chain polymers into the empty interstitials of the monolayer structure, both properties should be retained. Experimental tests will vary the size of the free polymer added to the nanoparticles and the relative amounts of free polymer to polymer-grafted nanoparticles to see what conditions form the most ordered and mechanically strengthened material. Transmission electron microscopy will be used to analyze structures of monolayers and nanoindentation will be used to measure mechanical strength of multilayers.

SELF-ASSEMBLY PROPERTIES OF AMPHIPHILIC BLOCK COPOLYMERS

STUDENTS Stacey Chin *Chemistry*

ADVISORS Krzysztof Matyjaszewski *Chemistry*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 11:37 am

Amphiphilic block copolymers aggregate into different structures based on solvent conditions, such as pH and temperature. Three variants of a novel triblock copolymers of TMS-MA/ME02MA/QEOMA300 were synthesized using a one-pot RAFT polymerization method. The reaction was monitored via GPC and NMR spectroscopy. The polymers were then deprotected and their particle size analyzed on a temperature gradient using DLS. This gives insight to how this temperature- and pH-responsive polymer assembles under different conditions.

SULFIDATION OF COPPER OXIDE NANOPARTICLES AND ITS EFFECT ON ION RELEASE

STUDENTS Tiffany Yang *Chemistry*

ADVISORS Greg Lowry *Civil and Environmental Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 11:37 am

Copper oxide nanoparticles (CuO NPs) are widely used in commercial products because of its antimicrobial properties. With increased use comes a concomitant increase of these particles being released in the environment. Due to its small size, CuO NPs have different properties than its larger bulk counterparts. As a result, it is unknown how they may affect the environment and subsequently humans. As a class B metal, an important transformation in the environment for copper is sulfidation. Hence the objective of this study is to investigate how CuO NPs are sulfidized and the properties of the sulfidized particles. The copper oxide nanoparticles were sulfidized at different (S/Cu) ratios (0.216, 0.432, 0.616, 0.864, 940, 2.158) of S/Cu that cover environmental conditions. Chemical speciation of sulfidized Cu NPs were identified by synchrotron XRD. Dissolution of CuO and sulfidized CuO were measured over time scale of 1 hour to 2 weeks using ICP. Based on XRD data, it was found that at a ratio of 0.216, the particles were still CuO, while at a ratio of 2.158 there was complete transformation to Copper Sulfide (CuS). One important finding is that the lower the ratio, the lower the amount of dissolution. As the ratio increases, there is a higher percentage of transformation from insoluble CuO to soluble CuS.

SYNAPTIC MECHANISMS OF AGE-RELATED COGNITIVE DECLINE IN NON-HUMAN PRIMATE NEOCORTEX

STUDENTS Leela Chockalingam *Chemistry*

ADVISOR John Morrison *Mount Sinai School of Medicine*

ROOM/TIME Rangos 2&3/Sigma Xi Group 3 / 10:25 am

Humans experience a decline in cognitive function during the natural aging process, specifically in the areas of executive function and working memory. This decline is directly correlated to a decrease in dendritic spine density and synaptic plasticity in the dorsolateral pre-frontal cortex (dlPFC). Recent evidence suggests that synaptic plasticity is mediated by the actin cytoskeleton and its ability to dynamically remodel. One regulation pathway of the actin cytoskeleton is mediated via phosphorylated LIM kinase's (pLIMK) effects on downstream targets. Phosphorylated LIM kinase phosphorylates the protein cofilin, inhibiting its severing action on filamentous actin. In doing so pLIMK increases the stability of the cytoskeleton, thereby inhibiting plasticity. Our research asks whether age affects synapse density, morphology, and pLIMK expression in the dlPFC of non-human primate (NHP) neocortex. Young monkeys had a mean age of 10.8 years, and aged monkeys had a mean age of 28.4 years. In this study, young and aged NHPs were tested on a recognition memory test (delayed response). Specific behavioral data from the delayed response (DR) task will be correlated to synaptic data. Using unbiased quantitative electron microscopy imaging of post-embedding immunogold labeling for pLIMK, we have examined the age effect on dlPFC synapses. We currently have preliminary data. Further data is necessary to definitively determine the age affect on pLIMK expression and synaptic plasticity, density and morphology.

SYNTHESIS OF DEUTERATED BOTTLEBRUSHES WITH BIMODAL DISTRIBUTION OF SIDE CHAIN LENGTHS

STUDENTS Brittany Robertson *Chemistry*

ADVISORS Krzysztof Matyjaszewski *Chemistry*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

My goal was to synthesize 'molecular bottlebrushes' with a bimodal distribution of side chain lengths using the Atom Transfer Radical Polymerization (ATRP) method. In order to synthesize these molecules, bottlebrushes with monomodal side chain length distributions were prepared, then a subset of these chain ends were deactivated. Extension of remaining active groups will result in both short and long side chains (bristles) thus achieving the bimodal distribution of graft lengths. This has been facilitated by nucleophilic substitution of ATRP active bromide chain ends with ATRP inactive azide groups and 4-oxo-TEMPO capping reagent. Degree of polymerization of the bottlebrushes as well as the efficiency of the nucleophilic substitution have been determined by Nuclear Magnetic Resonance Spectroscopy (NMR) and Gel Permeation Chromatography (GPC). Atomic Force Microscopy (AFM) will be used to visualize the bottlebrushes adsorbed to a substrate and explore physical properties.

SYNTHESIS OF PYRIDINIUM SALT FOR OLED APPLICATIONS

STUDENTS Hannah Kim *Chemistry*

ADVISORS Kevin Noonan *Chemistry*

ROOM/TIME Rangos 2&3/Sigma Xi Group 4 / 11:00 am

Organic light emitting diodes (OLED's) consists of organic compounds which emit light when excited by electric current. A series of pyridinium salts were synthesized from pyrylium salts in an effort to synthesize new materials for OLED applications. The pyrylium route was attractive as it offered facile functional group modification for the preparation of the final desired pyridinium salt. The functional group alteration is expected to alter the wavelengths at which the salts fluoresce. ¹H NMR spectroscopy was used to identify each salt and UV-Vis spectroscopy was used to determine maximum wavelength that each salt absorbs in the UV and visible region.

TARGETING GENETIC DISORDER AROUSED FROM UNSTABLE REPEAT EXPANSION WITH JANUS-BASED PEPTIDE NUCLEIC ACID (PNA) TRIPLET THROUGH NATIVE CHEMICAL LIGATION

STUDENTS Yidan Cong *Chemistry*

ADVISORS Danith Ly *Chemistry*

ROOM/TIME Peter / 1:00 pm

So far it has been found that more than 20 genetic disorders are associated with unstable expanded RNA repeats, including Huntington's disease (HD) and Myotonic dystrophy (DM1), just to name a few. Affected individuals have abnormal number of repeats which interact with crucial proteins and interfere with their functions. Currently, we focus on DM1, which arises from RNA triplet CUG expanded repeat. CUG repeat binds with protein MBNL, and in turn affects alternative splicing stage in protein synthesis process. Affected individuals often have muscle defects. By targeting CUG triplet with matching Janus-based PNA GAC, MBNL is released from CUG and abnormal phenotype is reversed. Matrix-assisted laser desorption/ionization (MALDI) is used on GAC to test its half life. Quenching experiments and melting experiments are performed to confirm the binding of GAC with RNA CUG.

MATHEMATICS

A FRIENDSHIP NETWORK ANALYSIS OF CARNEGIE MELLON STUDENTS

STUDENTS Shirui Hu *Mathematics* | Shu Wang *Mathematics*

ADVISORS Brian Junker *Statistics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 10:13 am

Do people favor others that share the same major? Are students more likely to become friends with those that came from the same place or lived in the same dorm during freshman year? In our friendship network analysis, we are taking all seniors in Carnegie Mellon University as our sample, asking every one of them to list up to five best friends among all other seniors, as well as other attributes such as gender, major, hometown, birthday, etc. In addition, we are interested in behaviors associated with lifestyle, such as average study time per day and average hours of partying per week. In our study, we aim to not only find the pattern of friendship network, but also study the formation of it based on attributes and behaviors.

In general, social network analysis has many applications including Epidemiology- the dynamics of disease spread, Business- viral marketing, Telecommunications-World Wide Web connectivity, and many more. This study uses a relatively small and simple sample to help us gain some general knowledge about social network patterns, in particular, friendship patterns. In the future, we can use similar strategies and models to understand much more complicated patterns.

ABSENCE AND ACHIEVEMENT IN PITTSBURGH PUBLIC SCHOOLS

STUDENTS Zachary Branson *Economics and Statistics* | Shaina Mitchell *Mathematics* | Sarah Peko-Spicer *Economics and Statistics*

ADVISORS William Eddy *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

In recent years the Pittsburgh Public School system (PPS) has become increasingly aware of the poor attendance rate of students within the system. Some students do not come to school for a quarter or even half of the year. The directors of PPS find this phenomenon concerning since school attendance may largely affect academic achievement.

PPS is particularly worried about students who are missing class at least once a week, who PPS defines as “severely absent”. Many factors may influence student attendance, including socioeconomic status, the distance a student must travel to get to school, or the school to which a student is assigned. What are the characteristics of these severely absent students, and what causes them to miss school so often?

Using statistical modeling and analysis such as logistic regression, we pinpointed some key factors that significantly relate to high absence rates. Furthermore, we determined some of the outcomes PPS should expect if the overall student absence rate decreases, especially for students who are severely absent. This research may suggest some new policies PPS could adopt to decrease student absence and thus increase academic achievement.

ANALYZING PSYCHOSTIMULANT USE IN THE CARNEGIE MELLON STUDENT POPULATION

STUDENTS Kevin Handerhan *Social & Decision Sciences* | Andrew Klein *Civil and Environmental Engineering* | Luke Racek *Economics* | Peter Satagaj *Mathematics* | Won Woo Sohn *Economics*

ADVISORS Trent Gaugler *Statistics* | Tracy Sweet *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

In general, performance-enhancing drugs are a sensitive and controversial issue. The most pervasive coverage of this in popular media deals with drugs used by professional and amateur athletes to improve their athletic performance. However, there is rarely coverage of so-called “academic” drugs, such as amphetamines, which are ubiquitous on college campuses in America. The use of these drugs, often without a legal prescription, is mysterious and students have many different opinions on the ethicality of their use and the potential benefits and risks one assumes when consuming them. This topic is particularly interesting at Carnegie Mellon because many Carnegie Mellon students believe that the university’s stressful and strenuous academic environment may incentivize, or even necessitate for some, the use of psychostimulants to maintain good course grades and secure a sound financial future. Studying the CMU student population’s relationship with psychostimulants, both legally and illegally consumed, through voluntary surveys may help us to discover revealing information about the state of the academic environment.

BUGGY TECHNOLOGY DEVELOPMENT

STUDENTS Gerald Carlson *Mechanical Engineering* | Kellen Chow *Mechanical Engineering* | Elise Everett *Computer Science* | Philip Garrison *Electrical & Computer Engineering* | Connor Hayes *Undecided* | Amy Hung *Mathematics* | Nathaniel Jeffries *Electrical & Computer Engineering* | Preston Ohta *Mechanical Engineering* | Glenn Philen *Mechanical Engineering* | Anibal Pichardo *Mechanical Engineering* | Rachael Schmitt *Undecided* | Guochen Shen *Mechanical Engineering* | James Snyder *Mechanical Engineering* | Patricia Xu *Materials Science Engineering* | Sophia Zikanova *Electrical & Computer Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The goal of this SURG is to improve the performance and safety of buggies (vehicles that compete in CMU’s annual Sweepstakes races) by exploring modifications to existing technology as well as developing novel designs. This SURG, which will be focused on Mechanical Engineering design and analysis, will provide an excellent hands-on educational experience to all members involved.

CAN I HAVE A SEAT?: A STUDY OF AVAILABLE SEATING IN THE UNIVERSITY CENTER

STUDENTS Allison Ma *Social & Decision Sciences* | Adams Rosales *Business Administration* | Jennifer Soong *Statistics* | Sam Zhang *Computer Science* | He Zhu *Mathematics*

ADVISORS Trent Gaugler *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

The second floor of the University Center provides a convenient spot for students to meet and study, but is often full. This survey investigates the problem of the insufficient amount tables and seating in the poolside, gym, and main area of the second floor. Data on a variety of variables, such as table usage and foot traffic, will be collected by observation and analyzed. Utilizing the results of the data analysis and considering a variety of solutions for a more efficient use of chairs and tables, a recommendation will be written as to how to optimally meet the needs of students.

EVOLUTIONARY ORIGINS OF THE SEDOHEPTULOSE-1,7- BISPHOSPHATASE (SHB17) GENE FAMILY

STUDENTS Hak-Jin Kim *Mathematics*

ADVISORS Dannie Durand *Biological Sciences*

ROOM/TIME Rangos 2&3/Sigma Xi Group 2 / 11:37 am

SHB17 is a recently characterized gene in *Saccharomyces cerevisiae* that encodes sedoheptulose-1,7-bisphosphatase, an enzyme that drives the committed step of a new, non-oxidative alternate pathway to ribose production. Since yeast central metabolism has been the target of intense study for 50 years, the discovery of a new ribose synthesis pathway is surprising. To better understand the origins of SHB17, we carried out a phylogenetic analysis that shows the SHB17-like homologs in closely related fungi and in the bacterial plant symbionts *Frankia*, *Rhizobium*, and *Agrobacteria*. The presence of SHB17-like genes in bacteria and fungi but not in plants or animals suggests horizontal gene transfer of a SHB17 ancestor between the fungal and bacterial domains. The transfer between domains seems plausible, given the known symbiosis between plants, fungi, and nitrogen-fixing *Frankia* and *Rhizobium* in plant roots. Further, the *Agrobacterium* pathogen is capable of transforming the nuclear DNA of fungi in the wild. Nitrogen fixation is an oxygen sensitive process; therefore, we hypothesize that SHB17 gave functional advantages to fungi and bacteria to grow in low-oxygen environments, such as the one found in plant roots. This suggests the possible role of SHB17 as drug target for biofilm forming pathogenic yeasts such as *Candida albicans*. *C. albicans* has a SHB17 homolog that is up-regulated during biofilm production. Our preliminary biofilm growth assays on a *C. albicans* SHB17 deletion mutant found that the lack of SHB17 gene reduces *C. albicans* biofilm dry weight. This project demonstrates the potential importance of evolutionary analysis to the studies of microbial metabolism and pathogenicity.

EXPLORATION OF OBSERVED BIRD POPULATION IN UNITED STATES

STUDENTS Jason Ha *Statistics* | Eun Ji Shim *Mathematics* | Jonathan Yu *Statistics*

ADVISORS William Eddy *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

Every year, the U.S. Geological Survey's Patuxent Wildlife Research Center and the Environment Canada's Canadian Wildlife Service collaborate on collecting observations of birds in North America from thousands of dedicated self-proclaimed birders in North America. This data set contains information on more than 700 known species, traffic, location, weather, and counts of observed birds on known routes.

Our group has conducted statistical analysis on the data set utilizing tools such as linear modeling and additive modeling. We then applied this method to all species and different regions to compare the change of the observed bird population per year.

MOTION INTELLIGENCE FROM SURVEILLANCE CAMERAS

STUDENTS Rutwik Parikh *Mathematics*

ADVISORS Yang Cai *Computer Science*

ROOM/TIME Peter / 12:40 pm

We are working with the Pennsylvania Department of Transportation (PennDOT) to conduct real-time simulation of traffic data in a virtual world in order to obtain information regarding buses around the city. Our solution involved the usage of OpenSim and construction of a virtual world using both the tools in GUI

and implementations in the open source language. We focused on District 21 traffic cameras available on PennDOT's website. Apart from a slight delay in the simulation due to data processing, we were able to reconstruct cars of a similar nature in the exact same environment but in OpenSim.

NEGATIVE SWAP SPREADS AND THEIR IMPLICATIONS

STUDENTS Chul Kyo Bae *Business Administration* | Shiyun Gan *Business Administration* | Bohan Li *Computer Science* | Brandon Ngiam *Mathematics*

ADVISORS William Hrusa *Mathematics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 10:25 am

Negative swap spreads are an unusual phenomenon in the interest rate markets. By no-arbitrage assumptions, rational market participants should put on trading strategies to profit from the negative swap spread, causing it to disappear. We will explore an arbitrage strategy to take advantage of the negative swap spreads, and show how this strategy breaks down in practice. This approach will allow us to gain a better understanding of why this phenomenon still persists.

ON THE MATHEMATICS OF IMAGE PROCESSING

STUDENTS Jieun Lee *Mathematics*

ADVISORS William Hrusa *Mathematics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 10:37 am

Studying mathematical foundation of image processing is critical in today, when the influence of image processing is significant in modern science and technology. This project talks about how the mathematical problems are constructed for image processing model. In particular, the project studies two image processing problems called Tychonov Regularization Model and Total Variation Model. Simulations in MATLAB will be presented in order to explain the advantages and disadvantages of each method. Furthermore, comparing the outcomes of the simulation will demonstrate important differences between the two models.

OPTIMAL INVESTMENT IN INCOMPLETE MARKET WITH THE USE OF DOUBLE BINOMIAL MODEL

STUDENTS Shirui Hu *Mathematics* | Tian Kang Lim *Electrical & Computer Engineering*

ADVISORS William Hrusa *Mathematics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 10:48 am

In this project, we use double binomial model, which is an extended model of binomial model, to study the optimal investment strategy in an incomplete market. Mathematically, an incomplete market is a system in which the number of stocks or derivatives is less than the number of possible states. We will try different utility functions and also investigate the relationship to the mean variance analysis.

OPTIMAL PATH FOR A BOAT TRAVELING AGAINST A VECTOR CURRENT

STUDENTS Jung Sun Park *Mathematics*

ADVISORS William Hrusa *Mathematics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 11:00 am

We are studying the behavior of a boat navigating against a river, and the effects of various currents, specifically on paths that minimize traveling time. Using methods from the Calculus of Variations, we have found an analytical solution corresponding to a vector current which depends only on the boat's distance from the river banks, and have been able to observe these paths graphically with the help of mathematical software.

OPTIMIZATION OF STUDENT DORMITORY PREFERENCES IN CARNEGIE MELLON UNIVERSITY

STUDENTS Neha Nandakumar *Chemical Engineering* | Yu-Hua Wang *Mathematics* | Kenneth Wong *Mathematics*

ADVISORS Fatma Kilinc-Karzan *Business Administration*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 11:13 am

Each May, Carnegie Mellon University's Housing & Dining Services gathers a list of incoming freshman students and assigns them to on-campus dormitories. Assigning students to dorms based on preferences is a tremendous issue to deal with every year, because dorm living plays a huge part in a freshman's college experience, and produces most of Housing & Dining Services' revenue. Our group decided to investigate this optimization problem as a two-phase Assignment Problem. We hope that our findings would reduce the amount of complaints from the students about their dorm room assignments and improve upon the students' first year experience in Carnegie Mellon University.

PHYSICS

A GPU ACCELERATED CORRELATION FUNCTION FOR LARGE COSMOLOGICAL DATASETS

STUDENTS Eric Chandler *Physics*

ADVISORS Shirley Chan Wan Ho *Physics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 10:48 am

In cosmology, the two-point correlation function measures the excess probability in the distribution of galaxies compared to a random distribution. The cosmological parameters governing the expansion of the universe predict its shape and a peak in the function corresponding to the baryon acoustic oscillations. The two-point correlation function is calculated on the SDSS DR9 dataset of approximately 200,000 galaxies. The correlation function is written in the CUDA programming language and run on an NVIDIA M2090 GPU processor to significantly reduce run-time compared to sequential or MPI code.

AN INVESTIGATION OF CLUSTER GALAXIES

STUDENTS John Wu *Physics*

ADVISORS Rachel Mandelbaum *Physics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 11:00 am

A galaxy cluster is a collection of galaxies that are gravitationally bound in orbits through the hot gas of the Intracluster Medium (ICM). Models for galaxy formation and evolution predict that this dense environment will physically alter the properties of galaxies in a cluster. We are investigating these properties in the cluster sample from the GMBCG catalog, which covers galaxies in the Sloan Digital Sky Survey (SDSS) in the redshift range $0.1 < z < 0.55$. Preliminary results suggest that galaxies nearest to the center have smaller physical sizes despite being more luminous than non-cluster galaxies, lending support to the claims that those galaxies should have special properties.

CONDUCTING THIN FILMS OF SILVER NANOWIRE-POLYMER COMPOSITE

STUDENTS Colleen Treacy *Physics*

ADVISORS Lisa Porter *Materials Science Engineering*

ROOM/TIME Rangos 2&3/Sigma Xi Group 5 / 10:48 am

Optoelectronic devices such as LEDs and solar cells rely on transparent electrodes which are electrically conductive while also optically transparent. The current industry standard is indium tin oxide (ITO), which has few alternatives that can compare with its electrical and optical properties. However, ITO is inapplicable in flexible devices because of its brittle nature. Expensive and high temperature processing also prevent its use in low-cost photovoltaics. In this research study we are investigating electrical and optical properties of thin films of a nanowire-polymer composite as an alternative to ITO; the composite is comprised of silver nanowires and the conducting polymer poly(ethylene dioxythiophene):poly(styrenesulfonate) (PEDOT:PSS). The properties of the composites were examined by measuring the conductivity and transparency at different concentrations of nanowires in the polymer to qualitatively determine the percolation (conductive) threshold, as a function of certain processing conditions. Network properties were also studied by simulating similar structures in MATLAB. The efficacy of these composites as transparent conductors was then tested by using them as anodes in a thin film organic photovoltaic cell.

DALITZ ANALYSIS OF THE DECAY $D_0 K_S^0$

STUDENTS Nicholas Eminizer *Physics*

ADVISORS Roy Briere *Physics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 11:13 am

We perform a measurement of the resonant substructure in $D_0 K_S^0$ decays using a Dalitz analysis of 2.9 inverse fb of data collected in 2010-11 with the BESIII detector at the BEPCII. Using a simple treatment of the small backgrounds and Monte Carlo simulations to calculate efficiency, we find that the asymmetric flavor-tagged Dalitz plot is described well by a combination of several quasi-two-body decay channels along with a non-resonant term. We compare our results to those of a similar study completed by the Belle Collaboration in 2006.

DESIGN AND MANUFACTURE OF HIGH EFFICIENCY HULLS FOR SOLAR POWERED BOATS

STUDENTS Kathryn Davis *Mechanical Engineering* | Thomas Eliot *Electrical & Computer Engineering* | Irene Lee *Mechanical Engineering* | Peter McHale *Physics* | Allen Miller *Mechanical Engineering* | Alexander Warzinski *Civil and Environmental Engineering* | Patricia Xu *Materials Science Engineering*

ADVISORS Susan Finger *Civil and Environmental Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Solar-powered boats offer a novel opportunity to replace nonrenewable petroleum products with renewable energy. Although solar energy is plentiful, it is difficult to use efficiently. One way to increase efficiency is to minimize water resistance on the hull. Hull resistance can be analyzed and minimized through the use of computational fluid dynamics analysis. After a hull shape is chosen, it is important to construct the hull so that it can resist the various forces it is subject to in the water. Carbon fiber and core materials can be used to reinforce the hull with a higher strength-to-weight ratio than traditional fiberglass layup. The research group used CFD analysis to create a set of hulls to test as scale models. Different combinations of core material, fiberglass, and carbon fiber were implemented in model hulls and stress-tested. Stress testing results and an analysis tank were used to determine an ideal hull with high strength, low resistance, and reasonable cost. These results will be presented at the Meeting of the Minds Symposium.

DETERMINING THE GAUSSIAN MODULUS OF BIOLOGICAL LIPID MEMBRANES

STUDENTS Jason Rocks *Physics*

ADVISORS Markus Deserno *Physics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 3 / 10:48 am

In order to accomplish many of their biological functions within cells, lipid membranes frequently undergo fission and fusion processes. The energetic costs associated with these membrane deformations can be very large (on the order of 20 ATP molecules) and depend strongly on a membrane's stiffness, characterized by the bending and Gaussian moduli. While the bending modulus can be measured via experiment and simulation with relative ease, the Gaussian modulus has only been measured in a few special cases, even though it is equally as important. Recently, the Deserno group developed a novel and accurate method to extract the Gaussian modulus from computer simulated membranes. The method has been successfully tested for simple coarse-grained models consisting of a single type of lipid. My project has focused on extending this method to take into account the various lipid sorting effects associated with bent membranes containing mixtures of lipids. The ultimate goal of this project is to establish a method by which the effects of membrane lipid composition on the Gaussian modulus can be measured for biologically realistic membranes. This will allow for further insight into how evolution has guided cell membrane composition to optimize membrane deformation energetics.

EXPLORING THE USE OF CUDA GPU IN ASTROPHYSICS APPLICATIONS

STUDENTS James Komianos *Physics*

ADVISORS Rupert Croft *Physics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 6 / 11:25 am

The use of GPU (Graphics Processing Units) as accelerators in high performance computing has been increasingly explored by scientific communities in the past decade. Optimized for performing simple graphical operations and offering high memory bandwidth and floating-point performance, GPU can significantly increase

performance in scientific computing. But, many problems arise when trying to mix GPU's with CPU for high performance computing, as GPU is much less general purpose than CPU. Luckily, NVIDIA CUDA (Computer Unified Device Architecture), a new GPU architecture and programming language based in C, allows for a broader scope of applications in using GPU for scientific computing. The main goal of this project is to find ways to use CUDA GPU in Fast Fourier Transformation applications, making them faster and more efficient. FFT's are used in a wide range of physics applications, including astrophysics and materials science simulations. I will use Lincoln, a GPU cluster located at the National Center for Supercomputing Applications for testing of this project, as well as Carnegie Mellon's hybrid cluster Euler.

LLP2 DOMAIN ON THE CYTOPLASMIC TERMINAL TAIL OF HIV-1 GP41 AFFECTS T-CELL BUT NOT HIV VIRION LIPID MEMBRANES

STUDENTS Alexander Boscia *Physics*

ADVISORS Stephanie Tristram-Nagle *Physics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 3 / 11:00 am

Kalia et al. produced a mutant MX2 of LLP2 where two highly conserved arginine residues (R3 and R21) were replaced with negatively charged glutamic acid. Although MX2 mutation showed no loss of Env expression, Env processing or infectivity of the HIV virion, both viral-initiated T-cell death and T-cell syncytium formation (cell-cell fusion) were greatly decreased. In the present work we investigated the interactions of five LLP2 variants with lipid mimics of the HIV virion and the T-cell membranes. The LLP2 peptides were designed to investigate the role of electrostatics, as well as the effect of a Crac, or cholesterol-binding motif, preceding LLP2, and of a palmitoylated cysteine. We obtained synchrotron x-ray diffuse scattering of oriented, fully-hydrated peptide/lipid bilayers that provides both structural and bending flexibility information. We find that none of the LLP2 peptides changed the structure or properties of the HIV lipid membrane, whereas they clearly altered the T-cell lipid membrane, and, importantly, did so differently for the wild type and MX2 mutant. Our work provides a structural explanation for the mutation studies, namely, that LLP2 has an effect on the HIV lifecycle only when it alters a membrane.

LOS TICOS Y LOS NICARAGÜENSES: ANTI-NICARAGUAN ATTITUDES IN COSTA RICA FROM THE 1980S TO THE PRESENT DAY

STUDENTS Vivian Chang *Physics*

ADVISORS John Soluri *History*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

Global immigration into Costa Rica has been spurred on by the receiving country's relative political peace (undisturbed as it was by the civil wars that rocked Central America in the twentieth century) and bountiful natural resources, giving it a high quality of life. However, many Costa Rican citizens have espoused anti-Nicaraguan views, especially derogatory stereotypes concerning Nicaraguan immigrants and their alleged effects on Costa Rica. In my project I will identify major stereotypes and misconceptions about Nicaraguans, determine the validity of these statements, and examine print media for possible influence on and contribution to anti-Nicaraguan attitudes.

PROJECT MeTiS

STUDENTS Job Bedford *Mechanical Engineering* | Connor Brem *Computer Science* | Jenna MacCarley *Electrical & Computer Engineering* | William Maynes *Computer Science* | Peter McHale *Physics* | Audrey Yeoh *Electrical & Computer Engineering*

ADVISORS David Kosbie *Computer Science*

ROOM/TIME Rangos 2&3/Sigma Xi Group 8 / 10:13 am

We aim to create a new kind of programming curriculum and the tools for that curriculum. Our project's aims are the following:

- 1) To create a syntax free programming language and IDE based on MIT's scratch program
- 2) To have an android app that will allow you to write such code from a mobile phone or tablet
- 3) To allow students to write code which offers a real world result from their code which can be tested efficiently in a classroom setting.

We believe such a curriculum will raise excitement over programming upfront when students see the physical results of their code and will allow students to focus on learning programmatic logic without the pains of syntax in the beginning. We also believe that such an attitude toward computer education has the potential to make a dramatic change in the United States STEM education system.

The tools for our curriculum include a robot to be controlled, a 4' X 4' physical auto-grading sensor array, and an application that can be ported to a phone or a tablet to write and save drag-and-drop code.

VOLUMETRIC STABILITY OF LIPID BILAYERS

STUDENTS Kelsey Hallinen *Physics*

ADVISORS John Nagle *Physics* | Stephanie Tristram-Nagle *Physics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 3 / 11:13 am

The gel phase of DPPC has been the best characterized lipid bilayer. It has therefore been alarming that recent publications have reported a gradual decrease in lipid molecular volume of DPPC multilamellar vesicle dispersions in the gel phase upon repeated thermal cycling between 10oC and 50oC using a commercial densimeter. The considerable size of this decrease would have significant implications for the physical chemistry of biomembranes. We have confirmed this phenomenon with the same densimeter model. By contrast, neutral buoyancy measurements performed with similar thermal cycling show no gradual change in lipid volume in the gel phase at 20oC. Remixing the lipid in the densimeter shows that the apparent volume decrease is an artifact. We conclude that volumes obtained by neutral buoyancy measurements remain accurate and that gel phase DPPC bilayers exist in a volumetrically stable state.

UNDECIDED

DESIGN AND DEVELOPMENT OF THERMOCOUPLE AND FUEL CELL CARS

STUDENTS Katia Bazzi *Chemical Engineering* | Jonathan Berman *Chemical Engineering* | Madison Calhoun *Chemical Engineering* | Anusha Chinthaparthi *Chemical Engineering* | Alisa De Bruyn Kops *Chemical Engineering* | Onyenma Enwereji *Undecided* | Alexandra Frankel *Chemical Engineering* | Stephen Greco *Electrical & Computer Engineering* | Dennis Guo *Chemical Engineering* | Sam Klein *Chemical Engineering* | Joshua Kubiak *Materials Science Engineering* | Rebecca Lui *Chemical Engineering* | Ishan Nag *Chemical Engineering* | Kaitlyn Nowak *Chemical Engineering* | Sanjana Padmanabhan *Chemical Engineering* | Allison Perna *Chemical Engineering* | Yijie Qiu *Chemical Engineering* | Anand Sastry | *Chemical Engineering* | Stephen Scannell *Chemical Engineering* | Wooram Seok *Chemical Engineering* | Joseph Whitmore *Chemical Engineering* | Patrick Xia *Undecided* | Amy Yuan *Chemical Engineering*

ADVISORS James Miller *Chemical Engineering*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

The purpose of this project is to prepare two cars for the AIChE Chemical Engineering Car Regional Competition hosted in New Jersey April of 2013. Two cars will be simultaneously entered in competition by Carnegie Mellon. The car that performs the best will compete at the National Competition in San Francisco in Fall of 2013. The Chemical Engineering Car Competition is a national, collegiate competition sponsored by the American Institute of Chemical Engineers (AIChE). It is based on the challenge of designing and building a model-sized car that is powered by a chemical reaction. The car must stop at a distance between 50 and 100 feet and carry a load of water. Both the distance and load are specified on the day of the competition. The competition is designed to give student engineers the opportunity to apply their knowledge to a design project and to gain research experience. It also gives students an opportunity to meet with other students across the country, share ideas, and network. Two separate cars will be prepared for the competition. The first car will be powered by a thermocouple and an exothermic reaction with a bimetallic strip-based stopping mechanism and the second car will be powered by a hydrogen fuel cell with a pressure-syringe-based stopping mechanism. In October 2011, the team placed 5th out of the 33 best teams throughout the United States at AIChE's National Competition. Our goal is to again perform well at the 2013 Regional Competition to qualify for the following National Competition.

MECHANICAL LOGIC

STUDENTS Spencer Barton *Electrical & Computer Engineering* | Connor Brem *Computer Science* | Steven Cunningham *Mechanical Engineering* | David Lu *Electrical & Computer Engineering* | Rudina Morina *Undecided* | Corinne Vassallo *Music*

ADVISORS James C. Hoe *Electrical & Computer Engineering*

ROOM/TIME Class of '87/12:20 pm (Oral Session)
Kirr Commons-1st Floor, Window side / 3-5 pm (Poster Session)

Boolean logic, the math of true/false or 1/0 values, forms the foundation of many important operations experienced in daily life. This project seeks to demystify basic Boolean logic through the use of mechanical logic gates as a teaching tool for high school students. We will construct a series of push-pull logic gates that will model basic Boolean math operations such as AND, OR, NOT and XOR (exclusive OR). Utilizing these units, we will then teach students the fundamentals of Boolean logic and demonstrate how powerful this concept can be. Through these education tools and lessons, we hope to interest high school students in Boolean logic and its application in electrical and computer engineering.



SCHOOL OF COMPUTER SCIENCE

COMPUTER SCIENCE

AN EVALUATION OF THE EFFECTIVENESS OF CAREER FAIRS AT CARNEGIE MELLON UNIVERSITY

STUDENTS Robert Eckels *Statistics* | Alex Klarfeld *Electrical & Computer Engineering* | Soham Sengupta *Economics and Statistics* | Shreepal Shah *Computer Science* | Jonathan Yu *Statistics*

ADVISORS Trent Gaugler *Statistics* | Tracy Sweet *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

A primary reason that many students come to Carnegie Mellon University is to improve their prospects of gaining better employment opportunities. The university provides various resources for students to be in touch with potential employers. The career fair is a prime example. Events such as the Employment Opportunity Conference, Business Opportunity Conference, and Technology Opportunity Conference are staples of the academic year. Through our research and analysis, we attempt to understand how effective career fairs are in their purpose to match students with employers. In our research, we control for how qualified a student is and other aspects of the student, to see if career fairs really do help a student's job search. Our research focuses just on the success of undergraduate students.

AUTOLAB SOFTWARE DEVELOPMENT

STUDENTS Ashley Kumar *Computer Science*

ADVISORS David O'Hallaron *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

I redesigned the way that grade tweaks are stored in the database. I also designed and implemented a simple notifications feature that will notify users of updates to their account, such as new grades or feedback.

AUTOMATICITY AND CLASSIFICATION OF DISCRETE DYNAMICAL SYSTEMS

STUDENTS Adrian Trejo *Computer Science*

ADVISORS Klaus Sutner *Computer Science*

ROOM/TIME Rangos 2&3/Sigma Xi Group 8 / 10:25 am

ROOM/TIME Class of '87 / 3:00 pm

Model checking is a method of building a model of a system and then exhaustively and automatically checking whether that model meets a given specification. In particular, the system could require infinitary descriptions (e.g., runs of a reactive system). Elementary cellular automata (ECA) form simple dynamical systems that exhibit a wide array of behaviors, ranging from trivial to computationally complete. I've built the automata-theoretic support structure to perform model checking on first-order logic formulae on one-way infinite cellular automata. Using these formulae, I separate the 256 different ECAs into distinct behavioral classes.

AUTONOMOUS INTERPLANETARY LANDING - TESTING AND IMPLEMENTATION

STUDENTS Kerry Snyder *Computer Science*

ADVISORS William Whittaker *Robotics Institute*

ROOM/TIME Wean Commons-1st Floor, Connan side / 12-2:30 pm

Interest in interplanetary space travel is on the rise, but typical landing methods' lack of precision limit scientific discovery. Presented is an implementation of a sensor capable of localization and hazard detection through stereo camera odometry, inertial measurement, and LIDAR scanning. Once implemented, this instrument is tested and sensor and algorithm performance is verified and improved.

BUGGY TECHNOLOGY DEVELOPMENT

STUDENTS Gerald Carlson *Mechanical Engineering* | Kellen Chow *Mechanical Engineering* | Elise Everett *Computer Science* | Philip Garrison *Electrical & Computer Engineering* | Connor Hayes *Undecided* | Amy Hung *Mathematics* | Nathaniel Jeffries *Electrical & Computer Engineering* | Preston Ohta *Mechanical Engineering* | Glenn Philen *Mechanical Engineering* | Anibal Pichardo *Mechanical Engineering* | Rachael Schmitt *Undecided* | Guochen Shen *Mechanical Engineering* | James Snyder *Mechanical Engineering* | Patricia Xu *Materials Science Engineering* | Sophia Zikanova *Electrical & Computer Engineering*

ADVISORS Steve Collins *Mechanical Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 12-2:30 pm

The goal of this SURG is to improve the performance and safety of buggies (vehicles that compete in CMU's annual Sweepstakes races) by exploring modifications to existing technology as well as developing novel designs. This SURG, which will be focused on Mechanical Engineering design and analysis, will provide an excellent hands-on educational experience to all members involved.

CAN I HAVE A SEAT?: A STUDY OF AVAILABLE SEATING IN THE UNIVERSITY CENTER

STUDENTS Allison Ma *Social & Decision Sciences* | Adams Rosales *Business Administration* | Jennifer Soong *Statistics* | Sam Zhang *Computer Science* | He Zhu *Mathematics*

ADVISORS Trent Gaugler *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

The second floor of the University Center provides a convenient spot for students to meet and study, but is often full. This survey investigates the problem of the insufficient amount tables and seating in the poolside, gym, and main area of the second floor. Data on a variety of variables, such as table usage and foot traffic, will be collected by observation and analyzed. Utilizing the results of the data analysis and considering a variety of solutions for a more efficient use of chairs and tables, a recommendation will be written as to how to optimally meet the needs of students.

COLORMYGRAPH

STUDENTS Nikolai Mushegian *Computer Science* | Jim Zhang *Computer Science*

ADVISORS Klaus Sutner *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

We did web development work for Adam Blank's teaching / course management app ColorMyGraph. This semester was just preliminary development for the pilot course this summer.

COMPLEXITY MEASURES OF ASYNCHRONOUS CELLULAR AUTOMATA

STUDENTS Samir Jindel *Computer Science*

ADVISORS Klaus Sutner *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

We examine the relative complexity measures defined by applying different types of embeddings on asynchronous cellular automata, including direct literal embeddings and extended spacial embeddings. We classify the elementary cellular automata by the partial ordering introduced by these measures.

DANGER AREA MARKING USING A LOW-COST ROBOT COLONY

STUDENTS Julian Binder *Electrical & Computer Engineering* | Priyanka Deo *Computer Science* | Yuyang Guo *Computer Science* | Ruben Markowitz *Drama* | Thomas Mullins *Electrical & Computer Engineering* | Rachael Ortega *Mechanical Engineering* | Peyton Randolph *Computer Science* | Matthew Sebek *Electrical & Computer Engineering* | Brent Stryko *Electrical & Computer Engineering* | Patricia Xu *Materials Science Engineering* | Alexander Zirbel *Computer Science*

ADVISORS George Kantor *Robotics Institute*

ROOM/TIME Wright / 12:00 pm

One of the biggest challenges to developing countries are explosive remnants of war (ERWs). ERWs create a structural barrier to development and growth of the area long after war ends. The United Nations Mine Action Centre spends an enormous amount of effort conducting danger area marking (DAM) operations, with an estimated 127 million land mines in as many as 88 countries. Currently, such operations are performed manually, at significant risk to human lives. The Colony Project proposes to create a low cost autonomous team of robots that can help humanitarian efforts to detect and remove these dangers.

DETECTING TEXT IN THE ENVIRONMENT USING RGB-D DATA

STUDENTS Joe Grinstead *Computer Science*

ADVISORS Thomas Kollar *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

Text is an important source of information in our environments. For instance, a sign near a door can say whether it opens to an office or a stairway. It is therefore useful for a robot to be aware of surrounding text. This project experiments with using RGB-D data (red, green, blue, and depth) to help a robot isolate and read nearby text.

DYNAMIC OFFENSIVE ROLE ASSIGNMENT FOR ROBOT SOCCER

STUDENTS Benjamin Choi *Computer Science*

ADVISORS Joydeep Biswas *Robotics Institute* | Juan Pablo Mendoza *Robotics Institute* | Manuela Veloso *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

Experienced human soccer players are able to intuitively move to open positions and pass the ball to one another in order to set up an attack on the opponent's goal. In robot soccer, the current algorithm used by CMU's team and many others for offensive play makes an assignment of roles to different robots when the decision to attack is made, and this assignment subsequently does not change until it has succeeded or failed. This project aims to dynamically assign roles to robots, switching roles when a particular avenue of attack is no longer the best available and keeping robots in positions where they are available to receive passes and take over the attack so as to keep multiple offensive options open.

EFFECT OF AUTONOMOUS BUS ROUTE PREDICTION ON CONTRIBUTION RATE FOR A TRANSIT CROWDSOURCING APPLICATION

STUDENTS Maxime Bury *Computer Science*

ADVISORS Charlie Garrod *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

Real-time Automatic Vehicle Location is expensive and not used in most U.S. transit systems. One approach to address this problem is for riders with smartphones to observe bus locations and make that data available to other riders. One existing application, Tiramisu, relies on riders to observe buses in the Pittsburgh transit system but suffers from low contribution rates; i.e., many riders use Tiramisu to see other riders' observations but do not themselves contribute bus observations. In this project, we study how different user interaction designs affect the contribution rate. Specifically, rather than relying on users to voluntarily contribute data, we use smartphone sensors to autonomously detect when the user boards the bus -- greatly reducing the number of interactions needed for the user to contribute bus observations -- and measure the effectiveness of our approach.

EVALUATION OF LOOP NESTING FOREST ALGORITHMS

STUDENTS Alexander Reece *Computer Science*

ADVISORS David Brumley *Electrical & Computer Engineering*

ROOM/TIME Class of '87 / 3:20 pm

Advanced control-flow analyses are often built on a technique known as structural analysis (SA), which iteratively transforms a control-flow graph (CFG) into a control-flow tree with leaves corresponding to CFG nodes and internal nodes corresponding to CFG regions. An iteration in SA typically proceeds by first identifying a region in the CFG that matches one of the known high-level control structures such as if-then-else and do-while, then contracting the region into a new node. In practice, however, many CFGs contain large regions that do not match any high-level control structures (e.g., due to the use of break), thus making control-flow analysis less precise. This is why researchers have recently started complementing SA with iterative refinement, which is the idea of using iteratively removing of a carefully-chosen arc to allow SA to continue and discover the finer structures embedded inside such regions. Unfortunately, their experience shows that straightforward implementations of SA with iterative refinement tend to be bug-ridden. In particular, the addition of refinements substantially complicates the control flow of the SA algorithm itself. Our insight is that we can partition the arcs removed during refinement into two groups depending on whether an arc is a backward feedback arc or not. (A feedback arc is an arc whose removal breaks a cycle, and the arcs removed by refinement are all backward.) This naturally leads us to a new, conceptually-clean implementation strategy by handling cyclic and acyclic regions in two independent phases. The first phase preprocesses a CFG into a so-called "loop-nesting forest" (LNF) using existing loop identification algorithms in the compiler literature. The result is a hierarchical decomposition of the CFG into acyclic regions, with all candidate feedback arcs identified. The second phase applies SA in each of the acyclic regions, which can be implemented much easier since each region is guaranteed to be acyclic. I propose to extend the CMU Binary Analysis Platform (BAP) with LNF algorithms from the literature. This will enable us to evaluate the effectiveness of the aforementioned two-phase structural analysis algorithms versus the existing mixed implementation in BAP.

EXPLOITING LONGITUDINAL EEG INPUT IN A READING TUTOR

STUDENTS Sang Jin Han *Computer Science*

ADVISORS Kai-Min Chang *Language Technologies Institute*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

In 2011, Mostow, Chang and Nelson conducted a study using EEG signals to train a classifier that identifies lexical features such as textual and word difficulty. In this research, I augment the previous study and attempt to find correlation between multiple lexical features and EEG. The features tested include part-of-speech tags, frequency of a word in a large corpus (such as the Google n-gram), complexity of grammatical structure of a sentence (measured by number of high-probability parse trees), and age-of-acquisition of a word.

FRED NAVIGATOR

STUDENTS Jack Papanian *Computer Science*

ADVISORS John Grefenstette *University of Pittsburgh* | Ronald Rosenfeld *Language Technologies Institute*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

Large-scale simulations are increasingly used to evaluate potential public health interventions in epidemics such as the H1N1 pandemic of 2009. Due to variations in both disease scenarios and in interventions, it is typical to run thousands of simulations as part of a given study. This presentation describes a new tool called FRED Navigator that allows a user to interactively visualize results from the FRED agent-based modeling system. This tool will be used in a class at the Pittsburgh Science and Technology Academy to augment their epidemiology curriculum.

GETTING PARALLEL SPEEDUPS ON REAL PROBLEMS

STUDENTS Michael Choquette *Computer Science*

ADVISORS Guy Blelloch *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

I sought efficient parallel implementations of algorithms for Huffman tree building and SAT solving, My goal was code that not only outperformed efficient sequential implementations, but scaled well with the number of cores added.

HOMINID-COMPUTER INTERACTION

STUDENTS Maxwell Hawkins *Computer Science*

ADVISORS M. Stephanie Murray *BHA*

ROOM/TIME Dowd / 1:40 pm

Is human-computer interaction applicable beyond humanity? For the past year I've been working with animals and computers at the Pittsburgh Zoo. During my internship as a primate keeper, I explored the efficacy of using custom computer software to communicate with non-human primates. The iPad and Xbox Kinect software I developed was play-tested with the zoo's resident Bornean orangutans. This presentation documents my experiences at the zoo, the unexpected connections between primatology and human-computer interaction, and my search for connections between our species amid barriers of profound difference.

IMPLEMENTATION AND ANALYSIS OF FACE DETECTION ALGORITHM PERFORMANCE ON AN ANDROID-BASED MOBILE DEVICE

STUDENTS Mansfield Mark *Computer Science*

ADVISORS Aaron Steinfeld *Robotics Institute*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

Face detection algorithms are relatively commonplace in today's technology. There has been much research in making such algorithms more robust and effective. However, the use of mobile devices is on the rise. If one wants to implement face detection on such a device, one must consider the limitations of the hardware being used. My research is to find what methods can be used to optimize performance of existing algorithms, while considering factors like limited processing power and battery life. This project also serves to implement a face tracking system, via mobile phone, for the Romibo Project, by Origami Robotics.

IMPROVING THE CATEGORIZATION OF ASTHMA PATIENTS BY LEVERAGING PHENOTYPE FEATURE SELECTION

STUDENTS Niveditha Jayasekar *Computer Science*

ADVISORS Aarti Singh *Machine Learning*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

In this project, we seek to improve the categorization of asthma patients based on severity of their condition by leveraging phenotype feature selection to improve the accuracy of the resolved groups. This also provides an understanding of the relevant phenotypes that characterize each patient group. We conducted PCA analysis on the different clusters formed by applying k-means algorithm to discover that the features that contribute most to the top principal components, ordered by variance, were inversely related to the results of using infogain to identify relevant features. In other words, relevant features are associated with small variance and high infogain within a cluster. We are currently working on leveraging these observations to improve the accuracy of resolved groups and comparing these observations with different clustering methods.

LEVERAGING DEPENDENCY PARSE STRUCTURES FOR LARGE-SCALE NOUN PHRASE CLASSIFICATION

STUDENTS Malcolm Greaves *Computer Science*

ADVISORS William Cohen *Machine Learning*

ROOM/TIME Rangos 2&3/Sigma Xi Group 8 / 10:48 am
Class of '87 / 3:40 pm

How do you construct a program that can read the web and learn about the world? How could a program process billions of sentences, learn the semantic meaning of hundreds of thousands of noun phrases, and use this knowledge to classify unobserved noun phrases? We developed a novel three-stage algorithm for noun phrase classification and present empirical results on a 3 TB corpus of parsed English text. Each sentence is represented as a directed, acyclic graph, where tokens are vertices and labeled edges represent the syntactic dependency relationship between tokens. The algorithm's first stage learns graph walk strategies for associating semantically related noun phrases. The second stage uses these strategies to build a rich noun phrase feature space. The third stage learns a logistic regression model on this constructed feature space that is highly effective at noun phrase classification. We present this novel three-stage algorithm in detail

and report its performance on several noun phrase classification experiments.

MECHANICAL LOGIC

STUDENTS Spencer Barton *Electrical & Computer Engineering* | Connor Brem *Computer Science* | Steven Cunningham *Mechanical Engineering* | David Lu *Electrical & Computer Engineering* | Rudina Morina *Undecided* | Corinne Vassallo *Music*

ADVISORS James C. Hoe *Electrical & Computer Engineering*

ROOM/TIME Class of '87/12:20 pm (Oral Session)

Kirr Commons-1st Floor, Window side / 3-5 pm (Poster Session)

Boolean logic, the math of true/false or 1/0 values, forms the foundation of many important operations experienced in daily life. This project seeks to demystify basic Boolean logic through the use of mechanical logic gates as a teaching tool for high school students. We will construct a series of push-pull logic gates that will model basic Boolean math operations such as AND, OR, NOT and XOR (exclusive OR). Utilizing these units, we will then teach students the fundamentals of Boolean logic and demonstrate how powerful this concept can be. Through these education tools and lessons, we hope to interest high school students in Boolean logic and its application in electrical and computer engineering.

MEMORY DEBUGGING HADOOP PROGRAMS

STUDENTS Annika Peterson *Computer Science*

ADVISORS Garth Gibson *Computer Science*

ROOM/TIME Kirr Commons-1st Floor, Window side / 3-5 pm

Analyzing big data sets on clusters has become an increasing part of many fields outside of Computer Science. In analyzing their data, many users run into issues that stop them from being able to complete their job. This project aims to analyze these issues on a specific cluster running and using Hadoop's MapReduce framework to analyze data. We aim to identify if these issues are related to memory allocations and parameters unknown to the casual user and also aim to give the casual user more information about how to debug these issues.

METHODS FOR EFFECTIVE DISTRIBUTED PROJECTION MAPPING

STUDENTS William Westlin *Computer Science*

ADVISORS Kayvon Fatahalian *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

Projection mapping is the use of a carefully calibrated projector, along with a virtual representation of a model, to recreate texture and animation detail on a 3D printed instance of the model. The use of multiple projectors further increases the complexity of a projection mapping problem by adding the need for coordination across n-distributed projection models. I have developed a system which stitches together multiple projector view-points to create a cohesive texture mapping across all surfaces of the model. I will demonstrate this system as well as introduce a pipeline for animation and texture creation for later rendering, and discuss the design challenges necessary for implementation.

METONYM IDENTIFICATION

STUDENTS Alison Kao *Computer Science*

ADVISORS Judith Gelernter *Language Technologies Institute*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

Metonyms are a type of figurative language where one word is used in place of another related word or phrase. Differentiating between literal and metonymic usages of location names in text will improve geographic information retrieval. After reviewing the performance of other schools in the SemEval-2007 metonym identification task, we plan to test the CMU METAL pipeline's ability to identify metonyms after adding Named Entity Recognition, Part-of-Speech tagging, and trigger words to identify literal senses and reduce the search space. These three methods have not been used in conjunction by any other school. Testing of our methods will be conducted over the summer.

MOBILE APP DEVELOPMENT FOR PEER-REVIEW IN VISUAL ART EDUCATION

STUDENTS Shiwei Yan *Computer Science*

ADVISORS Noboru Matsuda Human *Computer Interaction Institute*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

We already know that peer-review is an effective learning tool for both critiques and learning the subject matter in essay writing. By apply the same technique to visual art classrooms through the medium of an iPad application, we can improve the educational quality for hard-of-hearing students. However, designing an intuitive interface is the biggest challenge, as it must be able to cover the flow of art critiques and at the same time consider the students' needs.

NEGATIVE SWAP SPREADS AND THEIR IMPLICATIONS

STUDENTS Chul Kyo Bae *Business Administration* | Shiyan Gan *Business Administration* | Bohan Li *Computer Science* | Brandon Ngiam *Mathematics*

ADVISORS William Hrusa *Mathematics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 10:25 am

Negative swap spreads are an unusual phenomenon in the interest rate markets. By no-arbitrage assumptions, rational market participants should put on trading strategies to profit from the negative swap spread, causing it to disappear. We will explore an arbitrage strategy to take advantage of the negative swap spreads, and show how this strategy breaks down in practice. This approach will allow us to gain a better understanding of why this phenomenon still persists.

ORBITS OF ITERATED BINARY TRANSDUCERS

STUDENTS Pranav Senthilnathan *Computer Science*

ADVISORS Klaus Sutner *Computer Science*

ROOM/TIME Class of '87 / 4:00 pm

This project looks at a special case of transducers, specifically binary invertible transducers. Starting with simple 3 state transducers and moving to more complex ones, we address questions about the orbits of these transducers. We try to provide a general ways to find if two elements are in the same orbit. Categorizing the

transducers with efficient solutions to these problems could open applications in program verification where we want to check if a program ever enters a “bad” state.

P3 PROTOTYPE LUNAR ROVER

STUDENTS Brian Fischer *Computer Science*

ADVISORS William Whittaker *Robotics Institute*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

For this project, we rebuilt the P3 rover from planetary rover. Our goal is to use cameras to track the distance that we’ve traveled using joystick controls and to travel to locations a preset distance away with high accuracy.

PICOCTF 2013

STUDENTS Garrett Barboza *Electrical & Computer Engineering* | John Davis *Computer Science* | Ryan Goulden *Computer Science* | Tyler Nighswander *Computer Science*

ADVISORS David Brumley *Electrical & Computer Engineering*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

picoCTF is a computer security competition for high school students. The competition is a series of challenges centered around a unique storyline where participants must reverse engineer, break, hack, decrypt, or do whatever it takes to solve the challenge. The challenges are all set up with the intent of being hacked, making it an excellent, legal way to get hands-on experience. picoCTF 2013 is the first of hopefully multiple picoCTF events.

PROJECT LOCI: TANGIBLE INTERACTIONS WITH INFORMATION SYSTEMS

STUDENTS Canute Haroldson *Mechanical Engineering* | Christopher Henley *Design* | Yaakov Lyubetsky *Design* | Ajay Ravindran *Computer Science*

ADVISORS Mark Baskinger *Design*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

There is no doubt that modern technology and access to vast amounts of information has helped enrich our lives throughout the past few decades. Unfortunately the most common way to access this information up to this point has been through screen based interfaces; in effect forcing people to divert the majority of their attention to the screen. Project Loci addresses this issue by developing a backpack that responds to external variables and relays that information to the user using tactile feedback. The backpack is location aware and makes use of large databases of crime statistics to warn the user of their locations danger level by tightening the bags straps, a metaphor for parental attachment. The bag also takes cues from the animal world by its ability to change texture and color in response to environments; a reference to chromatophores and deimatic displays. The design of this backpack offers an example of how a future of interconnected artifacts can allow users to move past the screen to develop a deeper emotional connection with products when accessing information.

PROJECT MeTiS

STUDENTS Job Bedford *Mechanical Engineering* | Connor Brem *Computer Science* | Jenna MacCarley *Electrical & Computer Engineering* | William Maynes *Computer Science* | Peter McHale *Physics* | Audrey Yeoh *Electrical & Computer Engineering*

ADVISORS David Kosbie *Computer Science*

ROOM/TIME Rangos 2&3/Sigma Xi Group 8 / 10:13 am

We aim to create a new kind of programming curriculum and the tools for that curriculum. Our project's aims are the following:

- 1) To create a syntax free programming language and IDE based on MIT's scratch program
- 2) To have an android app that will allow you to write such code from a mobile phone or tablet
- 3) To allow students to write code which offers a real world result from their code which can be tested efficiently in a classroom setting.

We believe such a curriculum will raise excitement over programming upfront when students see the physical results of their code and will allow students to focus on learning programmatic logic without the pains of syntax in the beginning. We also believe that such an attitude toward computer education has the potential to make a dramatic change in the United States STEM education system. The tools for our curriculum include a robot to be controlled, a 4' X 4' physical auto-grading sensor array, and an application that can be ported to a phone or a tablet to write and save drag-and-drop code.

PYTHON IN THE CLOUD

STUDENTS Dustin Hellstern *Computer Science* | Karl Hellstern *Computer Science*

ADVISORS Jeffrey Eppinger *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

Prototyping web applications for the undergraduate Web Application Development course, including a comparison of Python frameworks to J2EE, with respect to cloud deployment and storage technologies.

RECONSTRUCTING DYSPHASIC SPEECH FROM CROSS-SPEAKER ARTICULATORY POSITION DATA USING SPEECH SYNTHESIS AND VOICE CONVERSION TECHNIQUES

STUDENTS Vinay Vemuri *Computer Science*

ADVISORS Alan Black *Language Technologies Institute*

ROOM/TIME Class of '87 / 4:20 pm

Dysarthria is a motor speech disorder that results from serious injury to a major component of the human speech system. Traditional speech synthesis techniques have often proven insufficient in constructing clear synthetic speech from source recordings of speakers affected by dysarthria. In this project, we propose an alternate approach to constructing a synthetic voice for a dysarthric speaker BF (a tongue cancer patient whose tongue had been surgically removed during cancer treatment) with the goal of constructing synthetic speech that both sounds clear and preserves distinctive acoustic features of BF's original voice. Our approach centers around the idea of constructing "an artificial tongue" for BF and using this along with information about the positions of BF's other major articulators for any given sentence to build a voice. Since no information about the positions of BF's articulators is available, we use recordings and corresponding articulator position data (APD) of an individual who will be referred to as MSAK to construct an articulatory speech synthesizer that predicts APD given acoustics. Using the articulatory speech synthesizer and recordings of BF post-surgery,

we determine the positions of all of BF's articulators except the tongue. Next, we synthesize recordings of MSAK speaking the same sentences as BF and run the articulatory speech synthesizer on newly synthesized MSAK recordings to determine the positions of MSAK's articulators for BF's sentences. We then use the predicted position of MSAK's tongue as an approximation of BF's tongue (the artificial tongue) and use this, along with the predicted positions of BF's other articulators to construct a voice for BF.

SCOUTING ANDROID APPLICATION

STUDENTS Alexander Lockwood *Computer Science*

ADVISORS Ananda Gunawardena *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

We developed an Android application for the Girls of Steel robotics team, an all-girl robotics team made up of high school students in the Pittsburgh area. The application provides an easy means of gathering and visualizing information during robotics competitions, a crucial method commonly used in robotics competitions called "scouting".

SIMULATED CLOTH MANIPULATION USING A TOUCH-SCREEN INTERFACE

STUDENTS Maria Bajzek *Computer Science*

ADVISORS Nancy Pollard *Robotics Institute*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

The purpose of this research was to complete an application that can simulate the manipulation of cloth using input from a touch-screen device. More specifically, I used an Apple iPad running the TUIO application to collect touch data and transmit it to the cloth application running on a computer. Cloth is a good example of a material that is simple to interact with in the physical world, but presents some challenges when trying to model it electronically. Through my exploration of computer graphics and touch-screen device input, I have come closer to a way to interact with simulated objects as though they existed in the physical world. The use of the iPad as a controller for the simulated cloth demonstrates the potential for using touch-screens to make user experiences more intuitive and realistic.

SIMULATION FOR AUTONOMOUS LUNAR LANDING

STUDENTS Neal Bhasin *Computer Science*

ADVISORS William Whittaker *Robotics Institute*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

Successful autonomous lunar navigation and landing requires the cooperation and correctness of many different software components. Simulation software assists in the development of these components and enables rigorous and continuous testing.

SMALL SIZE ROBOT SOCCER: MULTI-ROBOT COORDINATION FOR PASSING AND SHOOTING

STUDENTS Steven Klee *Computer Science*

ADVISORS Joydeep Biswas *Robotics Institute* | Manuela Veloso *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

The ability to quickly plan actions between multiple robots is important in the small size robot soccer league. In a fast-moving competitive environment, decisions must be made and executed rapidly. This year, the CMDragons small size robot soccer team has made strides in developing a Pass Ahead technique in which robots coordinate to pass a ball to a designated location. We adopt a novel policy of least commitment at all stages under the hypothesis that this approach to passing allows for greater flexibility when reacting to a changing environment. The procedure starts with a passing robot that can choose to pass to one of many potential receivers. Each receiver moves toward an optimal intercept location at the same time. At the last possible moment, the passing robot shoots at the receiver most likely to be able to intercept the ball. Once a robot intercepts the ball, it then considers whether to shoot on the goal or pass again. We present in-depth descriptions of the components of this system along with higher level implementation details and illustrative examples. We also discuss potential future extensions to this technique.

SPECTRAL METHODS FOR IMAGE SEGMENTATION

STUDENTS Prashant Sridhar *Computer Science*

ADVISORS Gary Miller *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

This project explores machine learning techniques to reweight edges on a graph before applying spectral methods to segment it. Has applications for image segmentation.

STATIC VERIFICATION OF C0 PROGRAMS USING THE Z3 THEOREM PROVER

STUDENTS Matthew McKay *Computer Science*

ADVISORS Frank Pfenning *Computer Science* | Andre Platzer *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

There are numerous common errors that beginning programmers encounter, including array index out-of-bounds, integer overflow, and NULL-pointer dereferencing. In 15-122, Principles of Imperative Computation, students are required to add contracts to their C0 programs, which dynamically verify that certain conditions are upheld when the program runs (and thus help to encourage correctness). However, the current implementation of these contracts is limited in that the contracts are only checked for the specific cases that they are run on, when they are meant to be capable of proving the program correct (at least for smaller programs). To solve this, I have integrated a verification system into the C0 compiler. This system uses the SAT-solving capabilities of Z3 to statically verify that the program adheres to the contracts in every case, and doesn't have any of the common errors mentioned above. It does this by first converting the program into SSA form, then traversing the program and making assertions about it, meanwhile verifying that the contracts hold. Currently the system is successful at finding errors with array indices, arithmetic errors, and contract violations (and soon pointer dereference). This system should be a very useful tool for 15-122 students, as it is helpful for producing programs with accurate, tight contracts.

SYSTEM FOR IDENTIFYING AVAILABLE STUDY SPACES IN UNIVERSITY LIBRARY

STUDENTS Esha Uboweja *Computer Science*

ADVISORS Martial Hebert *Robotics Institute*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

The purpose of the study is to identify whether study spaces in the University Libraries are available for use or not. Currently, the Sorrells Library has too few seats for the amount of demand for study space and a lack of information about study space availability is a common complaint the CMU Libraries hear. This project aims to help resolve this problem by providing library patrons with a system for identifying whether study spaces are available in real-time via the library website. The protocol for this project involves using a video camera to capture images of the study space when it is empty and compare those to captured images from time periods when patrons are actively using this space. By differencing these images, we can determine which spaces are in use and convey that information to potential library users. More specifically, images will be captured at some pre-defined interval (e.g. 5 minutes) and the captured image will be compared, on-the-fly, with images where no patrons are in the space (e.g. captured in the very early morning when the library is closed). This on-the-fly image processing will take place over a time period of seconds (<5 seconds) after which the captured image will be automatically discarded from computer storage – images will be stored for only the amount of time required for processing. Currently, we can detect the number of occupied study tables within a study space being monitored via an IP Camera. The next stage of this work is to count the number of people occupying a certain space to give better information about space availability to the interested user.

TESTING FOR THE LAW OF AGGREGATE DEMAND

STUDENTS Kevin Bao *Computer Science*

ADVISORS Mehmet Yenmez *Economics*

ROOM/TIME Class of '87 / 1:40 pm

We examine a restriction to an agent's preferences in a two-sided matching market known as the law of aggregate demand. Furthermore, we provide an algorithm to test for this property with runtime complexity polynomial to the length of the agent's preference relation over a set of contracts. Access to this preference relation is essential, as we show that any algorithms with only oracle access to the agent's choice function require an expected number of queries exponential to the number of contracts.

TYPE DIRECTED PARSING FOR LANGUAGE-EMBEDDED DSLS

STUDENTS Benjamin Chung *Computer Science*

ADVISORS Jonathan Aldrich *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

Domain specific languages are a common feature of modern framework programming and development, especially in the web and mobile spaces. We propose a new programming language called Wyvern that provides a whitespace delimited lexer combined with a novel type-directed parsing framework to allow for in-language support for DSLs.

VOXEL WORLD COSTMAP SOFTWARE FOR HUMANOID ROBOTS

STUDENTS Joseph Robinson *Computer Science*

ADVISORS David Stager *Robotics Institute*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 12-2:30 pm

In this presentation I hope to demonstrate how we can use ROS costmaps for robot navigation using laser data.

WATER TREATMENT IPHONE APPLICATION

STUDENTS Jeffrey Sun *Computer Science*

ADVISORS Terrence Collins *Chemistry*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

This iPhone app will help researchers at the Institute of Green Science calculate costs for their new method of water treatment. The app is designed to return a quick estimate when a prospective client asks about the cost to treat a certain amount of water. Inputs that are taken into consideration include pH, water volume, and retention time.

LANGUAGE TECHNOLOGIES INSTITUTE

GRAPHMINING USING RDBMS

STUDENTS Jay Yoon Lee *Language Technologies Institute*

ADVISORS Christos Faloutsos *Computer Science*

ROOM/TIME Hoch Commons-2nd Floor, Rangos side / 3-5 pm

What is the best language and system, to find patterns and anomalies in large graphs? We show that SQL is actually an excellent language for the task: our graph mining system is a carefully designed and implemented layer on top of SQL, and we show that it has desirable properties: (a) it is general, able to run on top of any sql engine (from smartphones with SQLITE3 to clusters with database machines) (b) it enjoys query optimization for free (hash joins, indices) (c) it is compact, thanks to the four fundamental matrix-algebra patterns we propose and (d) can lead to zero cost solutions, since it can run on top of free, open-source SQL engines. Additional contributions include (a) our timing results, which serve as a practitioner's guide; and (b) discoveries on large-scale real data which run on off-the-shelf workstation, with free software (linux, POSTGRES).



TEPPER SCHOOL OF BUSINESS

BUSINESS ADMINISTRATION

A PITTSBURGH PHOTO NARRATIVE: EAST LIBERTY

STUDENTS Alysia Finger *Business Administration*

ADVISORS Dylan Vitone *Design*

ROOM/TIME McKenna / 4:40 pm

Pittsburgh's East Liberty is currently undergoing major economic and social changes. This document analyzes East Liberty's history as well as trends in its urban planning goals, public policies, and demographic shifts. I follow the rises and falls in East Liberty's prosperity starting with its foundation. I use historic texts, surveys, documentaries, and city plans to compare and analyze social and economic situations and outcomes. I compliment this research with a photographic narrative of the neighborhood's more recent issues. Through this work, I have identified peaks and valleys in East Liberty's success as a business and residential community: the initial climb from its foundation in the 1700s to its reputation as a vibrant commercial district from the early- to mid-1900s; its descent into economic and social distress from the mid- to late-1900s; and its current re-growth during the early-2000s.

AN ANALYSIS OF RETURNS ON NEWLY LISTED STOCKS IN PERIODS OF ECONOMIC GROWTH AND CONTRACTION

STUDENTS Arjun Katragadda *Business Administration*

ADVISORS Jose Emilio Osambela Zavala *Economics*

ROOM/TIME Hoch Commons-2nd Floor, Window side / 3-5 pm

Past research has indicated that the stocks of firms that undergo IPOs are underpriced in the short run and overpriced in the long run. In this work, I update these findings by analyzing the performance of newly listed stocks in the years 2004 to 2012 and contrasting them to the returns of older 'matching firms' (as explained by Jay Ritter in his 1991 publication). Furthermore, this data allows us to compare IPO returns in the most recent periods of economic growth and economic contraction, while also providing recommendations to potential investors and to firms that may be considering going public.

CAN I HAVE A SEAT?: A STUDY OF AVAILABLE SEATING IN THE UNIVERSITY CENTER

STUDENTS Allison Ma *Social & Decision Sciences* | Adams Rosales *Business Administration* | Jennifer Soong *Statistics* | Sam Zhang *Computer Science* | He Zhu *Mathematics*

ADVISORS Trent Gaugler *Statistics*

ROOM/TIME Wean Commons-1st Floor, Connan side / 3-5 pm

The second floor of the University Center provides a convenient spot for students to meet and study, but is often full. This survey investigates the problem of the insufficient amount tables and seating in the poolside, gym, and main area of the second floor. Data on a variety of variables, such as table usage and foot traffic, will be collected by observation and analyzed. Utilizing the results of the data analysis and considering a variety of solutions for a more efficient use of chairs and tables, a recommendation will be written as to how to optimally meet the needs of students.

EFFECT OF TEXTBOOK OWNERSHIP ON CLASS PERFORMANCE

STUDENTS Liting Chen *Business Administration* | Hijae Kim *Business Administration* | Weichao Kong *Economics* | Philip Lee *Social & Decision Sciences* | Nadyli Nunez *Economics*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME McKenna / 3:00 pm

How does physical ownership of a required text for a class affect performance and perceived enjoyment in class? Participants will be cluster sampled from classes randomly sampled from each college.

ESTIMATING THE HUBBLE TELESCOPE ACS POINT SPREAD FUNCTION THROUGH STATISTICAL METHODS

STUDENTS Shiyang Gan *Business Administration* | Nicholas Thieme *Statistics* | Yunhao Yang *Electrical & Computer Engineering*

ADVISORS William Eddy *Statistics*

ROOM/TIME Kirr Commons-1st Floor, Window side / 12-2:30 pm

In this work we attempt to estimate the point spread function of the Hubble Telescope's Advanced Camera for Surveys; Wide Field Channel using images of (only) stars as an estimate of the PSF. We used two primary approaches, one using parametric statistical techniques from the exponential family, and another using a combination of non-parametric statistics (in the form of smoothing splines) combined with techniques from the field computer vision

IRON SHIRT PRODUCTIONS: SHORT FILMS SCREENING

STUDENTS Sean Groves *Drama* | Adam Hagenbuch *Drama* | Nicolas Hurt *Business Administration* | Lachlan McKinney *Drama* | Brian Morabito *Drama* | Rachel Piero *Drama* | Stephen Tonti *Drama*

ADVISORS Randy Kovitz *Drama*

ROOM/TIME McConomy Auditorium / 11:00 pm

The purpose of this project is to create 2 to 3 short films to be used as reels for graduating actors, directors, business students, artists, and designers. Utilizing the incredible talents of over a dozen CMU students in various disciplines, we hope to create films that will boost the professional careers of these students as well as establishing CMU as a major player in the Pittsburgh film world and beyond. For this event, we will be screening the films that we produce this semester.

NEGATIVE SWAP SPREADS AND THEIR IMPLICATIONS

STUDENTS Chul Kyo Bae *Business Administration* | Shiyang Gan *Business Administration* | Bohan Li *Computer Science* | Brandon Ngiam *Mathematics*

ADVISORS William Hrusa *Mathematics*

ROOM/TIME Rangos 2&3/Sigma Xi Group 7 / 10:25 am

Negative swap spreads are an unusual phenomenon in the interest rate markets. By no-arbitrage assumptions, rational market participants should put on trading strategies to profit from the negative swap spread, causing it to disappear. We will explore an arbitrage strategy to take advantage of the negative swap spreads, and show how this strategy breaks down in practice. This approach will allow us to gain a better understanding of why this phenomenon still persists.

REQUEST CONCERT FILM ADAPTATION SCREENING

STUDENTS Jamie Drutman *Drama* | Olivia Harris *Drama* | Nicolas Hurt *Business Administration* | Stephen Tonti *Drama*

ADVISORS Dick Block *Drama*

ROOM/TIME McConomy Auditorium / 11:30 pm

Jamie Drutman, a Senior directing major in the Carnegie Mellon University School of Drama, recently completed her Senior Thesis production: Franz Xavier Kroetz's Request Concert. The play is a monodrama about the day a woman decides to alter her predictable existence by committing suicide. Because of the positive response and the team's strong connection with the piece, they decided to pursue their next collaboration: bringing the spirit of the production to life in the form of a short film.

REWARD SYSTEMS

STUDENTS Tyler Vogt *Business Administration*

ADVISORS Carey Morewedge *Social & Decision Sciences*

ROOM/TIME KIRR Commons-1st Floor, Window side / 3-5 pm

Different reward systems are often used to motivate people and promote behavior. The research looks at how people perceive and are affected by different types of rewards. Through studies run online and in the lab the research seeks to understand how well people are able to forecast their affective response economic and status as well as the actual affective response to these types of rewards.

STUDENT PERCEPTIONS OF OTHER MAJORS/SCHOOLS AT CMU

STUDENTS Ronald Fudala *Economics and Statistics* | Like Li *Psychology* | Nazym Satbekova *Statistics* | Kit Ying Wong *Economics and Statistics* | Aleksandr Zeltser *Business Administration*

ADVISORS Tracy Sweet *Statistics*

ROOM/TIME KIRR Commons-1st Floor, Window side / 12-2:30 pm

This topic is interesting because there is a large unspoken divide on campus. Many people understandably congregate in their majors to work on assignments and socialize but often times very distinct group forms in which the people on the inside almost exclusively do everything together. There are well known stereotypes for virtually every school from computer science and business, to drama. In addition, there are also different perceptions and stereotypes concerning the amount of workload for different majors. Now is a good time to do this survey as understanding people's perceptions of other majors and their personalities and traits associated with it can provide some valuable insight as to why any social divide might exist. After a traumatic incident last year and general awareness of a stress culture at CMU, being able to provide a more socially nurturing and welcoming atmosphere would be beneficial towards the entire student body. Deans of the schools in question would be able to use this data to examine perceptions of how the rest of the school views their department and decide whether there are any negative aspects that could be fixed with a strategic change for the departments. The school can also take these opinions into consideration and try to instill and focus on the more positive aspects. The data can also be used to evaluate if the stereotypes are actually true. An interesting part of this type of survey is that fact that it can lead to many other beneficial research projects. In addition, administrators of specific programs can self-evaluate their departments' in light of the research to try to expand and enhance their program. In this study, we would like to investigate the following questions:

1. In general, what are CMU students' perceptions of each college at CMU?
2. Are certain colleges/majors considered more difficult or stressful than others?
3. How do students rank their own colleges/majors in terms of difficulty? Do these rankings match the general perception?
4. How do students think the rest of the student body perceives their college/major? Do students feel positively/negatively about how others perceive their major?
5. How many hours per week do students in each college/major work? Do these results match their own perceptions of how difficult their major is? Do these results match the general ranking of major difficulty?

Our target population is the entire undergraduate student body currently attending CMU, and we wish to make inference to the undergraduate population at CMU. Each individual undergraduate student at CMU will be a unit in this population.

We plan to sample from the population of all undergraduate students that are listed in the CMU Master address book (C-Book). The sampling frame should be nearly identical to the target population. However, a possible source of coverage error could come from those students who entered or left CMU in the spring 2013 semester, after the address book had already been published. This error could be partially addressed with regard to students who no longer attend CMU but are listed in the address book. We can cross-check each student who is selected for the sample by using the search function in the CMU online directory, which is up-to-date and does not list any students who no longer attend CMU.

THE GOVERNING LAW RISK PREMIUM ON GREEK GOVERNMENT BONDS

STUDENTS Alice Jun *Business Administration*

ADVISORS Brent Glover *Business Administration*

ROOM/TIME Dowd / 3:40 pm

The spread between yields on Greek government bonds with different governing law clauses, which determine the court of jurisdiction in the case of default, varies over time. In late 2009, yields on Greek law bonds and those on comparable English law bonds diverged as the Euro crisis began to unfold. This paper estimates the magnitude and time variation of this governing law risk premium for Greek sovereign debt. Additionally, I study the determinants of the time variation in Greece's propensity to issue foreign law bonds.

ECONOMICS

PRODUCT DIVERSIFICATION IN AN EMERGING MARKET YELE, SIERRA LEONE

STUDENTS Victoria Baggio *Economics*

ADVISORS Rebecca Lessem *Economics*

ROOM/TIME Class of '87 / 12:40 pm

Over 70% of the world's poor live in rural areas (World Bank 2011). Through extensive research there is a growing realization that electricity is a necessary condition for rural development, however, it has yet to be proven to be sufficient by itself to bring about the desired socioeconomic impact. Rural electrification is the generation and distribution of electricity through decentralized power grids to people in rural areas. Evidence on the topic of rural electrification is scarce. In general, authors agree rural electrification is important. However, there is little agreement on the overall effectiveness. My main research goal is to conduct an economic analysis of the market impact of the supported rural electrification project, e-Luma. I will do this by tracking the evolution of product diversity and product differentiation within the local market of Yele, Sierra Leone. Product diversification and differentiation are significant indicators of market growth and fluctuations. My research question will be, "How does the presence and deployment of external development projects affect a rural market as seen through product diversification and differentiation?" In documenting the different available product and uses of products over time I will be able to better understand the impact of such development projects.



SPECIAL COMPETITIONS

ALCOA UNDERGRADUATE RESEARCH AWARDS

Alcoa Inc. is sponsoring this award for projects in Information Technology, with a focus on mobility. Mobility is a key future state for all computing, where connectivity from anywhere to anywhere with myriad devices and for unlimited uses will be expected...and needed. How can we prepare to connect any-to-any seamlessly and securely, and how can this new paradigm add value to companies like Alcoa?

THE ALLEN NEWELL AWARD FOR EXCELLENCE IN UNDERGRADUATE RESEARCH

Open only to students in SCS. This endowed award, established in 1993, is presented annually by the School of Computer Science. Allen Newell had a long, rich and distinguished scientific career that contributed to multiple subdisciplines in computer science. Still, each individual endeavor was pursued with a characteristic style that his colleagues, students, and friends recognized as essential to Allen. Owing to the breadth and scope of Allen's contributions, this award recognizes extraordinary undergraduate research in his scientific style rather than computer science research in a particular area. The criteria by which a research project is judged is predicated, foremost, on the belief that a good idea is not enough. The qualities that transform a good idea into good science can be captured in three maxims attributable to Allen:

- 1) Good science responds to real phenomena or real problems.
- 2) Good science is in the details.
- 3) Good science makes a difference.

ALUMNI AWARD FOR UNDERGRADUATE EXCELLENCE IN COMPUTER SCIENCE

Open only to students in SCS. The Alumni Award for Undergraduate Excellence in Computer Science, established in 2003, is granted on behalf of Carnegie Mellon School of Computer Science alumni. The Award recognizes technical excellence in research and development. The Award is also intended to promote awareness within the undergraduate community that graduation represents both the end of an important phase of life and the beginning of a new phase within the vibrant Carnegie Mellon University School of Computer Science community as an alumnus. The Alumni Award recognizes such factors as contribution to the state of the art; technical excellence; potential societal impact; accessibility; quality of the written, oral, and poster presentations; and generated excitement among the alumni community participating in the process.

AWARD FOR ARTISTIC EXCELLENCE

The Award for Artistic Excellence is sponsored by engineers in support of the arts and the Center for the Arts in Society at Carnegie Mellon. Awards will be given to outstanding visual and performing arts presentations.

Cara Costello, *Intercultural Communications Center*

Tim Haggerty, *Humanities Scholars Program*

Yona Harvey, *Creative Writing, English*

Anna Houck, *Dietrich Dean's Office*

John Mackey, *Mathematical Sciences*

Joe Mannino, *Art*

Mame-Fatou Niang, *French & Francophone Studies*

THE BOEING BLUE SKIES AWARD

Boeing is pleased to sponsor The Boeing Blue Skies Award, created to encourage undergraduate students to present innovative research with applications involving technologies in wireless communications, networking protocols, sensors, controls and algorithms, cyber security, and autonomous vehicles. The Blue Skies Award is designed to reward students who dream big and deliver creative solutions to problems through sound engineering principles and innovative technology applications.

John Glatfelter, *Technical Fellow*
Denise Holiman, *IT Manager*
Jamina Lai, *Structural Design Engineer*

CIT HONORS POSTER COMPETITION

All students conducting research through the Carnegie Institute of Technology Honors Program participate in the CIT Poster Competition.

Peter Adams, *Civil and Environmental Engineering*
Burcu Akinci, *Civil and Environmental Engineering*
Warren Garrison, *Materials Science & Engineering*
Peter Gilgunn, *ICES & Electrical and Computer Engineering*
Kelvin Gregory, *Civil and Environmental Engineering*
James Hoe, *Electrical and Computer Engineering*
Gabriele Hug, *Electrical and Computer Engineering*
John Kitchin, *Chemical Engineering*
Michael Lancet, *Electrical and Computer Engineering*
Michael McHenry, *Materials Science & Engineering*
Jayshree Ranka, *Cylab*
Tom Sullivan, *Electrical and Computer Engineering*
Robert Tilton, *Chemical Engineering & Biomedical Engineering*
Newell Washburn, *Chemistry*
John Wesner, *Institute for Complex Engineered Systems/ME*

DIETRICH HUMANITIES PRIZE

The Dietrich Humanities Prize is awarded to student projects that best exemplify the humanities as they are understood at Carnegie Mellon: that the study of philosophy, history, language, and cultures enriches our experience and offers a template for understanding both traditional disciplinary legacies and new directions in scholarly inquiry. In addition to concrete emphasis on problem solving, the humanities at Carnegie Mellon seek ongoing dialogues with - not isolation from - the arts, sciences and technologies.

Cara Costello, *Intercultural Communications Center*
Tim Haggerty, *Humanities Scholars Program*
Yona Harvey, *Creative Writing, English*
Anna Houck, *Dietrich Dean's Office*
John Mackey, *Mathematical Sciences*
Joe Mannino, *Art*
Mame-Fatou Niang, *French & Francophone Studies*

FRANK-RATCHYE STUDIO FOR CREATIVE INQUIRY AWARD

This competition will reward an atypical, anti-disciplinary and/or inter-institutional student research project that explores new intersections of art, science, technology and culture.

Lorrie Cranor, *STUDIO for Creative Inquiry*

Golan Levin, *Art*

Marge Myers, *STUDIO for Creative Inquiry*

JOHNSON & JOHNSON UNDERGRADUATE RESEARCH AWARD

Johnson & Johnson is proud to support innovative projects in the field of Information Technology, with a focus on Healthcare Innovation. The Johnson & Johnson IT Innovation organization is responsible for identifying possibilities to drive the Johnson & Johnson business forward.

Alan Andryc, *IT Lead, Vision Care*

Vic Rios, *Vision Care CIO*

Robert Wilson, *IT Director, Enterprise Architecture*

PSYCHOLOGY DEPARTMENT COMPETITION

The department of Psychology is proud to sponsor a poster/presentation competition for all undergraduate students who are presenting research that involves psychological science.

David Creswell, *Psychology*

Brooke Feeney, *Psychology*

Anna Fisher, *Psychology*

Laurie Heller, *Psychology*

Charles Kemp, *Psychology*

David Rakison, *Psychology*

RICHARD SCHOENWALD PHI BETA KAPPA UNDERGRADUATE RESEARCH PRIZE

Open only to members of Phi Beta Kappa, this award is sponsored by CMU's Phi Beta Kappa chapter and named after Dr. Richard Schoenwald, late professor of History. Dr. Schoenwald was a member of Phi Beta Kappa, a proponent of undergraduate involvement in research, and the leader of CMU's first application effort (in the early 1970's) to shelter a Phi Beta Kappa chapter at Carnegie Mellon.

William Alba, *Science and Humanities Scholars*

Joseph Devine, *Dietrich College of Humanities and Social Sciences*

Clark Glymour, *Philosophy*

Antonio-Javier Lopez, *Biological Sciences*

Anne Marie Mesco, *University Libraries*

SIGMA XI POSTER COMPETITION

The Sigma Xi poster competition is an independently sponsored event within the Undergraduate Research Symposium. Coordinated by the Carnegie Mellon Chapter of Sigma Xi, a national honor society for those engaging in scientific research, the competition is open to students presenting posters in quantitative sciences.

Ben Anglin, *Materials Science & Engineering*
Joseph Ayoob, *Biological Sciences*
Marlene Behrmann, *Psychology*
DJ Brasier, *Biological Sciences*
Maggie Braun, *Biological Sciences*
Jill Dembowski, *Biological Sciences*
Emily Drill, *Biological Sciences*
Mark Fichman, *Tepper School of Business*
Ilhem-Faiza Hakem, *Material Science Engineering*
Robert Heard, *Material Science Engineering*
Veronica Hinman, *Biological Sciences*
Colin Horwitz, *Chemistry*
Greg Lowry, *Chemical Engineering*
C. Joel McManus, *Biological Sciences*
Cynthia Morton, *Hunt Institute for Botanical Documentation*
Parul Nisha, *Alumni*
Joe Orens (ECE'67), *Berkeley Research Associates*
Linda Peteanu, *Chemistry*
Subramanian Ramachandran, *Mechanical Engineering*
Raja Sooriamurthi, *Engineering & Public Policy*
Xiaohong Tan, *Chemistry*
Cheryl Telmer, *Biological Sciences*
Karen Thickman, *Computational Biology*
Richa Verma, *MBIC*
Tianlong Wen, *Physics*
Wenjie Xu, *Biological Sciences*

SRC-URO POSTER COMPETITION

This competition, sponsored by SRC (Semi-Conductor Research Corporation), seeks to recognize significant and creative work supported by the SRC-URO (Semi-Conductor Research Corporation – Undergraduate Research Opportunities) program, and to encourage students to develop and practice visual and oral presentation skills suitable for academic conferences and industrial research venues.

Three prizes will be awarded.

Sara Majetich, *Physics*
Marylisabeth Rich, *SRC*
Nisha Shukla, *Chemical Engineering*

STATISTICS COMPETITION

Sponsored by the Department of Statistics, the purpose of this competition is to encourage undergraduate projects and research in statistics and its applications, and to educate the CMU community about the wide range of opportunities in statistics. The competition is open to any student or team of students who have completed a project under supervision or with guidance of faculty in the Statistics Department.

Trent Gaugler, *Statistics*

Howard Seltman, *Statistics*

Tracy Sweet, *Graduate Student, Statistics*

Ryan Tibshirani, *Graduate Student, Statistics*

TOYOTA IDEAS FOR GOOD SCHOLARS AWARD

This award was created to encourage learning and investigation in green ideas and technology, emphasizing areas that can create improvement in the lives of people in the US and internationally.

This award is sponsored by a gift from Toyota Motor Sales, U.S.A., Inc.

Dan Jenkins, *Toyota Motor Sales, U.S.A., Inc.*

Jeremy Michalek, *Mechanical Engineering*

Illah Nourbakhsh, *Robotics Institute*

UNDERGRADUATE ECONOMICS PROGRAM (UEP) COMPETITION

A goal of the Undergraduate Economics Program is to encourage students to think creatively and bring together their formal training with their passions.

Undergraduate Economics Program Faculty and Guests

UNDERGRADUATE ENVIRONMENTAL RESEARCH AWARD

The Green Design Institute and the Steinbrenner Institute for Environmental Education and Research will award the Undergraduate Environmental Research Award to an undergraduate whose research includes a strong environmental component.

Neil Donahue, *Chemistry*

Paulina Jaramillo, *Engineering and Public Policy*

Meagan Mauter, *Chemical Engineering*

YAHOO UNDERGRADUATE RESEARCH AWARD

Yahoo! will be looking for interesting and creative projects in the area of mobile computing/applications and use of location awareness and Web-accessed local information.

Don McGillen, *Yahoo! Campus Representative*



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