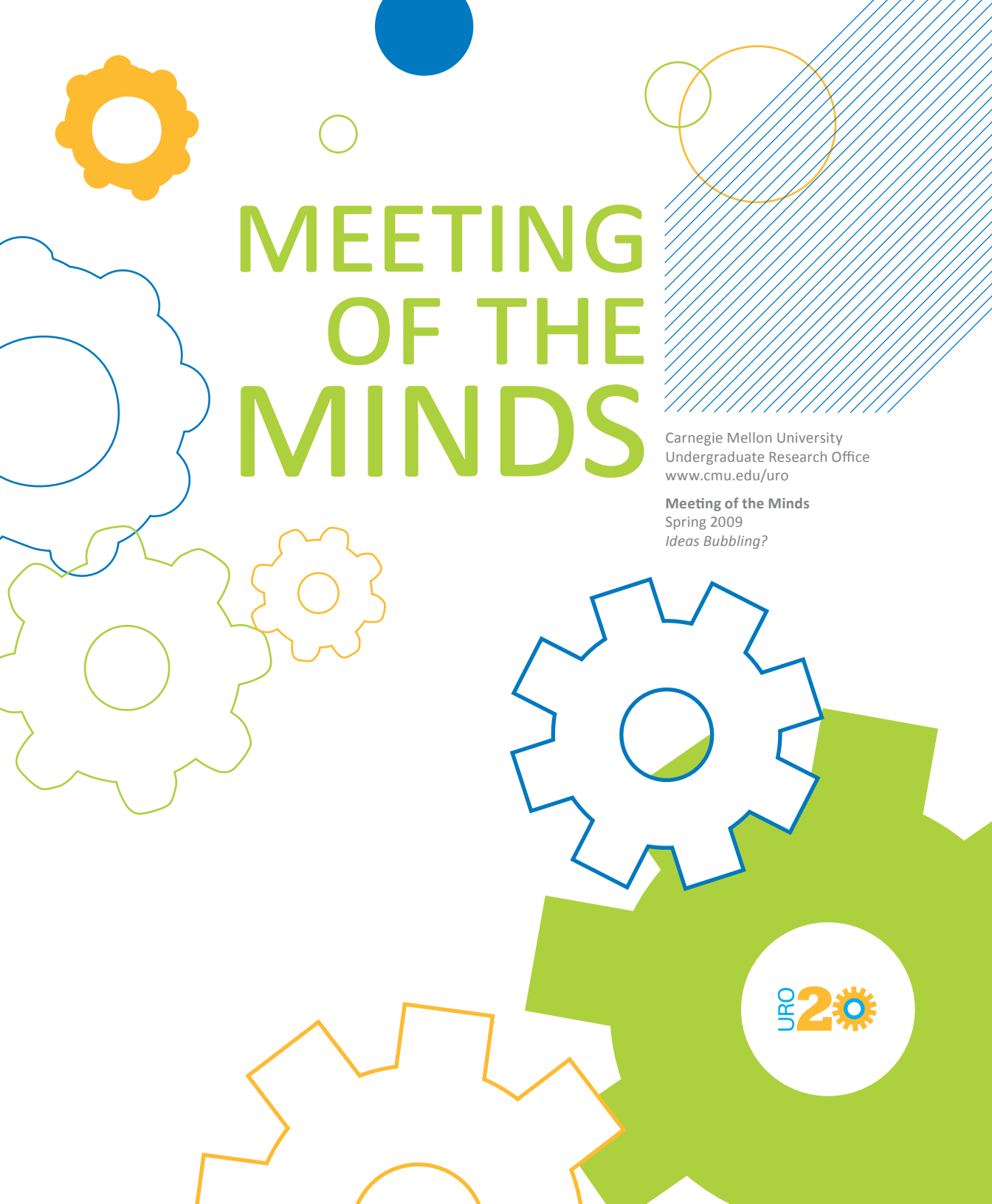
MEETING OF THE MINDS

Carnegie Mellon University
Undergraduate Research Office
www.cmu.edu/uro

Meeting of the Minds
Spring 2009
Ideas Bubbling?



MEETING OF THE MINDS

CARNEGIE MELLON UNDERGRADUATE RESEARCH SYMPOSIUM

PRESENTED BY THE UNDERGRADUATE RESEARCH OFFICE

WELCOME

We welcome you to our 14th annual Meeting of the Minds. This is an especially important year. Our Undergraduate Research Office, which sponsors Meeting of the Minds, is celebrating its 20th anniversary. A far-thinking Associate Provost, Barbara Lazarus worked very hard to establish an undergraduate research program in 1989. The result is a nationally recognized and flourishing undergraduate research office.

There is a lot to see and hear today. The abstracts in this booklet provide a good map to begin your journey. Be prepared for the descriptions to come alive in novel ways. Whether you travel through the poster displays, or attend a few oral presentations or watch a demonstration or visit the art gallery, you won't be disappointed. Consider taking some time to dabble in an interest. Or explore something completely new. Feel free to visit a friend's project or someone you don't know at all. Whatever path you choose, you will find a broad range of interesting research across all of the disciplines.

There are two important times to keep in mind. At 2:30, Indira Nair, Professor in Engineering and Public Policy and Vice Provost for Education, will deliver a short keynote address in the first floor Kirr Commons area. We will also hold a drawing in celebration of our 20th anniversary.

Just as importantly, 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.

Thank you again for coming, and please enjoy our 14th Annual Meeting of the Minds.

Best,

Stephanie Wallach
Director, Undergraduate Research Office

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 Initiative to ensure the accuracy or omission of information submitted for publication.

CONTENTS

SPECIAL THANKS

We extend our special thanks to:

School of Computer Science Dean's Office for the Mid-Afternoon Welcome

Carnegie Institute of Technology Dean's Office for the Mid-Afternoon Welcome

This symposium was funded by the Office of the Provost and the Undergraduate Research Office.

Many thanks to Stephen Chan, Rachael Clemmons, Susan Finger, Marcia Gerwig, Anna Houck, Kourtney Kissel, Alex Lezberg, Claire Morgenstern, Indira Nair, Jessie Ramey, Lizzie Solomon, Julia Spencer, V. Emily Stark, Mark Stehlik, Jen Weidenhof, Instructional Technology, Catering and Staff, the University Center Staff, Balloons Instead, A.G. Trimble Company, Enhanced Digital Printing, ImagePoint Pittsburgh and all the other wonderful students and staff who make this event work.

PRESENTATIONS

Students who are presenting at the symposium could sign up to do one of four different types of presentations:

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.

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 (Peter, Dowd, Pake, McKenna, 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.

VISUAL ARTS

Students' work is displayed in the UC Gallery, the McConomy Stage and in Wean Commons of the University Center. Students will be standing by their work from 3 until 5 p.m. to answer questions.

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

CIT

CARNEGIE INSTITUTE OF TECHNOLOGY

BIOMEDICAL ENGINEERING

Anatomical Modeling Via Rapid-Prototyping Techniques

MIKHAIL LARA · BIOMEDICAL ENGINEERING
Advisor(s): Kerem Pekkan · Biomedical Engineering
Yongjie Zhang · Mechanical Engineering
Hoch Commons-2nd Floor, Window side / 3-5pm

The fabrication of anatomical structures is becoming an increasingly important issue in the fields of computational imaging and biological mechanics. With respect to computational imaging, model fabrication is necessary in order to verify the accuracy of computational modeling techniques, such as CT. Modeling techniques are useful to biological mechanics because the end products can be used in in vitro experiments The purpose of this project is was to fabricate various models of anatomical structures from clinical data to qualitatively measure the accuracy of our computational methods as well as to determine the benefits and limitations of different rapid-prototyping techniques. The fabrication process for each model revealed various weaknesses and strengths of the rapid-prototyping methods, especially with regards to preparation of the digital model, surface properties, and specularity.

COMPUTATIONAL MODELING OF THE NUCLEAR LAMINA

NICHOLAS WREN · BIOMEDICAL ENGINEERING
Advisor(s): Kris Dahl · Biomedical Engineering
Rangos 1 / 12-2:30

Correlations of nuclear shape to disease and cell function are empirically known, but the molecular mechanisms are poorly understood. The lamin proteins, the structural and mechanical elements of the nucleus, form a planar network located between the inner nuclear membrane and the peripheral chromatin, as well as being distributed throughout the nucleus. These protein filaments, both A-type and B-type lamins, not only provide the nucleus with mechanical stability but also play a role in chromatin regulation and mechanotransductive regulatory pathways. Mutations in the gene encoding the A-type lamins result in a class of diseases known as the 'laminopathies.' One such condition is the premature aging disease Hutchinson-Gilford progeria syndrome (HGPS). In patients with this condition, the mutated lamin proteins preferentially localize to the nuclear periphery, membrane blebbing is observed and nuclear stiffness increases. Conversely, loss of lamins leads to a weaker nucleus,

but blebbing also results. In this research, a foundation is laid for in silico studies of nuclear organization, shape and mechanics. The lamin A and lamin B networks, together with the lamin-associated spectrins, are simulated within Matlab's programming environment; the model may be extended to include extranuclear forces as well. Localized and global overexpressions and underexpressions of the proteins contained within the model are examined for the effect on the membrane's propensity for displaying the blebbing behavior; these changes may be characterized using both statistical analysis of protein distributions and the digital image analysis techniques employed for images from in vitro experiments. By observing the transient changes to the lamina structure after the network is disturbed, the mechanisms and mechanics of the laminopathies may be better understood.

ELECTROPHORETIC LIGHT SCATTERING BY MICELLES OF CHARGING AGENT. BY OLOA MICELLES IN A CHARGING AGENT (HEPTANE).

ERIC HSU · BIOMEDICAL ENGINEERING
Advisor(s): Dennis Prieve · Chemical Engineering
Rangos 1 / 12-2:30pm

Dynamic light scattering performed on micelles migrating at their terminal velocities in an applied electric field would allow us to guage the size of charged micelles. It would be very interesting to compare this size to that of all micelles (obtained by dynamic light scattering performed without the electric field).

FIBROBLAST RESPONSE TO EQUIBIAXIAL CYCLIC TENSILE STRETCHING AND HA/PEG GELS WITH GRGDS PEPTIDE

REVA STREET · BIOMEDICAL ENGINEERING
Advisor(s): Abiraman Srinivasan · Biomedical Engineering
Hoch Commons-2nd Floor, Window side / 3-5pm

This study encompasses some initial experiments regarding the response of MC3T3-E1 mouse fibroblast cells to equibiaxial cyclic tensile stretching. Cellular response to stretching and the adhesion of cells on hyaluronic acid-polyethylene glycol (HA/PEG) hydrogels and on HA/PEG gels with added GRGDS peptide were analyzed for cell viability and cell attachment. The results of these initial experiments demonstrate that equibiaxial stretching does not have a detrimental effect on cell viability or attachment.

IN VITRO BIOCOMPATIBILITY AND BIODEGRADABILITY OF TYROSINE DERIVED POLYCARBONATES AS BONE TISSUE ENGINEERING SCAFFOLDS

JAMES DENT · BIOMEDICAL ENGINEERING
Advisor(s): Jinku Kim · Biomedical Engineering
Rangos 1 / 12-2:30

The Armed Forces Institute of Regenerative Medicine (AFIRM) funds research to develop a large number of clinical therapies, primarily to treat wounds sustained during military combat. Research completed at the Bone Tissue Engineering Center (BTEC), at Carnegie Mellon University, is part of the craniofacial reconstruction division of the AFIRM project, and focuses on the development of tissue engineering scaffolds for the purpose of bone tissue regeneration. To work towards a viable treatment, several experiments were completed with tyrosine-derived polycarbonate scaffolds, in order to determine their usefulness as an implantable material which supports and promotes bone and vascular regeneration. These tests included a determination of biodegradability, cytotoxicity, cell proliferation, cell viability, and pharmacokinetics. MC3T3 mouse pre-osteoblasts were cultured in vitro to determine whether or not the polymers are cytotoxic. Confocal microscopy was utilized to confirm that Tyr-PC is capable of supporting cell attachment. Polymer scaffolds which were seeded with the cells and incubated in osteogenic media showed evident mineralization and osteoblast activity. Finally, florescence microscopy was used to demonstrate that the polymer is capable incorporating bovine serum albumin, in a homogeneous distribution. This indicates the potential for the incorporation of growth factors, such as bone morphogenetic-2, in order to drive cell differentiation. From these results, the Tyr-PC polymer exhibited properties which make it a potential candidate for bone tissue engineering scaffolds. The capability of this scaffold as a biomaterial for osteogenesis and angiogenesis will be further quantified with a number of cell studies and bioassays.

NUCLEAR MORPHOLOGICAL EFFECTS AND LOCALIZATION OF THE PROGERIN TAIL DOMAIN IN HUTCHINSON-GILFORD PROGERIA SYNDROME (HGPS)

ALEXANDRA GERMAN • BIOMEDICAL ENGINEERING
ADVISOR(S): KRIS DAHL • BIOMEDICAL ENGINEERING
Rangos 1 / 12-2:30

Hutchinson-Gilford Progeria Syndrome (HGPS) is a rare premature aging syndrome whose devastating clinical manifestations include skeletal dysplasia and hypoplasia, osteoporosis, loss of subcutaneous fat, atherosclerosis and arteriosclerosis in children. It is caused by a de novo point mutation in the LMNA gene which interferes with post-translational processing of Lamin A, a nuclear intermediate filament protein. The mutant Lamin A, called progerin, is incorrectly retained at the nuclear membrane. We hypothesized that since the mutation is located on the tail domain of Lamin A, the tail domain alone is sufficient to cause the nuclear morphological changes and mislocalization we see with full-length progerin. Analysis of fluorescence microscopy images of fixed, immunostained HeLa cells expressing the tail domain progerin allowed us to quantify nuclear morphological parameters, such as circularity and area, and localization of the expressed protein. We found that the tail domain progerin localizes to the nuclear membrane and causes a significant decrease in circularity, similar to its full-length counterpart. Furthermore, we found that the tail domain protein of wild type Lamin A causes a significant increase in nuclear area then a decrease over six days suggestive of lamina network disruption and reorganization. We conclude that the tail

domain of progerin is primarily responsible for the molecular manifestations of HGPS and we intend to quantify the electrostatic interaction of the tail domain progerin with synthetic model membranes. A complete understanding of the molecular determinants of HGPS, which this study has contributed to, will support the use of drugs, such as farnesyl transferase inhibitors, and potential therapies with lipid mediators, such as cholesterol, to treat HGPS.

CHEMICAL ENGINEERING

AICHE STUDENT CHAPTER, CHEMICAL ENGINEERING CAR DESIGN TEAM: CAR CHASSIS DESIGN

BOO KIM · CHEMICAL ENGINEERING
ROBERT WIEGMANN · CHEMICAL ENGINEERING
Advisor(s): James Miller · Chemical Engineering
Kirr Commons-1st Floor, Window side / 3-5pm

Undergraduate Chemical Engineering Car Team built a car to compete in 2008 AIChE national competition. The car is powered by a battery and circuit. The battery consists of copper and zinc electrodes and copper sulfate and zinc sulfate solutions. The stopping mechanism is a reaction using sodium thiosulfate, potassium oxide, hydrogen peroxide, and sulfuric aicd that changes color from transparent to dark blue at a specified time.

BIODEGRADABILITY OF POLYMERIC COATINGS ON REACTIVE NANOPARTICLES FOR GROUNDWATER REMEDIATION

LISA PLIMPTON · CHEMICAL ENGINEERING
Advisor(s): Greg Lowry · Civil and Environmental Engineering
Robert Tilton · Chemical Engineering
Rangos 1 / 12-2:30

Chlorinated organic pollutants such as trichloroethylene (TCE) are a persistent source of groundwater contamination. Researchers in the Departments of Civil and Environmental Engineering and Chemical Engineering have developed nanoscale zero valent iron (NZVI) particles for in situ remediation of TCE-contaminated aquifers. These reactive nanoparticles are modified with a polymeric coating which allows the nanoparticles to transport through groundwater and access the sparingly soluble TCE source zone. The biodegradability of these polymeric coatings must be known in order to accurately determine the long term consequences, if any, of injecting these nanomaterials into aquifers. The biodegradability of the following four polymers was analyzed: poly(aspartate), poly(styrenesulfonate), carboxymethylcellulose, and poly(maleic acid-co-olefin). An aerobic biodegradation test method was used to determine the bioavailability of the polymers. Enrichment studies were done on each polymer in order to isolate bacteria that would readily biodegrade the

polymers. The extent of polymer biodegradation was determined by the evolution of carbon dioxide from bacterial degradation. Results showed that carboxymethylcellulose and poly(aspartate) were the most biodegradable. As expected, poly(styrenesulfonate) was the least biodegradable due to its large ring structure. Therefore, carboxymethylcellulose are poly(aspartate) are potentially acceptable polymeric coatings for NZVI particles. Future work will assess the bioavailability of polymeric coatings that are directly attached to NZVI particles since attached polymers may be inaccessible to bacteria.

CAR CHASSIS DESIGN
TIFFANY CHAN · CHEMICAL ENGINEERING
HAU CHEN · CHEMICAL ENGINEERING
JOHANNA LEE · CHEMICAL ENGINEERING
Advisor(s): James Miller · Chemical Engineering
Kirr Commons-1st Floor, Window side / 12-2:30

The objective of this research project is to design and build three car bodies which will support fuel cell, battery or a biological power source. The car must be able to carry the powering mechanism, motor, gears, and load. Other concerns include frictional forces and load carrying capabilities. Over the course of this project, the team will research the effects of car designs and terrain on performance. The cars will run in the regional and national competitions conducted by the American Institute of Chemical Engineering (AIChE).

CHEME CAR STOPPING MECHANISM
SHAHROZ AZIZ · CHEMICAL ENGINEERING
GAVIN CHEN · CHEMICAL ENGINEERING
YONG KIM · CHEMICAL ENGINEERING
SUDARSAN VENKATACHALAM · CHEMICAL ENGINEERING
Advisor(s): James Miller · Chemical Engineering
Wean Commons-1st Floor, Connan side / 3-5pm

Undergraduate Chemical Engineering Car Team built a car to compete in 2008 AIChE national competition. The car is powered by a battery and circuit. The battery consists of copper and zinc electrodes and copper sulfate and zinc sulfate solutions. The stopping mechanism is a reaction using sodium thiosulfate, potassium oxide, hydrogen peroxide, and sulfuric aicd that changes color from transparent to dark blue at a specified time.

DEVELOPMENT OF A RATIONAL APPROACH FOR FINDING FORMULATIONS THAT PHYSICALLY STABILIZE HUMAN GROWTH HORMONE
AMANDA DIIENNO · CHEMICAL ENGINEERING
Advisor(s): Todd Przybycien · Biomedical Engineering
Rangos 1 / 12-2:30

The tendency of pharmaceutical proteins to aggregate during storage and delivery is an important consideration as aggregates can compromise the effectiveness of the drug or the delivery system and can elicit an immune response. Protein drugs are formulated by adjusting solution composition variables, such as pH, ionic strength, additive type and concentration, to minimize the tendency to aggregate. Rapidly determining whether or not a given protein solution is stable is key to the timely development and commercialization of protein drugs. It is proposed that the osmotic second virial coefficient (B22) can be used as a measure of tendency to aggregate. The Przybycien group has previous data on B22 values for human growth hormone (hGH) over a range of formulation conditions. We will obtain protein plasmids from a commercial source for expression of hGH in an E. coli system and introduce mutations via alanine-scanning mutagenesis or phage display. We will use Self-Interaction Chromatography (SIC) to obtain the retention times of the mutated proteins and use these measurements to determine the B22 values. From this data we will be able to identify specific interaction sites on the surface of hGH and find formulation conditions that reduce the propensity of rhGH to aggregate. The overall aim is to develop SIC as a tool, which can identify the key protein surface residues involved in self-association and find solution conditions that block self-association to physically stabilize proteins.

DRUG DELIVERY TO WOUND SITES TO PROMOTE ANGIOGENESIS USING ENGINEERED HOLLOW FIBERS

BRIAN FREEMAN · CHEMICAL ENGINEERING
Advisor(s): Kris Dahl · Biomedical Engineering
Rangos 1 / 12-2:30

Drug delivery is an important aspect of medical treatment and the ability to regulate dosage time and amount can greatly improve the end result. Drug delivery of growth factors to wound sites to promote angiogenesis using a controlled release mechanism is one method of regulating those factors. The hollow fiber delivery mechanism was designed so that a scheduled delivery of growth factors to endothelial tissue can be explored. It is suspected that certain growth factors exhibit a better response than others and the overall response can increase if these growth factors are released in sequence. The natural delivery of growth factors, such as vascular endothelial growth factor (VEGF) and sphingosine 1-phosphate (S1P), to the body are used to mediate different stages of blood vessel development. VEGF is known to aid in endothelial cell recruitment and microvascular permeability in the early stages of angiogenesis, while S1P acts as a vessel stabilizer later in the process.

The hollow fiber was fabricated using an extraction method in which multiple compositions and flow rates were used to determine the properties of the fiber based on different process levers. The different fibers were analyzed using a Scanning Electron Microscope to determine the void fraction, thickness, and composition. To aide in the removal of the fiber once the drug delivery was completed, a polymer coating of NIPAM was applied to the fiber and tested to determine its effectiveness. The release of the growth factors out of the fiber was analyzed to determine the release profiles of the given molecules. Also, the effective diffusivity and tortuosity were calculated from experimental results to help characterize the release of a given

molecule using a given fiber. Using these parameters, a computer model was developed to try and match the experimental results with theory. The COMSOL diffusion program was used and multiple models of the hollow fiber were proposed. The end result is a compilation of diffusion rates for multiple molecules for multiple fibers using different fabrication parameters. This collection of rates will allow anyone who is using the hollow fiber system can already know the expected diffusion rate when they choose a molecule for delivery.

ENHANCED CATALYST UTILIZATION IN PEM FUEL CELLS VIA ULTRAFAST LASER MODIFICATION OF THE POLYMER EXCHANGE MEMBRANE SURFACE

ALICIA MARRIE · CHEMICAL ENGINEERING
Advisor(s): Jay Whitacre · Materials Science Engineering
Kirr Commons-1st Floor, Window side / 3-5pm

As our society comes to terms with the effects of greenhouse gases on earth's climate, low emission energy conversion technologies like fuel cells will become an important part of power production. Hydrogen PEM fuel cells, which were targeted in this study, utilize noble metals like Pt or Ru to catalyze a reaction between hydrogen and oxygen the products of which are water and energy. One obstacle in fuel cell technology is the high cost of the required catalysts. Current research focuses on the design of cheaper catalyst materials as well as increased catalyst surface area to reduce catalyst costs. This study utilizes a novel approach to the later method by roughening the Nafion membrane surface through ultrafast/femtosecond laser ablation. In this approach, high energy photons are used to modify the surface of the Nafion membrane. This study includes an analysis of the Nafion surface morphology as well as electrochemical tests of PEM fuel cell performance. The results indicate that significant increases in fuel cell performance and catalyst utilization can be achieved with this method.

IN SITU INVESTIGATION OF TRANSITION METALS AS OXYGEN EVOLUTION CATALYSTS IN NEUTRAL SOLUTION

NATALIE BRANDELL · CHEMICAL ENGINEERING
Advisor(s): John Kitchin · Chemical Engineering
Rangos Hallway, 2nd Floor / 12-2:30

Transition metals including nickel, cobalt, iron, and manganese were investigated for their activities towards oxygen evolution catalysis. 0.5mM solutions of each metal were prepared in neutral 0.1M KPi buffer solution, and the maximum current densities of these metals were measured at 1.29 V versus the Ag/AgCl electrode, corresponding to an over potential of 0.283 V. Assuming a typical double-layer capacitance of 60mF/cm2, cobalt and nickel appeared most active in solution, reaching maximum current densities of 4.37mA/cm2 and 1.88 mA/cm2, respectively. Bubble formation was observed on the surface of the electrode. The specific surface areas of the catalysts were calculated through double-layer charging analysis, and determined to be 27.43 cm2/g for cobalt and 33.29 cm2/g for nickel.

SINGLE-WALLED CARBON NANOTUBE'S INTERACTION WITH CELL PROLIFERATION

KELVIN HUNG · CHEMICAL ENGINEERING
Advisor(s): Mohammad Islam · Chemical Engineering
Kirr Commons-1st Floor, Window side / 12-2:30

Currently, there are four main methods of cancer treatment: biological therapy, chemotherapy, radiotherapy, and surgery. Although combinations of the previously mentioned therapies can be successful in curing cancer, the low efficiency and adverse side effects of these treatments are arduously painful with high life threatening possibilities. Thus, this project employs carbon nanotubes, an innovative nanomaterial, and researches how to develop it into an effective bionanotechnological treatment. Previous, fluorescence image of cells infected with single walled carbon nanotubes(SWCNT) showed reconstruction of actin networking. The intentions are to prevent cellular proliferation by modifying the cancer's cytoskeleton and then eradicating it. Actin bundling assay was performed with additions of SWNT at concentrations of 3.97551g/mL in SDS-PAGE, demonstrating the in vitro direct, proportional interaction of SWNT to actin. In addition, confocal imaging of the in vitro and in vivo HeLa, cervical cancer cells, treated with SWNT allowed us to quantify the effect of carbon nanotubes on actin networks.

SYNTHESIS OF NANOPARTICLES WITH CHIRAL SURFACES

SEIF YUSUF · CHEMICAL ENGINEERING
Advisor(s): Nisha Shukla · ICES
Wean Commons-1st Floor, Connan side / 12-2:30

The main issue that this research group is trying to solve is the separation of chiral molecules, an issue that is very important to the pharmaceutical industry. Dr. Shukla's group is attempting to make nanoparticles with chiral surfaces to which one enantiomer of a molecule will attach. This attraction between the nanoparticle and one enantiomer will allow the two different enantiomers to be separated. Wet chemical synthesis will be used to create the nanoparticles because it is a fast and inexpensive synthesis method. The long term goals of the project are to make stable nanoparticles which are enantioselective and to gain a deeper understanding of how to make nanoparticles for specific purposes.

VARIOUS COATING TECHNIQUES OF METALLIC NANOPARTICLES

ELYSE COLETTA · CHEMICAL ENGINEERING
Advisor(s): Nisha Shukla · ICES
Rangos 1 / 12-2:30

The project being studied involves the coating of a variety of shapes and sizes of metallic nanoparticles with different coating materials. The techniques being used involve wet chemical coating techniques using different solvents, including aqueous and organic solvents. Different coating surfactants will also be used. The choice of solvent and surfactant are

important for many different reasons. First, the solvent and surfactant can determine how the nanoparticles are coated. Oftentimes, when coating specific particles or using a specific coating procedure, the specificity of the solvent and surfactant will determine the success of the coating. Also, the solvent and surfactant can be specific to the type of coating being performed. For example one surfactant may be used when coating with silica but a different surfactant may be used when coating with aerogel. The goal of this research is to design multiple easy and efficient methods of coating metallic nanoparticles with various materials. The coating of the nanoparticles is necessary to help improve the applicability and usability of metallicnanoparticles as industry catalysts. The different types of nanoparticles include Gold, Platinum, Palladium, Iron Platinum, Cobalt, Nickel,and others. The ultimate goal of the project is to understand how to successfully coat these different types of metallic nanoparticles so they can be used for different industrial applications.

CIVIL AND ENVIRONMENTAL ENGINEERING

ASSISTANCE WITH SENSOR ANDREW PROJECTS

PETER TROCHA · CIVIL AND ENVIRONMENTAL ENGINEERING
Advisor(s): James Garrett · Civil and Environmental Engineering
Rangos Hallway, 2nd Floor / 12-2:30

With the parallel growths of infrastructural dilapidation and technological development, the massive Sensor Andrew project was launched in 2006 aiming to create a prototype test-bed for the creation of multifarious sensing applications. The ultimate goal of this project is the provision of a viable nervous system for the built-world. My research in this endeavor has primarily concentrated on the Firefly sensing platforms and related devices, focusing particularly on the node and data network interactions

BALLOON POWERED CARS

TANVI BUBNA · MECHANICAL ENGINEERING
KYLE GEE · MECHANICAL ENGINEERING
JONATHAN HERNANDEZ · CIVIL AND ENVIRONMENTAL ENGINEERING
SARAH PFEFFER · MATERIALS SCIENCE ENGINEERING
KONSTANTIN VIDENSKY · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

In our activity, children will build a balloon powered car and learn that energy that is stored can be transformed into kinetic energy. We will demonstrate a pre-made balloon

powered car and encourage the children to hypothesize why the car moves. After the children observe that it is the air moving out of the straw that causes the car to move, we will explain the concepts of conservation of energy, Newton's third law (equal and opposite forces), and conservation of momentum to help the children understand the physical principles behind the motion of the car. We will then show the children how the cars are made, and assist them in the construction of their own cars. When each child has built a car, he or she will test Newton's third Law by varying the amount they inflate their balloon, causing the car to travel varying distances.

CHARACTERIZATION OF COMMERCIALLY AVAILABLE SILVER NANOPARTICLES IN COMMON HOUSEHOLD PRODUCTS

DANIEL SCHOENFELDER · CIVIL AND ENVIRONMENTAL ENGINEERING
Advisor(s): Greg Lowry · Civil and Environmental Engineering
Rangos 1 / 12-2:30

The bactericidal properties of silver nanoparticles are well documented and are being implemented in commercially available products. Limited information is available concerning the nature of the particles after they have been released into the environment. The objective of this project is to characterize silver nanoparticles after they have been released from common household products.

CONCRETE CANOE

GENEVIEVE FUJIMOTO · CIVIL AND ENVIRONMENTAL ENGINEERING
DANIEL SCHOENFELDER · CIVIL AND ENVIRONMENTAL ENGINEERING
COREY TUCKER · CIVIL AND ENVIRONMENTAL ENGINEERING
MIKI URISAKA · CIVIL AND ENVIRONMENTAL ENGINEERING
Advisor(s): Larry Cartwright · Civil and Environmental Engineering
Wean Commons-1st Floor, Connan side / 12-2:30

The Concrete Canoe Team will represent Carnegie Mellon in the Concrete Canoe Competition held at the American Society of Civil Engineers (ASCE) regional conference. As participants in this annual competition, the team will design and construct a canoe made out of a concrete mixture that can be raced by three rowers. We will select our mixture, along with carbon fiber mesh for reinforcement , by conducting research on material strength and floatability using various testing methods. We will also determine a hull design that is effective for racing the canoe, and then construct the canoe by making a mold and pouring the selected mixture.

The competition will be held April 2-4 in 2009 at Western Kentucky University and the goal is to bring a canoe with an effective design that will be competitive. By doing so, the team will improve upon and expand their engineering skills, while also gaining practical experience regarding material testing and construction.

DESIGN, ANALYSIS, AND DESTRUCTIVE TESTING OF IMPACT ATTENUATOR

RACHEL HOESLY · CIVIL AND ENVIRONMENTAL ENGINEERING
JACOB SIBILSKI · MECHANICAL ENGINEERING
Advisor(s): Kenji Shimada · Mechanical Engineering
Hoch Commons-2nd Floor, Window side / 3-5pm

Professional racing organizations across the globe have adopted specific safety standards for the design of the racecars. These requirements continue to become stricter as the governing race bodies' knowledge of human energy absorption limits increases through research and accident investigations; Formula SAE (Society of Automotive Engineering) a student design and formula-style race competition, is no different. This year the FSAE governing body has enacted a requirement that all front impact attenuator designs must be modeled and destructively tested to produce better analysis than analysis previously performed by student teams. This new regulation requires that a 661 lb car traveling at 23 feet per second should undergo no greater than 40Gs on collision with a non-yielding impact barrier, and should average less than 20Gs overall. The goal of this research project is to design, model, and physically test a front impact attenuator for the Carnegie Mellon Racing team (CMR) 2009 racecar. This project will also research and manufacture a structure that will be used to test the energy absorbing ability.

FEASIBILITY OF JATROPHA PRODUCTION IN EASTERN AFRICA

DYANNA BECKER · CIVIL AND ENVIRONMENTAL ENGINEERING
NAKUL GUPTA · MECHANICAL ENGINEERING
DAVID KINSKEY-LEBEDA · CIVIL AND ENVIRONMENTAL ENGINEERING
ANNA LENHART · CIVIL AND ENVIRONMENTAL ENGINEERING
ERICA SPIRITOS · CIVIL AND ENVIRONMENTAL ENGINEERING
SARAH STRANO · CIVIL AND ENVIRONMENTAL ENGINEERING
EDWARD YUEN · CIVIL AND ENVIRONMENTAL ENGINEERING
Advisor(s): Mitchell Small · Civil and Environmental Engineering
Hoch Commons-2nd Floor, Rangos side / 12-2:30

Our research team is formed from within the Carnegie Mellon University chapter of Engineers without Borders, and intends to research the feasibility of small-scale Jatropha harvesting in the rural areas of Eastern Africa to produce bio-fuel and various other side-products for the village market. The Jatropha plant, which typically grows in tropical and arid climates along the equator, is indigenous to the East African region, and produces seeds that contain approximately 35% oil suitable for bio-fuel. Currently, energy access is dependent on the decreasing availability of fuel wood (the primary source of energy consumed in rural areas), as well as the rising prices of petrol, a secondary source. Both fuel wood and petrol have negative environmental, economic, and social consequences for villagers in the region.In this project, we outline the production process of Jatopha bio-fuel, and the impacts of each energy source: petrol, fuel wood, and Jatropha. We also provide

a life-cycle analysis calculator for the use of local Non-Governmental Organizations to determine whether small-scale Jatropha production would be beneficial to specific villages in the East African region, based on various environmental, economic, and social factors.

INTERACTIVE SAILCARS

BENJAMIN ALLEN · ICES
CHRISTIAN CHEN · CIVIL AND ENVIRONMENTAL ENGINEERING
MICHAEL CUSHMAN · MECHANICAL ENGINEERING
SANTIA VALERIO · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

The intent of this project is to teach children about wind power. The children will learn by creating a sail-powered car. While a fan is set to low power the wind created by the fan directs the sail-powered cars down a path. They will learn through trial-and-error which sail types will work best in utilizing the wind power to drive their car. Chopsticks and newspaper are provided to allow the children to experiment with different shapes and sizes of sails and these sails attach to the vertical supports. Children attach their sails to various attachment points on the provided car bases. During the project we will explain to the children how electrical energy is converted into mechanical energy, then converted to wind energy and back again into mechanical energy. We will also explain why certain sail types work better than others based on their shape and size.

MICROBIAL THERMODYNAMICS OF SEDIMENT MICROBIAL FUEL CELLS FOR REMOTE ELECTRICITY GENERATION

ANDREW STOCCHETTI · CIVIL AND ENVIRONMENTAL ENGINEERING
Advisor(s): Kelvin Gregory · Civil and Environmental Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5pm

Sediment microbial fuel cells are known to produce electricity which may be used to power small, remotely deployed sensors for extended periods of time. They take advantage of the natural potential gradient that exists at any sediment-water interface and are ultimately fueled by the presence of microorganisms which oxidize natural organic matter in the sediment and couple this to the production of electricity in a fuel cell. Although a fascinating technology, little is known about how sediment microbial fuel cells work or how their presence may affect the local biogeochemistry. The proposed research will begin to address these needs by evaluating whether the anode of a sediment battery is a more thermodynamically favorable electron acceptor that a variety of common electron acceptors found in sediments. It is hypothesized that the anode of a fuel cell is a better electron acceptor than either nitrate, iron, sulfate reduction or methanogenesis. Sediment microbial fuel cells will be operated in batches using pre-conditioned sediments from Panther Hollow Lake. They will be monitored over time for a variety of geochemical conditions and compared to appropriate controls. Results

from this research will help engineers design and optimize sediment fuel cells for remote electricity generation.

NONUNIFORM DEFORMATIONS IN SINGLE-CRYSTAL SAMPLES

NOLAN KURTZ · CIVIL AND ENVIRONMENTAL ENGINEERING
Advisor(s): Amit Acharya · Civil and Environmental Engineering
Rangos 1 / 12-2:30

Saurabh and I are using a computational framework that uses the Phenomenological Mesoscopic Field Deformation Mechanics (PMFDM) to obtain these results. We have modeled samples that have a nonhomogenous go factor.We investigate this nonhomogenous case for constrained, and unconstrained boundary conditions, which specify the surface flow of dislocations with zero for the constrained case and a nonzero value for the unconstrained case, and conventional plasticity. We then use the computational framework to get results for the same cases but with homogenous go values throughout the crystal. We are using a model that uses a finite element mesh, so we investigate how the mesh size effects the results we get by making the mesh much more refined or much more coarse for a constrained flow boundary condition sample with homogenous go.

We are investigating how nonuniform deformations, such as kink band formation, coarse slip band formation, and macroscopic shear band formation, happen in samples with nonhomogenous or homogenous go and the effects of mesh refinement on these results, particularly with respect to shear band formation, geometric softening, and strain hardening rates. Past models have attempted to model softening in crystals with nonhomogenous boundaries. These models lend themselves to issues with the theory that require too many assumptions and inaccuracies. For these reasons, we are trying to understand how the PMFDM theory predicts softening in homogenous crystals and what it looks like for small strain samples. These methods will give us better methods for understanding how exactly nonuniform deformation occurs in simple crystals, homogenous and nonhomogenous.

POTENTIAL TO KINETIC ENERGY ROLLER COASTER

JENAE PENNIE · CIVIL AND ENVIRONMENTAL ENGINEERING
BRANDON VAN TASSEL · MECHANICAL ENGINEERING
ROSE WEISBURGH · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

The goal of our project is to show the relationship between potential and kinetic energy, through experimentation. In order to teach this lesson, each child will design a roller coaster. The roller coaster will have several requirements including at least one loop and hill. The roller coaster will only work if the heights of at the initial drop, the hill, and the loop are within a specific set of proportions.

THERMODYNAMIC FEASIBILTY OF PLACING MICROBIAL FUEL CELLS IN NATURAL ENVIRONMENTS

JENNIFER LAWRENCE · CIVIL AND ENVIRONMENTAL ENGINEERING
Advisor(s): Kelvin Gregory · Civil and Environmental Engineering
Rangos 1 / 12-2:30

This project determines, through the principle of thermodynamics, the feasibility of placing microbial fuel cells in the natural environment. Four separate situations have been created, one where oxygen acts as the primary electron acceptor in aerobic respiration, another where nitrate acts as the primary electron acceptor in anaerobic respiration, a third where sulfate acts as the primary electron acceptor in anaerobic respiration, and a fourth where methanogenesis is the primary metabolic pathway for bacterial cells. Graphite batteries will be placed into each of these environments, to see if its placement has an effect on the natural processes occuring in the soil.

URBAN FARMING PROJECT AT CARNEGIE MELLON

ANDREW STOCCHETTI · CIVIL AND ENVIRONMENTAL ENGINEERING
SARAH STRANO · CIVIL AND ENVIRONMENTAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5pm

This project built a small, organic, fruit and vegetable farm on Carnegie Mellon's campus. The farm actively mitigates Carnegie Mellon's environmental footprint and educates students about the unsustainable nature of the current global food system. Though Carnegie Mellon purchases some food from local farmers, an on-campus farm will provide students with additional locally grown food and create awarenessabout the importance of sustainable agriculture. The farm is student designed and maintained.

VISUALIZING CONSTRUCTION PROJECT PERFORMANCE THROUGH DASHBOARDS FOR CONTROL AND MONITORING PURPOSES

KATHERINE BASTA · CIVIL AND ENVIRONMENTAL ENGINEERING
Advisor(s): Burcu Akinci · Civil and Environmental Engineering
Rangos 1 / 12-2:30

This research explores visualization of construction project performance for the purpose of control and monitoring through the use of a "dashboard." Various construction industry personnel were interviewed to determine individual information needs and variations due to responsibility or type and size of construction project. At the conclusion of the interview process, the interviews are analyzed to present a clear idea of what information and operations, or criteria, must be supported for a dashboard tool to be effective. Using these criteria, existing software systems are evaluated in order to determine the information gaps that currently exist between what is needed and what isavailable.

ELECTRICAL & COMPUTER ENGINEERING

3D AXONAL BOUTON MODELING AND AUTOMATED DETECTION IN THE MAMMALIAN CENTRAL NERVOUS SYSTEM

SARAH HSIEH · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Jelena Kovacevic · Biomedical Engineering
Rangos 1 / 12-2:30

The aim of this work is to investigate the potential for improving axonal bouton distribution analysis through the use of three dimensional bouton models and detection. The location of axonal boutons, the presynaptic specialization of the synapse, can be used to determine the organization of neural circuitry, and in time-lapse studies, neural circuit dynamics. Previous work in this application used simple geometric models for axonal boutons that account for variations in size, position, rotation and curvature of the axon in the vicinity of the bouton. In these, normalized cross-correlation was used between the model and image data as a test statistic for bouton detection and position estimation. We propose that three dimensional models for axons and boutons will allow us to better utilize information between two-dimensional image slices. Then using three-dimensional normalized cross-correlation, we hope to obtain better performance results for axonal bouton detection. We will present the receiver operating characteristic (ROC) curve for our new implementation and compare them to previous results.

A CONTROLLED WIRELESS NETWORKING TESTBED BASED ON A WIRELESS SIGNAL PROPAGATION EMULATOR

NAM-PHUONG CONG-HUYEN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Peter Steenkiste · Computer Science
Hoch Commons-2nd Floor, Window side / 12-2:30

This purpose of this research is to address how testing for wireless network protocols can be improved. It is accomplished through wireless emulators that recreate the environment, the conditions and specifications, for the testing, so that the physical layer is no longer required. However, without the physical layer, factors such as repeatability, realism, configurability, and isolation are difficult to emulate simultaneously. The proposed summer project involves helping the emulator team to expand the emulator by adding nodes and extending the functionality of the software used for managing experiments.

ASME DESIGN PROJECT: REMOTE CONTROLLED MARS ROVER

JOSHUA BLOSSER · MECHANICAL ENGINEERING
JAIME BOURNE · MECHANICAL ENGINEERING

ANDREW BURKS · MECHANICAL ENGINEERING
SAMANTHA CATANZARO · COMPUTER SCIENCE
JACOB COFFELT · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING
MICHAEL CUSHMAN · MECHANICAL ENGINEERING
MEGAN DORITY · MECHANICAL ENGINEERING
BRADLEY HALL · MECHANICAL ENGINEERING
ANDREW HILLENIUS · ELECTRICAL & COMPUTER ENGINEERING
MICHAEL KAHN · COMPUTER SCIENCE
PAUL KENNEDY · ELECTRICAL & COMPUTER ENGINEERING
SZU-CHIEH LU · MECHANICAL ENGINEERING
CHARLES MUNOZ · UNDECIDED
RICHARD PANTALEO · MECHANICAL ENGINEERING
WEI SHI · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING
BENJAMIN SOM-PIMPONG · MECHANICAL ENGINEERING
DAVID STONESTROM · MECHANICAL ENGINEERING
GAURAV VERMA · MECHANICAL ENGINEERING
Advisor(s): Metin Sitti · Mechanical Engineering
Rangos 2 & 3 / Sigma Xi Group 4, 10:00am

The objective of this project is to allow the design group to gain practical knowledge of the mechanical engineering design process and the dynamics of interdisciplinary teamwork. Based on research gathered over several weeks, a team assembled through the American Society of Mechanical Engineers (ASME) and the Robotics Club will develop and produce a theoretical model using a parametric modeling software package and after prototyping and testing will produce a working physical model. The team will compete in the regional ASME conference in April 2009. The purpose of this project is to develop a remote-controlled robot that will simulate tasks to be performed by future NASA rovers to both mars and the moon. Members of the group will analyze the given problem and come up with solutions designed to maximize efficiency in order to collect and deliver the target objects in accordance with stringent guidelines set forth by ASME. Through the course of this project, the group members will gain valuable skills needed to pursue additional mechanical design projects in the future.

ACCELERATION OF OPTICAL FLOW CALCULATION

BENJAMIN NOWAK · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): James C. Hoe · Electrical & Computer Engineering
Rangos 1 / 12-2:30

Computer vision algorithms have been classified into high level and low level processing. High-level processing is associated with determining meta information about the scene such as meaning. Low-level processing, on the other hand, is used to calculate image features such as depth, motion, and edges. A characteristic of many low-level computer

vision problems is a common stream of repetitive operations applied to many locations in the image. Very Long Instruction Word (VLIW) processing platforms are ideal to take advantage of the dependency free, spatial and operational parallelism present in these algorithms. This research focused on the acceleration of the optical flow calculation on the TI Davinci DM6467 platform. An analysis of the system architecture was conducted. System bottlenecks were examined and several techniques to tolerate or remove them were explored. Suggestions are made to improve the architecture to enable real time calculation of optical flow in HD image streams.

ASSISTIVE AUTOMOTIVE INTELLIGENCE TECHNOLOGY

ILYA KELNER · ELECTRICAL & COMPUTER ENGINEERING
NISARG KOTHARI · ELECTRICAL & COMPUTER ENGINEERING
ETHAN MINOGUE · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): George Kantor Robotics Institute
Kirr Commons-1st Floor, Window side / 3-5pm

This project is the creation and testing of a driving assist technology called Assistive Automotive Intelligence Technology, or AAIT (pronounced "a'ight"), that is designed to give predictive feedback to the user by helping to guide the user's actions, but not supersede them, to provide a safer and easier control of the vehicle. The aim is to make the AAIT system both versatile/robust and fast, so that it can function as designed well beyond the range of normal expected operation.

BOSS FAILURE DIAGNOSIS

LAURA PRITCHARD · ELECTRICAL & COMPUTER ENGINEERING
KISHORE RAMASWAMY · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Priya Narasimhan · Electrical & Computer Engineering
Rangos 1 / 12-2:30

The purpose of this research is to be able to automatically analyze and diagnose errors from log files of the BOSS car, CMU's autonomous vehicle that won the Urban Grand Challenge. The research is geared toward automatically deriving state machines based on the log data, extracting data and control flows, and to pinpoint the source of the problem to a specific node (or even line of code) in BOSS's computerized system.

CHANNEL-AWARE RATE ADAPTATION ALGORITHM

JOSHUA PRIMERO · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Peter Steenkiste · Computer Science
Rangos 1 / 12-2:30

Most rate selection algorithms determine the best transmission rate using a probe-based approach. In dynamic environments, probe-based techniques perform poorly. A channel-aware rate adaptation algorithm (CHARM) was developed in CMU which is able to respond quickly to dynamic channel changes and outperforms the probe-based algorithms in many instances. CHARM is able to do this by passively overhearing messages sent by receivers and thus gain important channel information which allows it to smartly choose the transmission rate.

In my research, I explored ways in improving and refining the algorithm. Specifically, I explored ways to extract channel information such as coherence time and used this to make better rate decisions.

COMPONENT TESTING FOR PRISMATIC CUBES: WHAT COULD POSSIBLY GO WRONG?

NICOLAS PARIS · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Brian Kirby · Computer Science
Rangos Hallway, 2nd Floor / 12-2:30

Inherent to the field of robotics is the need for reliable testing methodologies and structures in order to facilitate the upkeep of robots. In highly complex robots, the coordinated actions of many components are required to work in sync in order to produce meaningful actions. Containing several microcontrollers each, the robots of the Claytronics project have many areas in which a small malfunction in one robot can render an entire formation of robots unfit for the completion of their task. My work has been focused on determining the most likely areas for failure on the robots and building test structures and automated test programs to isolate and identify problematic subsystems.

COMPUTER GRAPHICS AND VISION IN MOBILE ROBOT SIMULATORS

JARED GOERNER · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Maria Veloso · Robotics Institute
Peter/Wright / 12-2:30

Mobile robots with some kind of vision component are becoming more prevalent in cutting-edge robotics research. While simulators with physics engines that allow the user to see what is going on are useful, to aid in the accurate simulation of the robot's behavior a vision component from the simulator should be piped into the robot code the same way as any other sensor might. Using the Open Dynamics Engine and OpenGL, we can pass an image from where a camera is located in the simulator to CMVision, creating results close to that of the actual camera.

DEFORMABLE WHEELS FOR LUNAR APPLICATIONS

ROSS FINMAN · ELECTRICAL & COMPUTER ENGINEERING
JOEL PAZHAYAMPALLIL · UNDECIDED
Advisor(s): David Wettergreen · Robotics Institute
Rangos 2 & 3 / Sigma Xi Group 4, 10:15am

The mobility system of a vehicle intended to operate on extraterrestrial terrain faces unique challenges and the wheels used are particularly critical. The wheels used on a lunar rover in particular, must withstand temperature changes of over 300 C, cope with lunar soil, navigate over obstacles, and, like any other spacecraft component, be extremely light weight. This project intends to develop deformable glass fiber resin wheels that conform to terrain contours and obstacles, for application with Carnegie Mellon's Red Rover project. The project will also evaluate the effectiveness of this wheel and similar designs for future planetary exploration vehicles.

DESIGN OF AN OPTIMIZED CHARGE CONTROLLER FOR THE EFFICIENT STORAGE OF SOLAR ENERGY

DAVID BROMBERG · ELECTRICAL & COMPUTER ENGINEERING
ADITHYA KRISHNAPRASAD · ELECTRICAL & COMPUTER ENGINEERING
WINSTON WAN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Hoch Commons-2nd Floor, Window side / 12-2:30

In order to maximize the efficiency of solar or other alternative energy systems, high-performance, low-loss charge controller devices must be designed. For the most part, energy generated through solar power systems is stored in batteries or capacitors before it is consumed by a load. Charge controllers are the devices that govern this storage process, ensuring minimal electrical losses when energy is transferred from the output of a solar panel to batteries for storage. For this reason, they prove to be vital components of a power-generation system, as they boost overall efficiency and prolong battery life. The proposed research entails the design of a charge controller optimized for non-static, vehicular applications, and includes the construction of an efficient DC-DC converter and the programming of a control algorithm to regulate the output of that converter. The custom charge controller will then be implemented in a full-scale, high-current system, where it will be used to charge a bank of deep-cycle, lead-acid batteries as efficiently as possible according to the charging specifications of the batteries.

DESKTOP MOBILE MANIPULATOR ROBOT SIMULATION

IAN CLANTON-THUON · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Siddhartha Srinivasa · Robotics Institute
Rangos Hallway, 2nd Floor / 12-2:30

This presentation outlines my work on a simulator for a small robot that manipulates paper on a table. The robot has four fixed wheels, which are used both for movement and for manipulation. The simulator allows for real-time control of a virtual robot and paper as well as planning to move the paper to a specified location. I outline the goals of the simulator, describe the algorithms and technologies implemented, and summarize possible future work on the project.

DEVELOPMENT OF AN OPTIMIZED EXHAUST SYSTEM FOR A FORMULA SAE RACECAR

JOSHUA BLOSSER · MECHANICAL ENGINEERING
MING-YANG HUNG · MECHANICAL ENGINEERING
FEDOR KLESHCHEV · UNDECIDED
MICHAEL LIN · MECHANICAL ENGINEERING
ERICA TUCKER · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Kenji Shimada · Mechanical Engineering
John Wiss · Mechanical Engineering
Kirr Commons-1st Floor, Window side / 12-2:30

This project aims to develop an optimized exhaust system for a Honda CBR600F4i motorcycle engine for use in a Formula SAE racecar. This research will utilize drivetrain simulation software to pre-determine the most appropriate exhaust system for the application. A custom exhaust header, manifold and muffler will be developed to fit within the confines of the Formula SAE racecar. The result will be a quieter car that satisfies noise regulations while having higher performance than when using the stock exhaust system. This will allow Carnegie Mellon Racing (CMR) to produce a more competitive product in the areas of design and performance for the Formula SAE Competition.

DOES CAUSAL AMBIGUITY AFFECT EXPLORATORY PLAY IN PRESCHOOL CHILDREN?

BRIAN GOLDFAIN · ELECTRICAL & COMPUTER ENGINEERING
ANDREA POON · BIOLOGICAL SCIENCES
Advisor(s): Anna Fisher · Psychology
Rangos 2 & 3 / Sigma Xi Group 6, 10:00am

People are often faced with ambiguity in everyday situations. At the same time, young children are very poor at recognizing empirical indeterminacy (or ambiguity); they almost never confuse determinate event for indeterminate, but they often consider empirically indeterminate events to be determinate (Fay & Klahr, 1996). However, recent work by Shulz and Bonawitz (2007) suggests that ambiguity affects exploratory play in 4- to 5-year-old children. Specifically, causal ambiguity about how an object works resulted in reduced novelty preference. Conclusions of this study are contrary to the results of many other studies suggesting that 4- to 5-year-old children are poor at recognizing empirical indeterminacy.

The present study present a set of follow-up experiments designed to investigate whether exploratory play in children is affected by causal ambiguity.

DYNAMIC PHYSICAL RENDERING

ERIC CHENG · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Jason Campbell · Robotics Institute
Rangos Hallway, 2nd Floor / 12-2:30

Effective communication between modules in a robotic ensemble is an important aspect of Dynamic Physical Rendering. This project investigates communication techniques from a software perspective as it pertains to communication within and amongst claytronic cubes.

EDUCATION E-VILLAGE PROJECT

SAURABH SANGHVI · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Mary Bernardine Dias · Robotics Institute
Peter/Wright / 12-2:30

The Education e-Village project was created to increase access of technical resources to developing regions around the world. Our specific goal is to create an online virtual community to share technical course ware that can be used to empower a new generation of technologists in developing regions. However, unlike current Open Course ware we want to explore the role of collaboration and online communities in spreading education of technology in developing regions. The goals of the project are to design, implement, launch, and evaluate an online virtual community of post-secondary-school educators dedicated to educating technologists in developing communities around the world. Through E-Village, educators from around the globe will be able to share ideas, experiences, expertise, resources, and strategies for effective technology education in under-resourced regions. The iterative design was created based on feedback from needs-assessment surveys of professors in both developed and developing regions. Conversations with several individuals and organizations in developing regions around the world revealed that many people are seeking increased access to education at all levels. E-village will give educators in developing regions the opportunity to teach more advanced technical subjects which will help students in developing regions use technology to solve challenging problems within their communities. This presentation focuses on the participatory design of E-village and what features are essential for educators to collaborate through a virtual online community.

EDUCATIONAL ROBOTICS

SI YING HU · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Illah Nourbakhsh · Robotics Institute
Rangos Hallway, 2nd Floor / 12-2:30

Through IFYRE funding, I worked with CREATE lab to implement different projects in educational robotics. During the first semester I worked on the creation of vex-recipes. The idea is to implement communication with the Qwerk board from CREATE lab and Vex robotic platforms. From this, I was able to interface the RSS-feed feature from the Qwerk into a robotic whether display. I worked on the mechanical implementation as well as the robotic behavior programmed in Java to parse the feeds. Currently for the second semester, I am working to create programs in Java that showcase the ranges of possibilities from the finch robot, which is a robot that seeks to teach programming to beginners. It has many sensors so that a student can explore and solve concrete problems, while learning the basics of computer science and also basic robotic behavior.

ENERGY STORAGE OPTIMIZATION: SOLAR PANELS AND ELECTROCHEMICAL CAPACITORS

NORA TARANO · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Tim Hoffman · Computer Science
Rangos Hallway, 2nd Floor / 12-2:30

This Solar Panel Research includes the assessment of the efficiency of Gallium Nitride, and other materials, in solar cells to absorb ambient light, and the use of nanophysics and electrochemical capacitors to optimize the storage of the generated electricity. This work, in alliance with the Intel Research lab at Carnegie Mellon, looks forward to energy generation and storage alternatives for portable electronics, such as laptops. Our tests and findings might provide insight into higher-efficiency charging and recharging of the energy-storage devices (i.e. small-sized electrochemical capacitors) used in conjunction with said electronics. Currently, self-education on solar cell and electrochemical capacitor usage in the market are the main foci, but it is planned to further findings in the near-future.

ENVIRONMENT MAPPING WITH A LOW-COST ROBOT COLONY

JAIME BOURNE · MECHANICAL ENGINEERING
AUSTIN BUCHAN · ELECTRICAL & COMPUTER ENGINEERING
BRIAN COLTIN · COMPUTER SCIENCE
SIYUAN FENG · COMPUTER SCIENCE
CHI-HSIU HONG · COMPUTER SCIENCE
JAMES KONG · ELECTRICAL & COMPUTER ENGINEERING
CHRISTOPHER MAR · ELECTRICAL & COMPUTER ENGINEERING
VICTOR MARMOL · COMPUTER SCIENCE
EVAN MULLINIX · ELECTRICAL & COMPUTER ENGINEERING
BRADFORD NEUMAN · COMPUTER SCIENCE
BENJAMIN POOLE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DAVID SCHULTZ · PHYSICS
JOHN SEXTON · ELECTRICAL & COMPUTER ENGINEERING

KEVIN WOO · ELECTRICAL & COMPUTER ENGINEERING
ANDREW YEAGER · COMPUTER SCIENCE
BRADLEY YOO · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s):George Kantor · Robotics Institute
Pake / Oral 3, 12:40pm

Environment mapping is the process of constructing a map with features relevant to a task without any initial knowledge of the environment. The Colony project would like to implement a mapping behavior with our low-cost colony of robots. Our goal for this research is enabling the robots to cooperatively construct a map of a simple two-dimensional environment with some coordination from a central computer. Key aspects of this research will involve making the best use of multiple, distributed, mostly autonomous agents while still gaining an accurate representation of their environment. This work is a continuation of previous Colony project research, and will serve as a foundation for future endeavors.

EXTENDING RELIABILITY IN NETWORKS-ON-A-CHIP (NOCS) WITH NONLINEAR POWER-PERFORMANCE TRADEOFFS

RYAN SAKAUYE · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Donald Thomas · Electrical & Computer Engineering
Rangos 1 / 12-2:30

In computing systems, the integration of multiple processors and memories on a single chip is increasing. Due to deep submicron effects, wear-out related permanent faults become more frequent for smaller processes, making system reliability an increasingly important issue. Many newer devices use voltage and frequency scaling to reduce power consumption when the device does not need to operate at full capacity. Such scalings, like those used in Intel's Atom processor, lead to a nonlinear power-performance trade-off. The goal of this research is to investigate the effect of various task mapping heuristics on the reliability of networks-on-a-chip (NoCs) with homogeneous resources and nonlinear power-performance trade-offs.

EXTENDING THE BRAILLE WRITING TUTOR FOR INCREASED IMPACT IN TEACHING FRENCH AND ARABIC BRAILLE

AMAL EL-GHAZALY · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Mary Bernardine Dias · Robotics Institute
Rangos Hallway, 2nd Floor / 12-2:30

Because of the need for increased literacy among the blind in developing countries, Carnegie Mellon University's TechBridgeWorld group (*www.techbridgeworld.org*) developed an automated device to tutor braille writing in English. Through the IFYRE 2008-2009 program, we worked towards expanding the tutor's functionality to the French and Arabic languages. We compiled information about the braille alphabet in each of the

languages and reconfigured the braille tutor software to support each different alphabet. In addition, since computer visuals and graphics are of no use to visually impaired learners, we created new sound files spoken in the two new languages. These sound files are the main form of communication with a visually impaired learner.

Next, we need to examine any specific difference in the teaching methods of braille in each of these languages to ensure that the expansion of functionality is accurate and effective. Thus, ongoing research includes collaborating with foreign French and Arabic schools for the blind to examine specific teaching methods for each of those languages. We will make adjustments to customize the tutoring methods to adapt to local teaching curricula.

FEATURE EXTRACTION AND IDENTIFICATION FROM NHL HOCKEY VIDEO

WILLIAM MCHENRY · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Priya Narasimhan · Electrical & Computer Engineering
Rangos 1 / 12-2:30

Attempt to analyze frames of video of NHL hockey games to extract useful features. This includes finding features to find a mapping of image pixel to ice location, then locating where different players are, and identify which team and number corresponds to each player.

FERROFLUID ACTUATION IN ROBOTS

ROHAN ALETTY · ELECTRICAL & COMPUTER ENGINEERING
JOHN BRESSON · COMPUTER SCIENCE
MATTHEW FIORILLO · PHYSICS
RENTARO MATSUKATA · ELECTRICAL & COMPUTER ENGINEERING
ANDREW TAN · UNDECIDED
Advisor(s): Seth Goldstein · Computer Science
Rangos 2 & 3 / Sigma Xi Group 4, 10:30am

An actuator for a robot with no moving parts using solely ferrofluid and magnetism.

INCREASING SOLAR PANEL SHADE RESISTANCE TO MAXIMIZE POWER EFFICIENCY

DAVID BROMBERG · ELECTRICAL & COMPUTER ENGINEERING
YUAN LI · ELECTRICAL & COMPUTER ENGINEERING
WINSTON WAN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Hoch Commons-2nd Floor, Rangos side / 12-2:30

For the most part in today's world, solar energy exists as a largely untapped source of electrical power in mobile applications. Renewable energy sources, like solar power, can only gain

widespread use to power vehicles and other mobile devices through significant redesign to increase efficiency. The proposed research regards just that redesign, one based on ideas to increase a solar panel's resistance to shade (a factor that could significantly increase power output) without having to purchase high-cost solar cells. This research is unique as compared to other solar panel redesign proposals in that it is specifically targeted at moving panels. If a panel is stationary, it can be placed in an area that tends to receive ample sunlight, whereas if the panel's position is always changing, any time a shadow is cast on even a small part of the panel there can be a great reduction in output power. These moving panels find special use on vehicles, such as cars and boats.

INTEGRATION OF PHYSICS-BASED CHEMICAL MECHANICAL POLISHING MODEL INTO COMPUTER AIDED DESIGN OF INTEGRATED CIRCUITS

TRAVIS IWANAGA · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Cecil Higgs · Mechanical Engineering
Rangos 1 / 12-2:30

The use of chemical mechanical polishing (CMP) in the fabrication process of integrated circuits (IC) has allowed for aggressive interconnect patterns and over eight metal layers in modern microprocessors. As we move into deep sub-micron technologies, non-idealities during polishing, such as dishing and erosion, begin to play an increasingly significant role in device yield and performance. Ideally, designers should be able to consider the effects of CMP before the costly fabrication step. Physics-based models of CMP have been shown to qualitatively match experimental results. Proof of concept work in integrating the wear data from these models into computer aided design (CAD) of IC's is demonstrated, showing the effects on the parasitic resistance and capacitance.

INVESTIGATING RELIABILITY AND ROBUSTNESS IN A LOW-COST ROBOT COLONY

JAIME BOURNE · MECHANICAL ENGINEERING
AUSTIN BUCHAN · ELECTRICAL & COMPUTER ENGINEERING
RYAN CAHOON · COMPUTER SCIENCE
BRIAN COLTIN · COMPUTER SCIENCE
EMILY HART · ELECTRICAL & COMPUTER ENGINEERING
CHI-HSIU HONG · COMPUTER SCIENCE
JAMES KONG · ELECTRICAL & COMPUTER ENGINEERING
ABRAHAM LEVKOY · ELECTRICAL & COMPUTER ENGINEERING
CHRISTOPHER MAR · ELECTRICAL & COMPUTER ENGINEERING
EVAN MULLINIX · ELECTRICAL & COMPUTER ENGINEERING
BRADFORD NEUMAN · COMPUTER SCIENCE
NICOLAS PARIS · ELECTRICAL & COMPUTER ENGINEERING
BENJAMIN POOLE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING

DAVID SCHULTZ · PHYSICS
JOHN SEXTON · ELECTRICAL & COMPUTER ENGINEERING
KEVIN WOO · ELECTRICAL & COMPUTER ENGINEERING
ANDREW YEAGER · COMPUTER SCIENCE
BRADLEY YOO · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): George Kantor · Robotics Institute
Rangos 2 & 3 / Sigma Xi Group 4, 10:45am

The overarching goal of the Colony project is to maintain a flexible yet inexpensive group of robots for researching emergent behavior and cooperative problem solving. To this end we have implemented several features and behaviors over the years, but rarely have we been able to operate the entire colony of robots in concert for days at a time. The two main obstacles to this goal are an inconsistency in robot I/O capabilities and the inability to recognize and recover from failure. Through research into stability and robustness we seek to better understand the capabilities of the robots by quantifying their performance and that of the Colony as a whole. Developing this benchmarking system will provide an incredibly useful tool for debugging and assessing the feasibility of future projects.

INVITRO CATTLE POSITION TRACKING USING WIRELESS COMMUNICATIONS

KENDALL LOWREY · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Priya Narasimhan · Electrical & Computer Engineering
Peter/Wright / 12-2:30

Cattle herds are frequently left to graze over large areas of land without herders to monitor the status of the herd, and, in the scope of this research project, they are unable to prevent the theft of the individual cows. Being able to track the position and heart rate of each member of the herd from a central location would allow caretakers to avoid the theft of their valuable cows and view deviations in cow behavior. Due to the constraints of the environment, an internal device was chosen as the platform for the embedded system, with heart rate being tracked by microphone, and Zigbee used for the wireless protocol. The movement of the cattle was tracked by using a known cow positions to track unknown positions, all relative to the known central location position. By relaying the position and heart rate information along the cow herds to the central location, the power requirements for transmit can be kept low with a target product lifetime of two years.

LINE SCAN!!!

DANIEL BURROWS · ELECTRICAL & COMPUTER ENGINEERING
KEVIN HUNG · INFORMATION SYSTEMS
YOUNG HO KIM · STATISTICS
Advisor(s): William Eddy · Statistics
David Friedenberg · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

Line scan is a technology currently used to monitor brain activity using a laser. Research has been done on small live animal using this technology. However, each line scan does not occur instantaneous, so the results contain systematic movements of the animal's breathing and heart beat. Our goal is to remove these systematic movements and create an accurate representation of the animal's brain.

LOCATION-BASED CONVOLUTION REVERB

DAVID TUZMAN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Roger Dannenberg · Computer Science
Peter/Wright / 12-2:30

We aim to produce a more realistic-sounding stereo reverberation effect through different impulse response procedure and application.

LOW-COST MOBILE PERFORMANCE MONITORING DEVICE FOR INTEGRATED MECHANICAL AND ELECTRICAL SYSTEMS

MARK FUGE · MECHANICAL ENGINEERING
GIRIDHAR PATHAK · ELECTRICAL & COMPUTER ENGINEERING
CHUNKIT YU · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Kirr Commons-1st Floor, Window side / 3-5pm

When dealing with complex integrated mechanical and electrical systems, identifying important performance information can be difficult or expensive, especially when proper laboratory equipment is unavailable. When performing field tests, you are often interested in monitoring several different aspects of your system and are forced into purchasing many specialized measurement devices. Through our research project we plan to design and develop a low cost, extensible, mobile testing unit that is capable of monitoring several different physical phenomenons simultaneously, removing the need for several independent devices. By combining the monitoring and display functions into one unit with several sensors, we are providing a toolkit by which operators can measure the performance of a basic mechanical/electrical system without the need for a laboratory setting or expensive equipment. This low-cost solution must provide invaluable monitoring capabilities for small to large scale systems, allowing for fault prevention or for optimization of performance. While there are some pre-existing solutions to performance monitoring, such as LabVIEW, these solutions either are expensive or limit mobility. Our proposed system will incorporate sensors measuring a host of performance metrics such as RPM, current draw, force, and speed, all without needing an external computer. This information will be recorded or displayed for human operators in real time, allowing for inexpensive monitoring of an electric motor system driven by a motor controller. This system will need to be extensible enough for the development of further measurement capabilities, and can act as the basis of future research in mobile testing applications.

MOBILE EAGLE: TAKING THE "STORE" OUT OF "GROCERY STORE"

BRYAN HINCH · ELECTRICAL & COMPUTER ENGINEERING
SUDEEP YEGNASHANKARAN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Priya Narasimhan · Electrical & Computer Engineering
Rangos 1 / 12-2:30

Mobile Eagle is an online grocery shopping application built for mobile platforms from the ground up with collaboration from Giant Eagle. The intent is to provide a web-based portal that will combine the ease and convenience of "smart shopping" with grocery shopping with mobile devices. Currently the application offers users history-based predictive shopping lists, recipe cross-references, personalized discounts, Fuel Perks calculation, inter-brand product suggestions, and store-based shopping route calculation.

With this platform, we create the potential for many, in-depth user studies based on brand selectivity, pricing and in-store product placement effectiveness, item popularity, seasonal marketing strategies, and much more.

MOBILE PREDICTIVE SHOPPING LIST

EILEEN MIN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Priya Narasimhan · Electrical & Computer Engineering
Wean Commons-1st Floor, Connan side / 12-2:30

Forgetting to buy something you need is probably a common experience especially if you go grocery shopping regularly. Since everyone carries their mobile phone at all times at this time and age, a mobile application with a predictive shopping list can help shoppers remember what they need to buy, even if they forgot to put it in their own list! By taking a history of the user's grocery shopping and analyzing the pattern in which items are bought, the application can remind the user when it is time to buy certain items.

MODELING AND VISUALIZATION OF MEMS MODELS FOR CAD LEARNING

CHUNKIT YU · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s):Gary Fedder · Electrical & Computer Engineering
Rangos Hallway, 2nd Floor / 3-5pm

Design of Microelectromechanical System (MEMS) often involves complex system integration and variable definition. There is a need to optimize the model library to speed up simulation of large-scale system and provide a library of models with varying physics complexity for both advanced and novice users. This projects targets to tailor the MEMS model library for new users and construct visualization for these models. Cadence and VPython/Matlab will be used to serve the purpose of the project. Another goal of this project is to write a tutorial providing information about the models such as short introduction and physical properties.

MYRON: SMART FOOTBALLS FOR AUTOMATED COACHING

STEVEN ELIA · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Priya Narasimhan · Electrical & Computer Engineering
Rangos 1 / 12-2:30

Through a series of related projects, Myron focuses on developing new technologies that assist football coaches in training players on various aspects of the game (e.g., how to properly throw or kick the football). These key tasks often involve repetitive instruction on the part of the coach, and it would be useful to supplement this human supervision with automated coaching feedback the player can follow himself.

Using a combination of sensors, wireless protocols, and embedded devices, the smart football can be tracked in real time in 3D space, even when it is obscured under a pile of players (making computer vision techniques difficult to use in such situations). This works in tandem with other enhanced athletic equipment (e.g., gloves worn by the players) that is used during training in order to track the players' contact with the football to determine their control and possession of the ball. All of the sensory capabilities provided to the football equipment should allows for extracting key statistics (e.g., hang time) that will inevitably be useful in training and coaching games.

The research challenges underlying these projects involve not only designing smart football equipment that meets the overall objectives, but also ensuring that the resulting equipment does not detract from the way that the game is played or from the players' level of comfort with the equipment. To that end, the enhancements aim to be compact in form factor, low in power usage, and low in weight so that the performance (e.g., torque and weight of the football) of the equipment is not adversely impacted.

NANOCOMPOSITE THIN FILMS

AANCHAL RAJ · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Michael McHenry · Materials Science Engineering
Rangos Hallway, 2nd Floor / 12-2:30

The purpose of this project is to investigate the properties of amorphous and nanocrystalline phases of FeCo-alloys, since FeCo is an essential part of soft-magnetic materials. The thin films are of composition Fe5Co95 and will be characterized via nanocrystalization, magnetization, and possibly oxidation properties. All samples of varying thickness will be characterized using X-ray analysis and VSM. The Al2O3 capped samples and even some uncapped samples will then be annealed in a vacuum to introduce the nanocrystalline phase, which will be analyzed again using X-ray and VSM. The uncapped samples may also be subjected to oxidation to observe the effects it has on the amorphous phase. The data from the X-ray analysis and VSM will enable effective characterization of specific magnetic properties of Cobalt-rich amorphous thin films.

NANOPARTICLE CHEMIRESISTIVE SENSOR MODELING

KELLY FRANK · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Gary Fedder · Electrical & Computer Engineering
Hoch Commons-2nd Floor, Rangos side / 12-2:30

The objective of this research is to develop a model of chemiresistive sensors made from conductive gold nanoparticle materials. Sensitivity to various volatile organic compounds and long-term drift of the output signal will be experimentally characterized. The results will be analyzed and incorporated into a Verilog-A model of the chemiresistor for circuit simulation. Preliminary testing has shown a electrical turn-on drift that exhibits an exponential decay with a time constant on the order of one hour. Driving the sensor with a square-wave modulation voltage allows modification of this behavior. The hypothesis is that with an appropriate predictive model, the electrical drift can be nulled by setting the duty cycle of the modulation appropriately. I will be trained to use an existing chemical testbed in Roberts Hall, and will learn how to program in LabView in order to customize my own test protocols. Ultimately we will attempt to put the sensors in feedback to stabilize the drift, using LabView as the controller. This will be done in collaboration with the Chemistry department, and I will be working with three graduate students working on related topics.

OPTIC IMAGE CORRECTION - OCT

SUREKHA MURALIDHARAN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Mei Chen · Unknown
Sheng-Chung Liao · Unknown
Tim Hoffman · Computer Science
Rangos Hallway, 2nd Floor / 12-2:30
Class of '87 / Oral 8, 3:00pm

Worked to identify vessels in ophtalmolgic images for use in comparision with a correction algorithum. In addition, worked with simpler forms of the algorithum involving SV-train and Predict.

PERSONAL ROBOTICS

KUN QIAN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Siddhartha Puri · Electrical & Computer Engineering
Rangos Hallway, 2nd Floor / 12-2:30

I will be presenting the GUI's I wrote for Intel.

POWERING YOUR OWN CART: EXPLORING SPEED AND POWER THROUGH TRANSMISSIONS

JEFFREY BIZZAK · ICES

YIXIN LIU · ELECTRICAL & COMPUTER ENGINEERING
ELIZABETH SCHWARTZ · ICES
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

In this project, students will learn about mechanical advantage through different gear ratios. They can explore the trade-off between speed and power. By manipulating a system of color-coded gears mounted on a pegboard, the children will learn that the distance of rotation (input) due to different gear ratios affects the displacement (output) and power (output) of the system. In addition, the students will have a chance to use a gear system to propel themselves on a platform cart. The children will use a crank that is connected to the front axel of the cart to learn about the transfer of power from the hand crank to the cart wheels.

ROTATING SPHERICAL ROBOTIC EXPLORER (ROSPROBE) DYNAMICALLY STABLE MOTION AND SENSING INSIDE RIGID SPHERICAL HOUSING
JOSHUA CAPUTO · ELECTRICAL & COMPUTER ENGINEERING
DAVID STONE · PHYSICS
Advisor(s): Metin Sitti · Mechanical Engineering
Hoch Commons-2nd Floor, Window side / 12-2:30

Through funding from SURG and SURF, the ROSPROBE concept of a robot housed inside a rigid spherical shell which causes rolling of the shell through the use of a single drive wheel has gone through several iterations. Here we present the latest iteration of the robot and discuss the results of the project thus far. The current iteration of the robot is capable of turning while in motion and has overcome major problems with the predictability of motion and the quality of shell construction. We believe ROSPROBE now provides a viable mobile robotic platform and future research aims to implement computer control to enable exploration of complex environments.

ROBORCHESTRA IV
LAURA ABBOTT · COMPUTER SCIENCE
ROHAN ALETTY · ELECTRICAL & COMPUTER ENGINEERI
ANDREW BURKS · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING
MATTHEW FIORILLO · PHYSICS
JAYWOO KIM · MECHANICAL ENGINEERING
LESLEY LINNE · COMPUTER SCIENCE
RICHARD PANTALEO · MECHANICAL ENGINEERING
ERICA SANDBOTHE · COMPUTER SCIENCE
MICHAEL SANDBOTHE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING

STEFAN SULLIVAN · MUSIC
GREGORY WILLIAMS · COMPUTER SCIENCE
Advisor(s): Roger Dannenberg · Computer Science
Hoch Commons-2nd Floor, Rangos side / 3-5pm

The RobOrchestra project is dedicated to the creation of music using technology coupled with art. Now in its fourth year, RobOrchestra has created a number of robots with specific musical functions and generated meaningful ways for them to play together cooperatively. This year, RobOrchestra hopes to expand its technological outreach to other instruments as well as creating methods for humans to interact with the robots' performance. In this manner we will expose the connection between science and art by showing the mathematical complexity of music and the artistic possibilities of robotics.

SCM PROJECT
RICHARD WANG · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Peter Steenkiste · Computer Science
Rangos 1 / 12-2:30

Create a high-speed link between an FPGA and a PC with an off the shelf Ethernet controller.

SILICON LISTENER
GEOFFREY DIXON-ERNST · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Richard Stern · Electrical & Computer Engineering
Hoch Commons-2nd Floor, Window side / 3-5pm

Extraneous noise is an unwanted feature of audio recordings. For live music recordings, crowd noise can be particularly detracting from the recording of the music. Fortunately, the extraneous noise has certain features that distinguish it from the desired music. By decomposing the recording into its building blocks, the noise can be separated from the music by selectively removing noises that have certain features. This allows for the removal of unwanted noise from a noisy recording.

TASK ASSIGNMENT AND NETWORK ROUTING IN INTEGRATED CIRCUIT NETWORKS-ON-CHIP USING LP
BRADLEY MILLER · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Donald Thomas · Electrical & Computer Engineering
Rangos 1 / 12-2:30

As transistors continue to become smaller, network-on-a-chip (NoC) devices will be able to include more processors and memories with greater capacities. Unfortunately, due to smaller transistor sizes, these devices will also fail sooner. To increase the mean time to

failure of NoC devices, redundancy may be introduced on the architectural level. This will allow redundant components to compensate for failed components. However, in order to determine the usefulness of a given redundant architecture, it is necessary to know exactly how the redundant resources can best be used to meet the computational requirements of the system. This project uses linear programming to assign computational and storage tasks to processors and memories respectively, and assign network traffic to a specific path or paths in the network. To allow for maximal use of redundant resources, provision is made to allow a given computational task to require a different number of instructions on different processing elements.

THE MAPPRENTICE PROJECT

JON MILLER · ELECTRICAL & COMPUTER ENGINEERING
SEAN MOORMAN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Anind Dey Human Computer Interaction Inst.
Hoch Commons-2nd Floor, Rangos side / 12-2:30

The Mapprentice Project is software which provides customized routes for drivers. This application is particularly useful for the elderly and people with certain driving preferences.

THE MIND AND THE MUSCLE

KWABENA AGYEMAN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): James C. Hoe · Electrical & Computer Engineering
Rangos Hallway, 2nd Floor / 12-2:30

The Mind and the Muscle are two parts of a powerful computer system that will be designed to allow students and hobbyists to learn about and design complex computer systems with little knowledge of electrical engineering, while at the same time simplifying everything they need to know in a safe programming environment. This research project explores the design of a new type of educational computer system made for students and hobbyist.

THERMO-OPTICAL MODELING OF NEAR FIELD OPTICAL SOURCES

CHEN SONG · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Jim Bain · Electrical & Computer Engineering
Rangos 2 & 3 / Sigma Xi Group 5, 11:15am

This project will address modeling of near field optical sources using COMSOL for application in heat assisted magnetic recording (HAMR). This will involve solving the optical fields interaction problem with small metallic structures near conducting surfaces and optimization of the waveguide. The overall project goal is to help move the research project towards structures that can produce smaller, more intense, more efficient optical spots. As an initial calibration of the model, this work will examine Mie scattering

from small metallic spheres that can be solved analytically. As time permits, mechanical deformations of the apertures will also be considered.

VEHICLE PROPULSION DYNAMICS
JONATHAN BATES · SELF-DEFINED
ALEXANDER HANSON · ICES
AANCHAL RAJ · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

Using a simple mousetrap powered vehicle, children will be challenged to find propulsion configurations that meet distance and power objectives. This is accomplished by a modular car design with multiple gears mounted to the rear axle and variable length lever arms. Children will be asked to collaborate in pairs to achieve greatest distance on flat ground, up a ramp, and to win in a race. The exhibit will reinforce basic propulsion, energy conservation, and mechanical advantage concepts. It will also provide a template for iterative design. The ability to rapidly change configurations will allow for multiple attempts at the same objective. The concepts behind engineering design are further developed by the optimization process.

VEHICULAR NETWORKING EMULATION
ABRAHAM REN · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Peter Steenkiste · Computer Science
Rangos 1 / 12-2:30

Wireless networking is currently a technology mostly limited to stationary access points and users. In this project, the researchers explore the development of an emulation tool combining the technologies of CMU's own wireless emulator and a traffic modelling tool called SUMO. The result will hopefully be a means of measuring the limitations of WiFi technology and standards, in producing stable and functional network connections between rapidly moving vehicles.

WII WANT TO WRITE: AN ACCELEROMETER BASED GESTURE RECOGNITION SYSTEM
JEFFREY LAI · ELECTRICAL & COMPUTER ENGINEERING
TIAN SENG LEONG · ELECTRICAL & COMPUTER ENGINEERING
JEFFREY PANZA · ELECTRICAL & COMPUTER ENGINEERING
PETER PONG · COMPUTER SCIENCE
Advisor(s): Jason Hong · Human Computer Interaction Inst.
Rangos 2 & 3 / Sigma Xi Group 4, 11:00am

The popular adoption of accelerometers in entertainment and mobile communication devices allows the use of physical gestures as an additional source of input. In particular, the successful

adoption of accelerometer technology in the iPhone and the Wiimote (a controller for the Nintendo Wii gaming console) reveals the untapped potential of physical gestures as an intuitive form of user input. As a result, the necessity to accurately recognize acceleration data is becoming increasingly relevant. In this paper, we present a gesture recognition algorithm that recognizes user's gestures based on input signals from a 3-axis Analog Device ADXL330 accelerometer in the Wiimote. We explored the use of Dynamic Time Warping (DTW) as a means to classify accelerometer data. In a study comparing our DTW classifier with the Hidden Markov Model (HMM) and the feature based classifier on recorded gestures, we found that our classifier obtains 94% accuracy using only one training example and over 97% accuracy using 3 or more examples. In addition, our classifier is able to obtain satisfactory recognition accuracy using training data from one user and validation data from another user. Results have also shown that the algorithm is generally unaffected by varying size and speed of the gestures. Code and data presented in this paper are available online at *http://www.wiiwant2write.com*.

WIRELESS SENSOR NETWORKS FOR WIDE-AREA, LONG-TERM MONITORING

BENJAMIN CHIDESTER · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Bruce Krogh · Electrical & Computer Engineering
Rangos 1 / 12-2:30

The area of wireless sensor networks has been a growing area of research as the span, mobility, and flexibility demanded by sensor networks has surpassed the reasonable capabilities of wired networks. Though such capabilities are enabled through wireless communication, new complications are also introduced that must be addressed and resolved. This project is motivated from the need to create more efficient and effective solutions to these problems, specifically the issue of power conservation and the resulting life expectancy of a wireless sensor network.

This project will encompass the development of a wireless sensor network, as well as the software applications that will manage network protocol parameters, node selection for activation, data requests and storage, and user interaction, for research specifically on monitoring carbon dioxide sequestration sights. Firefly sensor nodes will be programmed to collect data from the surrounding environment and transmit it to a gateway Firefly node over a multi-hop ad hoc wireless network. A network management software application will be designed to monitor the data sampled by the network, as well as the health of the network, and to send requests for specific data from nodes via communication with the gateway. A node selection algorithm run in MATLAB will analyze the received data from the network management and communicate with the network management to activate nodes for future sampling periods.

Experiments will be run to determine the characteristics of the network, such as message latency, power consumption, and transmission reliability. Modifications to the network protocol, Firefly node software, and node selection algorithm will be made in response

to observed efficiency of the system, with the ultimate purpose still to reduce power consumption. The goal of this project is that such necessary modifications can be determined and reported for the benefit of developing low power consuming wireless sensor networks in the future.

YINZ CAM
DAN DANCESCU · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Priya Narasimhan · Electrical & Computer Engineering
Peter/Wright / 12-2:30

Yinz Cam involves large-scale wireless video streaming in an indoor venue, such as a hockey arena or a football stadium. The intent is to allow fans to experience interactive entertainment, select camera angles, receive data feeds, etc., on their mobile devices while inside the indoor venue, with the intention of enhancing their viewing experience of the game. The research issues underlying this project include streaming video over WiFi to hundreds, if not thousands, of devices, being energy-sensitive to the viewing of video on mobile devices, supporting multiple different kinds of mobile devices, and ensuring end-to-end reliability for the delivery of the service to the mobile devices.

ICES

CRANK THAT
JACOB BEATTY · ICES
MANA HESHMATI · ICES
FEDERICO RIOS · DESIGN
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

Through the application of a mechanism that demonstrates the process of transforming rotational energy into linear energy, young students will learn about mechanical advantage. This mechanism includes a crank and gear system. When the crank is turned, the gear will lift a rack which holds a weight. The weight is too heavy to be lifted by hand, but when using the mechanism, students will realize that it is easy to overcome the forces of gravity. This project teaches the importance of mechanical advantage, and how through turning a set of gears that are attached to a rack, rotational energy can be transferred into linear motion.

HUMAN POWERED GENERATORS
ADAM KNOWLTON · ICES
JUSTIN PRATT · ICES

JUSTIN WHALEY · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

Our project will show children the transformation form mechanical to electrical energy. Area students will use simple DC generators powered by hand and drills to create enough current to power a small LED. By connecting the wires to an ammeter, the children can see how mechanical input work relates to electrical energy output as well as the importance of efficient generators. Finally children will have the opportunity to power energy efficient and energy inefficient lights in order to learn the importance of energy efficiency.

INTERACTIVE EXPLORATION OF COMPRESSED AIR
MICHAEL LIN · MECHANICAL ENGINEERING
JOSEPH MEYER · MECHANICAL ENGINEERING
KESHAV RAGHAVAN · ICES
JOHN SMARTO · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

The Interactive Exploration of Compressed Air activity teaches middle school children about the storage of energy in compressed air and also the transformation of that stored energy to kinetic energy. To achieve this, the activity is centered around experimenting with a bicycle-pump-powered air cannon. By varying pressures, launch angle, projectile shape, and other variables, the children will leave with hands-on experience with energy transformation using compressed air.

INTERACTIVE SAILCARS
BENJAMIN ALLEN · ICES
CHRISTIAN CHEN · CIVIL AND ENVIRONMENTAL ENGINEERING
MICHAEL CUSHMAN · MECHANICAL ENGINEERING
SANTIA VALERIO · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

The intent of this project is to teach children about wind power. The children will learn by creating a sail-powered car. While a fan is set to low power the wind created by the fan directs the sail-powered cars down a path. They will learn through trial-and-error which sail types will work best in utilizing the wind power to drive their car. Chopsticks and newspaper are provided to allow the children to experiment with different shapes and sizes of sails and these sails attach to the vertical supports. Children attach their sails to various attachment points on the provided car bases. During the project we will explain to the children how electrical energy is converted into mechanical energy, then converted to wind

energy and back again into mechanical energy. We will also explain why certain sail types work better than others based on their shape and size.

LEVERS, PULLEYS, AND MECHANICAL ADVANTAGE
CLAYTON CRITES · MECHANICAL ENGINEERING
ROSEMARY LUO · ICES
REBECCA MCAUSLAND · DRAMA
COLIN O'SHEA · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

To better familiarize children with the concept of mechanical advantage, we've devised an activity which will allow for hands on engagement with a pulley-driven see-saw apparatus. During the session the children will interact with the apparatus by pulling a rope attached to pulleys which will raise the weighted end of the see-saw. Children can be seated on both ends of the apparatus, essentially acting as counterweights to change the mechanical advantage. By moving the fulcrum of the see-saw and changing the number of pulleys used to raise a given weight, the children will be able to experience physically the mechanical advantage provided by each setup. This activity will help solidify the basic statics concepts behind both the classic lever and pulley mechanisms.

POWERING YOUR OWN CART: EXPLORING SPEED AND POWER THROUGH TRANSMISSIONS
JEFFREY BIZZAK · ICES
YIXIN LIU · ELECTRICAL & COMPUTER ENGINEERING
ELIZABETH SCHWARTZ · ICES
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

In this project, students will learn about mechanical advantage through different gear ratios. They can explore the trade-off between speed and power. By manipulating a system of color-coded gears mounted on a pegboard, the children will learn that the distance of rotation (input) due to different gear ratios affects the displacement (output) and power (output) of the system. In addition, the students will have a chance to use a gear system to propel themselves on a platform cart. The children will use a crank that is connected to the front axel of the cart to learn about the transfer of power from the hand crank to the cart wheels.

VEHICLE PROPULSION DYNAMICS
JONATHAN BATES · SELF-DEFINED
ALEXANDER HANSON · ICES
AANCHAL RAJ · ELECTRICAL & COMPUTER ENGINEERING

Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

Using a simple mousetrap powered vehicle, children will be challenged to find propulsion configurations that meet distance and power objectives. This is accomplished by a modular car design with multiple gears mounted to the rear axle and variable length lever arms. Children will be asked to collaborate in pairs to achieve greatest distance on flat ground, up a ramp, and to win in a race. The exhibit will reinforce basic propulsion, energy conservation, and mechanical advantage concepts. It will also provide a template for iterative design. The ability to rapidly change configurations will allow for multiple attempts at the same objective. The concepts behind engineering design are further developed by the optimization process.

MATERIALS SCIENCE ENGINEERING

ASME DESIGN PROJECT: REMOTE CONTROLLED MARS ROVER
JOSHUA BLOSSER · MECHANICAL ENGINEERING
JAIME BOURNE · MECHANICAL ENGINEERING
ANDREW BURKS · MECHANICAL ENGINEERING
SAMANTHA CATANZARO · COMPUTER SCIENCE
JACOB COFFELT · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING
MICHAEL CUSHMAN · MECHANICAL ENGINEERING
MEGAN DORITY · MECHANICAL ENGINEERING
BRADLEY HALL · MECHANICAL ENGINEERING
ANDREW HILLENIUS · ELECTRICAL & COMPUTER ENGINEERING
MICHAEL KAHN · COMPUTER SCIENCE
PAUL KENNEDY · ELECTRICAL & COMPUTER ENGINEERING
SZU-CHIEH LU · MECHANICAL ENGINEERING
CHARLES MUNOZ · UNDECIDED
RICHARD PANTALEO · MECHANICAL ENGINEERING
WEI SHI · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING
BENJAMIN SOM-PIMPONG · MECHANICAL ENGINEERING
DAVID STONESTROM · MECHANICAL ENGINEERING
GAURAV VERMA · MECHANICAL ENGINEERING
Advisor(s): Metin Sitti · Mechanical Engineering
Rangos 2 & 3 / Sigma Xi Group 4, 10:00am

The objective of this project is to allow the design group to gain practical knowledge of the mechanical engineering design process and the dynamics of interdisciplinary teamwork. Based on research gathered over several weeks, a team assembled through the American Society of Mechanical Engineers (ASME) and the Robotics Club will develop and produce a theoretical model using a parametric modeling software package and after prototyping and testing will produce a working physical model. The team will compete in the regional ASME conference in April 2009. The purpose of this project is to develop a remote-controlled robot that will simulate tasks to be performed by future NASA rovers to both Mars and the moon. Members of the group will analyze the given problem and come up with solutions designed to maximize efficiency in order to collect and deliver the target objects in accordance with stringent guidelines set forth by ASME. Through the course of this project, the group members will gain valuable skills needed to pursue additional mechanical design projects in the future.

AN ALTERNATIVE TO ANTIBODIES: PHAGE-DISPLAYED PEPTIDE TARGETING ON THE TNF-A NEUTRALIZATION SITE

MAGNUS GAN · MATERIALS SCIENCE ENGINEERING
Advisor(s): Newell Washburn · Chemistry
Rangos 1 / 12-2:30

Tumor Necrosis Factor-a (TNF-a) is a well studied cytokine that has been shown to induce inflammation. This research is directed at exploring the feasibility of mediating TNF-a induced inflammation through competitive inhibition by selected phage-displayed peptides at the TNF-a neutralization site.

This is in contrast to conventional anti-TNF-a antibody-mediated neutralization, the production of which is much more expensive and less scaleable than sequential peptide synthesis.

Ligands for TNF-a were selected from a randomized 12-mer phage peptide library. Selection was performed by non-specific binding disruption using Glycine-HCl. We hope to discover that the selected phage populations are specific for TNF-a, and further, that consensus binding sequences indeed neutralize the inflammatory function of TNF-a.

BALLOON POWERED CARS

TANVI BUBNA · MECHANICAL ENGINEERING
KYLE GEE · MECHANICAL ENGINEERING
JONATHAN HERNANDEZ · CIVIL AND ENVIRONMENTAL ENGINEERING
SARAH PFEFFER · MATERIALS SCIENCE ENGINEERING
KONSTANTIN VIDENSKY · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

In our activity, children will build a balloon powered car and learn that energy that is stored can be transformed into kinetic energy. We will demonstrate a pre-made balloon powered car and encourage the children to hypothesize why the car moves. After the children observe that it is the air moving out of the straw that causes the car to move, we will explain the concepts of conservation of energy, Newton's third law (equal and opposite forces), and conservation of momentum to help the children understand the physical principles behind the motion of the car. We will then show the children how the cars are made, and assist them in the construction of their own cars. When each child has built a car, he or she will test Newton's third Law by varying the amount they inflate their balloon, causing the car to travel varying distances.

BIOMEDICAL APPLICATION OF FECO MAGNETIC NANOPARTICLES AS CONTRAST AGENT FOR MRI - SYNTHESIS OF FERROFLUID

ASWIN TEJASUKMANA · MATERIALS SCIENCE ENGINEERING
Advisor(s): Nicholas Jones · Materials Science Engineering
Michael McHenry · Materials Science Engineering
Katie McNerny · Materials Science Engineering
Kelsey Miller · Materials Science Engineering
Rangos 1 / 12-2:30

There is current interest in the use of magnetic nanoparticles as contrast agents for enhancement of magnetic resonance imaging (MRI). The large magnetic moment of the FeCo-based MNPs allows for reduced concentrations of contrast agent. The use of different functionalized groups is being investigated to selectively bind the MNPs to the collagen fibers of the ECM remodeled scaffold. As the repair site heals and the scaffold degrades, the tracking of the degradation products will be performed using MRI. These MRI studies of how the scaffold degrades will help further explain the role of the ECM in the remodeling process.

CARBON FIBER REINFORCED PLASTIC SIDE IMPACT STRUCTURE FOR VEHICLE SAFETY AND LIGHT WEIGHT

ANDREW CHARTERS · MECHANICAL ENGINEERING
IAN NORMAN · MECHANICAL ENGINEERING
MARYANNA SAENKO · MATERIALS SCIENCE ENGINEERING
Advisor(s): Robert Heard · Materials Science Engineering
Wean Commons-1st Floor, Connan side / 12-2:30

This project aimed to develop a feasible method to create and test carbon fiber reinforced plastic panels with the intention of use on a car in order to replace heavier steel frame structure. This research utilized more accessible methods of fabrication than that of top level motorsports with the goal of creating an affordable yet effective lightweight side impact structure. This structure resulted in a safer car without having to sacrifice performance. Our final goal for this project was to replace a large portion of the race car built each year by the

Formula SAE Chapter of Carnegie Mellon. This allowed Carnegie Mellon Racing (CMR) to produce a product better able to compete with other schools in areas such as marketing, design, and performance in the Formula SAE Competition.

HIGH-CAPACITY LITHIUM-ION BATTERY IN AQUEOUS ENVIRONMENT: MORPHOLOGY AND COMPOSITION

TERRY SHYU · MATERIALS SCIENCE ENGINEERING
Advisor(s): Jay Whitacre · Materials Science Engineering
Rangos 1 / 12-2:30

Cathode materials of lithium-ion battery are synthesized. The morphology and composition are investigated and related to the overall battery performance.

HYPERTHERMIC CANCER THERAPY - CELL SURVIVAL RATE IN HYPERTHERMIC TREATMENT

YOUNGEUN KIM · MATERIALS SCIENCE ENGINEERING
Advisor(s): Michael McHenry · Materials Science Engineering
Rangos Hallway, 2nd Floor, 12-2:30

Hyperthermia (thermotherapy) is a type of cancer treatment in which body tissue is exposed to high temperatures. Research has shown that hyperthermia can damage and kill cancer cells without injuring the normal tissues since cancer cells become more sensitive to radiation. Recently, it has been discovered that hyperthermia treatment when combined with anti-cancer drug therapy, creates a synergistic effect. In my research, I tested the efficiency of such radiation heat therapy in killing cancer cells (specifically, the Ramos cancer cells and CX-1 cancer cells). Two different temperature ranges were tested for a wide spectrum of time. I seek to explore a synergistic effect of combining thermotherapy and chemotherapy by observing the cancer cell death rate at an effective temperature range. Further research will includetesting the efficacy of radio frequency heating on magnetic nanoparticles in killing these cancer cells. The research is conducted in collaboration with the Hillman Cancer Research Center.

LOW RESISTIVITY CONTACTS ON N-TYPE GALLIUM NITRIDE FOR LIGHT EMITTING DIODE APPLICATIONS

MICHAEL SCHMITT · MATERIALS SCIENCE ENGINEERING
Advisor(s): Robert Davis · Materials Science Engineering
Hoch Commons-2nd Floor, Window side / 3-5pm

Low resistivity contacts to n-type gallium nitride (GaN) surfaces are of particular interest to materials scientists because they will lead to better functioning light emitting diodes (LEDs), an increasingly important light source with many applications, especially solid state lighting. Much work has been done to elucidate the best contact materials to GaN. Contacts to n-type

GaN are of particular importance because of their difficulty to create. Our work focused on utilizing multi-layer schemes, polarizing capping layers, and low temperature thermal anneals. Preliminary results suggest that a tri-layer scheme involving gold and nickel as the top two layers, respectively, that is subjected to a moderate temperature thermal anneal (~600C) produced the lowest resistance contacts. Previous methods have utilized titanium as a base contact layer, but our work suggests chromium is a better alternative.

MODELING OF EXCHANGE BIAS IN MULTI-LAYERED MAGNETIC MATERIALS

YUE MA · MATERIALS SCIENCE ENGINEERING
Advisor(s): Nicholas Jones · Materials Science Engineering
Michael McHenry · Materials Science Engineering
Rangos Hallway, 2nd Floor / 12-2:30

Magnetic multi-layered Fe-Co systems have great implications and potential in the application of giant magnetoresistance materials and magneto-optical recording media. To understand the energetic of this system, the magnetocrystalline anisotropy energy, the shape anisotropy energy, and the Zeeman energy will be represented by mathematical models using Mathematica to create a comprehensive model of the system's energetics. The change in energies as a response to varying magnetic field and exchange bias anisotropies will also be observed. The different anisotropies of oxidized samples will be characterized using the VSM.

MODELING OF HEATING OF MAGNETIC NANOPARTICLES FOR APPLICATIONS INCLUDING FLIP-CHIP MANUFACTURE AND CANCER THERMOTHERAPY

CAROLYN SAWYER · MATERIALS SCIENCE ENGINEERING
Advisor(s): Michael McHenry · Materials Science Engineering
Rangos 1 / 12-2:30

Magnetic nanoparticles in an alternating magnetic field generate heat via relaxation of the magnetic moment. I will present two related projects using this point-source heating for minimally invasive, low side-effect cancer therapy and for solder reflow and epoxy curing in next-generation electronic chip packages. In both applications, magnetic nanoparticles offer localized heating with minimal damage to surrounding material, either healthy tissue or fragile silicon wafers.

MODELING OF ABSORBANCE AND EXTINCTION SPECTRA FOR CHARACTERIZATION OF ANISOTROPIC GOLD NANOPARTICLES

OLIVER NAKANO-BAKER · MATERIALS SCIENCE ENGINEERING
Advisor(s): Michael Bockstaller · Materials Science Engineering
Rangos 1 / 12-2:30

Gold nanorods are widely investigated for their potential biomedical applications. UV-Vis spectroscopy is the most common method of characterization of particle size and anisotropy for gold nanoparticles in solution, and it is often assumed that the UV-Vis extinction profile is equivalent to the absorption profile of the particles. There is, however, a possibility that light scattering has a non-negligible contribution to the UV-Vis extinction profile. This would necessitate a reevaluation of the current characterization method. A computer program was used to model absorbance and scattering over the visible and ultraviolet light spectrum for anisotropic metal particles distributed in solution with random orientation. A variety of particle sizes and anisotropies were considered, and the relative contributions of absorbance and scattering to extinction was evaluated.

RESONANT FILTERS BASED ON LAMINATED POLYMER NANOCOMPOSITES
MING-LIN LEE · MATERIALS SCIENCE ENGINEERING
Advisor(s): Michael Bockstaller · Materials Science Engineering
Rangos 1 / 12-2:30

Fabricating and characterizing the multilayer polymer mental nanoparticle thin films.

Spin-coating approach is developed to systematically build asymmetric layered polymer.

Characterizing the film architecture by SEM as well as small-angle X-ray scattering.

ROBORCHESTRA IV
LAURA ABBOTT · COMPUTER SCIENCE
ROHAN ALETTY · ELECTRICAL & COMPUTER ENGINEERING
ANDREW BURKS · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING
MATTHEW FIORILLO · PHYSICS
JAYWOO KIM · MECHANICAL ENGINEERING
LESLEY LINNE · COMPUTER SCIENCE
RICHARD PANTALEO · MECHANICAL ENGINEERING
ERICA SANDBOTHE · COMPUTER SCIENCE
MICHAEL SANDBOTHE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING
STEFAN SULLIVAN · MUSIC
GREGORY WILLIAMS · COMPUTER SCIENCE
Advisor(s): Roger Dannenberg · Computer Science
Hoch Commons-2nd Floor, Rangos side / 3-5pm

The RobOrchestra project is dedicated to the creation of music using technology coupled with art. Now in its fourth year, RobOrchestra has created a number of robots with specific

musical functions and generated meaningful ways for them to play together cooperatively. This year, RobOrchestra hopes to expand its technological outreach to other instruments as well as creating methods for humans to interact with the robots' performance. In this manner we will expose the connection between science and art by showing the mathematical complexity of music and the artistic possibilities of robotics.

SEE ACTIVITY: HOW SPEAKERS WORK

SHREY AGGARWAL · MECHANICAL ENGINEERING
JONATHAN MATUSKY · MATERIALS SCIENCE ENGINEERING
DAVID O'CONNOR · MECHANICAL ENGINEERING
JUSTIN YI · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

In this activity, students will learn how electromagnetism and vibrations can be used to produce sound. The students will learn that current, when run through a coil, can produce a magnetic field. Students will also learn how vibrations can be used to produce sound, and how volume and pitch can be altered. Students will build their own speaker by making electromagnetic coils and amplification chambers. They will make the speakers by using different numbers of magnets and coils to vary the volume. They will construct amplification chambers out of cardboard and experiment with different sizes and shapes. In this way, students will learn how the physical properties of a speaker change the volume of the sound.

SELF-LIMITED HEATING AND BIOCOMPATIBILITY OF FERROFLUIDS SYNTHESIZED FROM FE-NI-BASED SPEX-MILLED NANOCOMPOSITES

MARIANNA SOFMAN · MATERIALS SCIENCE ENGINEERING
Advisor(s): Michael McHenry · Materials Science Engineering
Kelsey Miller · Materials Science Engineering
Rangos Hallway, 2nd Floor / 12-2:30

The goal of this research is to synthesize Fe73Ni27 nanoparticles with a Curie temperature (Tc) of 27o-37o C appropriate for biomedical applications. The ultimate goal is to stabilize the gamma-FeNi phase in order to control Tcto correspond to biologically relevant temperatures to facilitate self-regulated RF heating (heating which stops at Tc). The target composition was found by extrapolating the Tc vs. composition curve for FeNi to room temperature. A biomedical application of these self-limiting particles is hyperthermia treatments and thermoblative cancer therapy. The self-limited heating property of nanoparticles containing fluids (ferrofluids) determines how rapidly the particles can heat and how rapidly they stop heating. In hyperthermia treatments, flu-like symptoms are induced by generating elevated heat in the body (about 42.5o C). Thermoblative cancer therapy is the localized ablation of cancerous cells in the body at a temperature no higher

than 52o C, for the purpose of extracting a tumor without harming surrounding healthy tissue. The self-limited heating properties of the particles are important in order to be able to control the heating at the Curie temperature of interest. Because the Tc of the particles typically present as a metastable mix of BCC alpha-Fe and FCC FeNi3, is much to high (about 550o C), the goal is to transform the particles into the pure stable FCC gamma-FeNi phase in order to reach the desirable Tc. Two FeNi compositions at 23% and 25% Ni were also studied, each in powder form and nanocrystallized ribbon form. X-Ray diffraction patterns will be performed on these four samples in order to see if the stable form of gamma-FeNi was achieved. After synthesis, SPEX-milling, encapsulation, annealing and quenching, X-ray diffraction scattering patterns revealed that the 27% Ni FeNi particles successfully transformed into the FCC phase. The heating response of these nanoparticles was investigated in a surfactant through RF heating experiments. The Tc of the particles was found through vibrating sample magnetometry (VSM). VSM revealed two Curie temperatures indicating two phases present in the particles, showing that there were remains of the FCC gamma-FeNi phase in addition to the FCC FeNi3 phase that the particles transformed into. This may have been due to the particles not being annealed for a long enough time and future studies will entail annealing the particles for about 2 hours in order to fully quench in the gamma-FeNi phase. The four new samples of the FeNi will reveal if the stable form of gamma-FeNi was achieved. Several different compositions of FeNi with varying Ni content will also be tested since there is no documentation of the Curie temperature being investigated for the FeNi alloy composition at interest.

SYNTHESIS AND CHARACTERIZATION OF MAGNETIC NANOPARTICLES FOR BIOMEDICAL APPLICATIONS

KELLY COLLIER · MATERIALS SCIENCE ENGINEERING
Advisor(s): Michael McHenry Materials Science Engineering
Rangos Hallway, 2nd Floor / 12-2:30

FeCo and FeNi magnetic nanoparticles used in biomedical applications can be synthesized through a chemical solution method. Biomedical uses include hyperthermia cancer therapy through radio frequency heating of MNPs and tagging of ECM tissue scaffolds to track degradation. Characterization of MNPs is done through x-ray diffraction, transmission electron microscopy, and vibrating sample magnetometry. Successful synthesis of FeCo MNPs has produced faceted, monodisperse particles with an average diameter of 7 nm. The advantages of using FeCo for its high magnetic moment and high a high heating rate, or using FeNi for its low Curie temperature to achieve self-limited heating are explored.

X-RAY DIFFRACTION CHARACTERIZATION OF PHOTOVOLTAIC INAS QUANTUM DOTS ON A GAAS SUBSTRATE.

BRIAN HOSKINS · MATERIALS SCIENCE ENGINEERING
Advisor(s): Alysha Grenko · Materials Science Engineering

Elias Towe · Electrical & Computer Engineering
Rangos Hallway, 2nd Floor / 3-5pm

Samples of InAs Quantum Dots of known growth parameters and previously electronically characterized were subjected to X-Ray diffraction. Symmetrical surface reflections confirmed whether the actual growth occurred parameters created the desired nanostructure. Asymmetrical reflections quantitatively and qualitatively related device quality to strain between the dots and the GaAs substrate and wetting layers.

MECHANICAL ENGINEERING

3D DIGITIZERS:OPTIMIZATION OF DATA ACQUISITION PROCESS

ADAM AARON · MECHANICAL ENGINEERING
Advisor(s): Kenji Shimada · Mechanical Engineering
Rangos 1 / 12-2:30

3D digitizers use a laser and vision system to create a 3D representation of an object in a CAD program. The main applications of 3D scanners are to reverse engineer or inspect an object. The focus of this work will be to create an initial algorithm or heuristic to scan an object more efficiently than current methods. This algorithm or heuristic will be implemented through a computer application developed to reposition an object using a type of 3D graphical interface common to most CAD software. The software will show the current progress on the coverage of the object and suggest the next scan location based on the coverage data. This will improve the efficiency of the scanning process and lead to more accurate and complete data collected.

A TESTING METHOD AND COGNITIVE MODEL OF HUMAN DIAGRAM UNDERSTANDING FOR AUTOMATING DESIGN SKETCH RECOGNITION

MARK FUGE · MECHANICAL ENGINEERING
Advisor(s): Levent Kara · Mechanical Engineering
Rangos 1 / 12-2:30

Sketches, whether hand-drawn or computer generated, are a natural and integral part of the design process. Despite this fact, modern day computational design tools are ill-equipped to take full advantage of sketching input. The computational challenges of recognizing sketches are easily overcome by human visual recognition and much insight stands to be gained by emulating human cognitive processes. Creating robust, automated tools that overcome the ambiguity of sketching input would allow for advances not only in the practice of engineering design, but in the education of design itself. One first step toward the development of a robust sketching tool is to determine how humans interpret mechanical

engineering diagrams. This paper presents two contributions toward the goal of an automated diagram understanding system. First, a method is presented to gain insight into human diagram recognition using techniques analogous to peripheral vision and human attention. Following this, a cognitive model of human diagram understanding is presented from which to further develop computational design tools. With this work, researchers should be able to (1) improve understanding of human diagram recognition and (2) use our model to emulate human diagram recognition in future computational design tools.

ASME DESIGN PROJECT: REMOTE CONTROLLED MARS ROVER

JOSHUA BLOSSER · MECHANICAL ENGINEERING
JAIME BOURNE · MECHANICAL ENGINEERING
ANDREW BURKS · MECHANICAL ENGINEERING
SAMANTHA CATANZARO · COMPUTER SCIENCE
JACOB COFFELT · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING
MICHAEL CUSHMAN · MECHANICAL ENGINEERING
MEGAN DORITY · MECHANICAL ENGINEERING
BRADLEY HALL · MECHANICAL ENGINEERING
ANDREW HILLENIUS · ELECTRICAL & COMPUTER ENGINEERING
MICHAEL KAHN · COMPUTER SCIENCE
PAUL KENNEDY · ELECTRICAL & COMPUTER ENGINEERING
SZU-CHIEH LU · MECHANICAL ENGINEERING
CHARLES MUNOZ · UNDECIDED
RICHARD PANTALEO · MECHANICAL ENGINEERING
WEI SHI · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING
BENJAMIN SOM-PIMPONG · MECHANICAL ENGINEERING
DAVID STONESTROM · MECHANICAL ENGINEERING
GAURAV VERMA · MECHANICAL ENGINEERING
Advisor(s): Metin Sitti · Mechanical Engineering
Rangos 2 & 3 / Sigma Xi Group 4, 10:00am

The objective of this project is to allow the design group to gain practical knowledge of the mechanical engineering design process and the dynamics of interdisciplinary teamwork. Based on research gathered over several weeks, a team assembled through the American Society of Mechanical Engineers (ASME) and the Robotics Club will develop and produce a theoretical model using a parametric modeling software package and after prototyping and testing will produce a working physical model. The team will compete in the regional ASME conference in April 2009. The purpose of this project is to develop a remote-controlled robot that will simulate tasks to be performed by future NASA rovers to both mars and the moon. Members of the group will analyze the given problem and come up with solutions designed to maximize efficiency in order to collect and deliver the target objects in accordance with stringent guidelines set forth by

ASME. Through the course of this project, the group members will gain valuable skills needed to pursue additional mechanical design projects in the future.

AN OSCILLATORY TOUCH-PROBE SYSTEM FOR MICROMACHINING

ALEXANDER SCHLICHTING · MECHANICAL ENGINEERING
Advisor(s): Burak Ozdoganlar · Mechanical Engineering
Rangos 1 / 12-2:30

This project focuses on the development of a dynamics-based touch-probe system for indicating work piece surface location in miniature machine-tool systems. The touch-probe system is comprised of a steel flexure, two piezoelectric bimorph beams for actuation and sensing and a micro-scale ruby-tipped probe. The project focuses on dynamic characterization and performance testing of the touch-probe system with both a modeling and an experimental aspect. The modeling aspect involves verifying ANSYS's piezoelectric capabilities using a simple bending piezoelectric bimorph beam. The experimental aspect involves the determining the frequency response function which characterize the touch-probe as well as performing accuracy and repeatability tests when using the touch-probe system.

ANALYSIS OF THERMO-MECHANICAL STRESS FOR CRYOPRESERVATION APPLICATIONS

MICHAEL REINDL · MECHANICAL ENGINEERING
Advisor(s): Yoed Rabin · Mechanical Engineering
Rangos 1 / 12-2:30

Cryopreservation is the preservation of tissues at low temperatures, with applications to transplantation medicine. Cryopreservation via glass formation represents a cutting-edge technology, whereby the destructive effect of ice crystallization is avoided. In the scope of the current study, a glass-forming medium used for cryopreservation applications was thermo-mechanically modeled using the finite element program ANSYS. Simulations were conducted for cooling rates typical to cryopreservation in vials, placed in a temperature-controlled freezer. The results of the simulations were used to gain insight on the likelihood of fracturing in typical glass-forming processes relevant to cryopreservation.

AUTONOMOUS CRACK CLIMBING ROBOT

NATHANIEL FOX · MECHANICAL ENGINEERING
Advisor(s): Howie Choset · Mechanical Engineering
Wean Commons-1st Floor, Connan side / 12-2:30

There are currently many methods of robotic climbing. However, one of the most natural methods rock climbers employ has not yet been investigated, and that is climbing cracks. Crack climbing is much more energy-efficient and less processor intensive than active

balancing systems, and they do not require frequent cleaning like polymer-based adhesives. A simple crack climbing robot would consist of a small chassis, with two arms with end effectors which can cam into cracks to hold the weight of the robot. Wheels on the body would allow the chassis to roll up the face while the arms are pulling the robot up. This would allow the only energy to be exerted while lifting the robot up the wall, as the spring-loaded cams would hold the robot tightly into the crack.

BALLOON POWERED CARS
TANVI BUBNA · MECHANICAL ENGINEERING
KYLE GEE · MECHANICAL ENGINEERING
JONATHAN HERNANDEZ · CIVIL AND ENVIRONMENTAL ENGINEERING
SARAH PFEFFER · MATERIALS SCIENCE ENGINEERING
KONSTANTIN VIDENSKY · MECHANICAL ENGINEERING
Advisor(s):Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

In our activity, children will build a balloon powered car and learn that energy that is stored can be transformed into kinetic energy. We will demonstrate a pre-made balloon powered car and encourage the children to hypothesize why the car moves. After the children observe that it is the air moving out of the straw that causes the car to move, we will explain the concepts of conservation of energy, Newton's third law (equal and opposite forces), and conservation of momentum to help the children understand the physical principles behind the motion of the car. We will then show the children how the cars are made, and assist them in the construction of their own cars. When each child has built a car, he or she will test Newton's third Law by varying the amount they inflate their balloon, causing the car to travel varying distances.

BOTTLE ROCKETS
RAY BARSA · MECHANICAL ENGINEERING
JOSEPH SEYMOUR · MECHANICAL ENGINEERING
SAMANTHA SHROPSHIRE · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

Children will learn about concepts of exit pressures with respect to nozzle diameters in our rocket activity. The children will place Mentos into bottles of soda, which will react to make the gases that power the rockets. The experiment will be repeated with holes of different diameters in the bottle caps, so that they can see the effect that the nozzle diameter has on the velocity of the stream exiting the bottle. We will also have an interactive demonstration to explain the physical reasons behind the soda and Mentos eruption.

CARBON FIBER REINFORCED PLASTIC SIDE IMPACT STRUCTURE FOR VEHICLE SAFETY AND LIGHT WEIGHT

ANDREW CHARTERS · MECHANICAL ENGINEERING
IAN NORMAN · MECHANICAL ENGINEERING
MARYANNA SAENKO · MATERIALS SCIENCE ENGINEERING
Advisor(s): Robert Heard · Materials Science Engineering
Wean Commons-1st Floor, Connan side / 12-2:30

This project aimed to develop a feasible method to create and test carbon fiber reinforced plastic panels with the intention of use on a car in order to replace heavier steel frame structure. This research utilized more accessible methods of fabrication than that of top level motorsports with the goal of creating an affordable yet effective lightweight side impact structure. This structure resulted in a safer car without having to sacrifice performance. Our final goal for this project was to replace a large portion of the race car built each year by the Formula SAE Chapter of Carnegie Mellon. This allowed Carnegie Mellon Racing (CMR) to produce a product better able to compete with other schools in areas such as marketing, design, and performance in the Formula SAE Competition.

DESIGN OF A CLOSED CHAMBER TO CONTROL EVAPORATION AND CONDENSATION FOR THE FORMATION OF HIGHLY UNIFORM MICROCAVITY ARRAYS

LAUREN WALCH · MECHANICAL ENGINEERING
Advisor(s): Shelley Anna · Mechanical Engineering
Hoch Commons-2nd Floor, Window side / 3-5pm

A small chamber to be designed in order to controlt emperatures while curing PDMS to create uniform microcavity arrays in the material.

DESIGN, ANALYSIS, AND DESTRUCTIVE TESTING OF IMPACT ATTENUATOR

RACHEL HOESLY · CIVIL AND ENVIRONMENTAL ENGINEERING
JACOB SIBILSKI · MECHANICAL ENGINEERING
Advisor(s): Kenji Shimada · Mechanical Engineering
Hoch Commons-2nd Floor, Window side / 3-5pm

Professional racing organizations across the globe have adopted specific safety standards for the design of the racecars. These requirements continue to become stricter as the governing race bodies' knowledge of human energy absorption limits increases through research and accident investigations; Formula SAE (Society of Automotive Engineering) a student design and formula-style race competition, is no different. This year the FSAE governing body has enacted a requirement that all front impact attenuator designs must be modeled and destructively tested to produce better analysis than analysis previously performed by student teams. This new regulation requires that a 661 lb car traveling at 23 feet per second

should undergo no greater than 40Gs on collision with a non-yielding impact barrier, and should average less than 20Gs overall. The goal of this research project is to design, model, and physically test a front impact attenuator for the Carnegie Mellon Racing team (CMR) 2009 racecar. This project will also research and manufacture a structure that will be used to test the energy absorbing ability.

DEVELOPING A POWER LINE DOCKING SYSTEM FOR SMALL SCALE AERIAL PLATFORMS

BEN BERKOWITZ · MECHANICAL ENGINEERING
Advisor(s): Lyle Chamberlain · Robotics Institute
Rangos 1 / 12-2:30

The field of unmanned aerial vehicles has been constantly growing but still suffers from one key problem: limited flight time due to batterylife. In order to solve this problem a system to allow a micro aerial vehicle to dock with and ultimately charge from a power line is developed and explored, resulting in a system which is both lightweight and robust.

DEVELOPING AN IMAGING DEVICE FOR 3D SCANNING OF CRYOPRESERVATION PROCESSES

CHRISTOPHER LIN · MECHANICAL ENGINEERING
Advisor(s): Yoed Rabin · Mechanical Engineering
Rangos 1 / 12-2:30

This study focuses on imaging of large-scale cryopreservation processes, where cryopreservation is the preservation of tissues at low temperatures. Currently, the study focuses on imaging the physical events occurring during the freezing of the cryoprotective agent (CPA) dimethyl sulfoxide (DMSO). This project focuses on post-processing of the recorded freezing protocol to include temperature data, measuring scale, and time stamps, in order to create a single electronic file of a given experimental procedure. This data is used to identify the conditions for fracture formation in the freezing material, where fracture formation is known to be one of the most destructive effects during cryopreservation.

DEVELOPMENT OF AN OPTIMIZED EXHAUST SYSTEM FOR A FORMULA SAE RACECAR

JOSHUA BLOSSER · MECHANICAL ENGINEERING
MING-YANG HUNG · MECHANICAL ENGINEERING
FEDOR KLESHCHEV · UNDECIDED
MICHAEL LIN · MECHANICAL ENGINEERING
ERICA TUCKER · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Kenji Shimada · Mechanical Engineering

John Wiss · Mechanical Engineering
Kirr Commons-1st Floor, Window side / 12-2:30

This project aims to develop an optimized exhaust system for a Honda CBR600F4i motorcycle engine for use in a Formula SAE racecar. This research will utilize drivetrain simulation software to pre-determine the most appropriate exhaust system for the application. A custom exhaust header, manifold and muffler will be developed to fit within the confines of the Formula SAE racecar. The result will be a quieter car that satisfies noise regulations while having higher performance than when using the stock exhaust system. This will allow Carnegie Mellon Racing (CMR) to produce a more competitive product in the areas of design and performance for the Formula SAE Competition.

DISPERSION OF MICROSCALE DROPLETS OF FLUIDS

CHANGHO OH · MECHANICAL ENGINEERING
Advisor(s): Nadine Aubry · Mechanical Engineering
Rangos 1 / 12-2:30

The goal of this project is to develop a device which can dispense mirco-sized droplets of fluid inducing dispersion in the fluid and control the transportation of dispensed droplets to desired positions for further use. To induce dispersion in the fluid, two different methods of flow focusing and DEP (Dielectrophoresis) were validated through experiments. For the practical use of the device in the field of medicine, droplets of virus sample and relevant reagent will be formed using one of the dispersion techniques and reaction will be induced between two kinds of droplets inside the device. With the use of the device, it is expected that we can achieve reduced consumption of expensive chemicals and bioagents necessary. Especially, in medical field, the amount of liquid necessary for running tests such as expensive reagents will be significantly reduced, which leads to cost saving effect. However, according to the results from the experiments, the flow focusing method turned out to be not appropriate for the purpose of this project, and currently, DEP method is on the stage of getting validated and further result is expected.

DRY-ADHESIVE CLIMBING ROBOTS

JEFFREY WANG · MECHANICAL ENGINEERING
Advisor(s): Metin Sitti · Mechanical Engineering
Rangos 1 / 12-2:30

Utilized dry elastomer adhesives in miniature climbing robots. Conducted various adhesion experiments to test feasibility and accuracy of theoretical models and design. Implemented climbing method in two different designs - 4-bar walker robot and TANKBOT.

DYNAMIC NEURAL FORAMINA CROSS SECTION MEASUREMENT AND KINEMATIC ANALYSIS OF LUMBAR SPINE UNDERGOING EXTENSION

CHANGHO OH · MECHANICAL ENGINEERING
Advisor(s): Yongjie Zhang · Mechanical Engineering
Rangos 1 / 12-2:30

The research project aimed at investigating experimental analysis of neural foramina cross section and lumbar spine undergoing extension. Spinal biomechanics experiments were conducted in William C. Welch Neurosurgical Research Laboratory in University of Pittsburgh Medical Center led by Professor Boyle Cheng. A sequence of fluoroscopy imaging data of lumbar spine undergoing extension, with device placed at L2-3, was obtained. The primary goal of this project is to develop robust, automatic, fast and accurate image processing techniques for dynamic measurement of neural foramina cross section and kinematics analysis of lumbar spine undergoing flexion extension bending that ideally would be applicable to patient datasets.

ELECTROLYTE CARS

GWENDOLYN BARR · MECHANICAL ENGINEERING
BENJAMIN MATZKE · MECHANICAL ENGINEERING
FRANCISCO SANTIAGO · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

In this activity, the children will learn how varying fluids allow electricity to flow through interaction with mini-electrolyte cars. The wires that provide power to the car will be routed through a small container of liquid. This liquid completes the circuit and, based on its electric conductivity, the car will move faster or slower. This fun and engaging activity will illustrate transformation of energy from elastic to kinetic states and at the same time help children understand how electricity flows through fluids.

ENHANCEMENTS TO THE ACTIVE HOME ROBOT

ESSIEN OHUES · MECHANICAL ENGINEERING
Advisor(s): Mike Vande Weghe · ICES
Rangos Hallway, 2nd Floor / 3-5pm

In this project I've done several tasks to help in the creation of the Active Home Robot. To meet all my goals I used a power computer program, Pro Engineer. My first task was to design a camera compartment to be placed on the robot in a variety of angles. The camera to be placed inside the compartment is used as the "eye" of the robot. The camera was then used in my other which task was to design an environment the robot would interact with. The environment was a kitchen area that included a sink, faucet, mini fridge and multiple cabinets. It was important to measure the right sizes because if the camera shifted a little or objects were not the right sizes the robot would need to be recalibrated.

ENVIRONMENT MAPPING WITH A LOW-COST ROBOT COLONY
JAIME BOURNE · MECHANICAL ENGINEERING
AUSTIN BUCHAN · ELECTRICAL & COMPUTER ENGINEERING
BRIAN COLTIN · COMPUTER SCIENCE
SIYUAN FENG · COMPUTER SCIENCE
CHI-HSIU HONG · COMPUTER SCIENCE
JAMES KONG · ELECTRICAL & COMPUTER ENGINEERING
CHRISTOPHER MAR · ELECTRICAL & COMPUTER ENGINEERING
VICTOR MARMOL · COMPUTER SCIENCE
EVAN MULLINIX · ELECTRICAL & COMPUTER ENGINEERING
BRADFORD NEUMAN · COMPUTER SCIENCE
BENJAMIN POOLE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DAVID SCHULTZ · PHYSICS
JOHN SEXTON · ELECTRICAL & COMPUTER ENGINEERING
KEVIN WOO · ELECTRICAL & COMPUTER ENGINEERING
ANDREW YEAGER · COMPUTER SCIENCE
BRADLEY YOO · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): George Kantor · Robotics Institute
Pake / Oral 3, 12:40pm

Environment mapping is the process of constructing a map with features relevant to a task without any initial knowledge of the environment. The Colony project would like to implement a mapping behavior with our low-cost colony of robots. Our goal for this research is enabling the robots to cooperatively construct a map of a simple two-dimensional environment with some coordination from a central computer. Key aspects of this research will involve making the best use of multiple, distributed, mostly autonomous agents while still gaining an accurate representation of their environment. This work is a continuation of previous Colony project research, and will serve as a foundation for future endeavors.

EXPERIMENTING WITH HEAT CONDUCTION
MICHAEL FOX · MECHANICAL ENGINEERING
DANIEL SAWL · SOCIAL & DECISION SCIENCES
JACOB SIBILSKI · MECHANICAL ENGINEERING
GAURAV VERMA · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

The purpose of our project is to engage students in learning about the transfer of thermal energy. Children will be able to perform experiments on how different materials conduct heat. The children will learn why certain materials are used to conduct heat and why others are used as insulators. They will achieve this by designing walls made of different materials, with one side touching a heat source and the other touching a thermometer. The students

will observe how various materials enhance or inhibit heat conduction by observing the differences in temperature. The children will be able to see how heat, like electricity, can flow through objects, and how material affects heat flow.

FEASIBILITY OF JATROPHA PRODUCTION IN EASTERN AFRICA

DYANNA BECKER · CIVIL AND ENVIRONMENTAL ENGINEERING
NAKUL GUPTA · MECHANICAL ENGINEERING
DAVID KINSKEY-LEBEDA · CIVIL AND ENVIRONMENTAL ENGINEERING
ANNA LENHART · CIVIL AND ENVIRONMENTAL ENGINEERING
ERICA SPIRITOS · CIVIL AND ENVIRONMENTAL ENGINEERING
SARAH STRANO · CIVIL AND ENVIRONMENTAL ENGINEERING
EDWARD YUEN · CIVIL AND ENVIRONMENTAL ENGINEERING
Advisor(s): Mitchell Small · Civil and Environmental Engineering
Hoch Commons-2nd Floor, Rangos side / 12-2:30

Our research team is formed from within the Carnegie Mellon University chapter of Engineers without Borders, and intends to research the feasibility of small-scale Jatropha harvesting in the rural areas of Eastern Africa to produce bio-fuel and various other side-products for the village market. The Jatropha plant, which typically grows in tropical and arid climates along the equator, is indigenous to the East African region, and produces seeds that contain approximately 35% oil suitable for bio-fuel. Currently, energy access is dependent on the decreasing availability of fuel wood (the primary source of energy consumed in rural areas), as well as the rising prices of petrol, a secondary source. Both fuel wood and petrol have negative environmental, economic, and social consequences for villagers in the region. In this project, we outline the production process of Jatopha bio-fuel, and the impacts of each energy source: petrol, fuel wood, and Jatropha. We also provide a life-cycle analysis calculator for the use of local Non-Governmental Organizations to determine whether small-scale Jatropha production would be beneficial to specific villages in the East African region, based on various environmental, economic, and social factors.

GRANULAR LUBRICATION: DETERMINATION OF GRANULE PROPERTIES

TAKAHIRO MATSUURA · MECHANICAL ENGINEERING
Advisor(s): Cecil Higgs · Mechanical Engineering
Rangos 1 / 12-2:30

Granular flow lubrication involves the flow of granular materials in sliding contacts such as annular or bearing-type shear cells. Study of the behavior of granular materials in rough sliding contacts, such as the granular lubricated journal bearing (GLJB) or granular shear cell (GSC), is important for a couple of reasons which include: the possibility of these particles acting as solid/particulate lubricants in extreme environments where oils can not lubricate and the implications of the studies to planetary rover exploration where the wheel/sand traction is important for negotiating Martian terrain.

The specific work to be done here will involve the improvement of current models used to simulate the behavior of these granular flows. Improvement of the current granular flow simulations will be two fold. The first aim is to increase the accuracy of these simulations. To that end, material properties, which are vital to predicting behaviors of the granules, need to be accurately measured using granule samples. Inputting experimentally determined coefficient of friction, coefficient of restitution, and the elastic modulus into the granular models will serve to improve the accuracy of the simulations. The second aim in improving the simulations is to increase the speed of the granular models. This focuses on achieving more computationally efficient modeling through parallel processing. Combining both the physical and computational improvements on the granular flow simulation, the project aims to accomplish its ultimate goal: a development of more accurate and efficient granular flow modeling simulations.

This research project will require a large time commitment; however it is felt that this will not be a problem for a couple of reasons. First of all, combining efforts will reduce the work load on either individual. And secondly, the research is being done as research units through CIT and the mechanical engineering department.

GREENERBILLS
DAVID KENNEDY · ARCHITECTURE
JACOB MOHIN · CHEMISTRY
BENJAMIN SOM-PIMPONG · MECHANICAL ENGINEERING
Advisor(s): Cliff Davidson · Civil and Environmental Engineering
Justin Parisi · Industrial Management
Kirr Commons-1st Floor, Window side / 12-2:30

A Thermodynamics professor at Carnegie Mellon University slyly grinned at his class and offered a dollar to any student who could explain to him the definition of energy. Hands shot up and answers flew back and forth, but after a few moments, the professor, smiling knowingly, returned his bill to his wallet. No one could give a satisfactory definition because energy, particularly in the form of electricity, is an elusive concept. People can neither touch it nor see it and yet it powers our world and is the subject of great debate and controversy. The inability to tangibly grasp electricity is compounded by the fact that energy usage patterns are largely hidden from domestic consumers by utility companies. The problem is that consumers are wasting money and harming the environment through inefficient energy usage because of a lack of information.

This is the problem that we intend to correct. Through a grant from the Mascaro Center for Sustainable Innovation, we have implemented a system that uses our custom interactive website (*greenerbills.net*), social networking, and an electricity metering system to give consumers feedback on their energy usage in a unique way. Greenerbills.net will create an environment where consumers can be aware of their usage through pop-up notifications, stunning visuals. They can also compete with others in their neighborhood. Studies show

that consumers saved 15% in energy costs just by being aware of their usage. Our system goes farther by putting power in the hands of consumers through a psychological model called "norm activation". According to norm activation, consumers must first be aware that there is a problem; they must then realize that they have a role in causing that problem and that they have the power to effect a change. This new consciousness spurs individuals to take action based on motivations such as pressure from friends or family, moral concerns, or the desire to save money. Receiving a monthly bill from a utility company with data that is often difficult to decipher just is not effective. Our system creates an environment for consumers where conserving energy is enjoyable, cost effective, and helpful for the environment.

HUMAN POWERED GENERATORS
ADAM KNOWLTON · ICES
JUSTIN PRATT · ICES
JUSTIN WHALEY · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

Our project will show children the transformation form mechanical to electrical energy. Area students will use simple DC generators powered by hand and drills to create enough current to power a small LED. By connecting the wires to an ammeter, the children can see how mechanical input work relates to electrical energy output as well as the importance of efficient generators. Finally children will have the opportunity to power energy efficient and energy inefficient lights in order to learn the importance of energy efficiency.

INTERACTIVE EXPLORATION OF COMPRESSED AIR
MICHAEL LIN · MECHANICAL ENGINEERING
JOSEPH MEYER · MECHANICAL ENGINEERING
KESHAV RAGHAVAN· ICES
JOHN SMARTO · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

The Interactive Exploration of Compressed Air activity teaches middle school children about the storage of energy in compressed air and also the transformation of that stored energy to kinetic energy. To achieve this, the activity is centered around experimenting with a bicycle-pump-powered air cannon. By varying pressures, launch angle, projectile shape, and other variables, the children will leave with hands-on experience with energy transformation using compressed air.

INTERACTIVE SAILCARS
BENJAMIN ALLEN ICES
CHRISTIAN CHEN · CIVIL AND ENVIRONMENTAL ENGINEERING

MICHAEL CUSHMAN · MECHANICAL ENGINEERING
SANTIA VALERIO · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

The intent of this project is to teach children about wind power. The children will learn by creating a sail-powered car. While a fan is set to low power the wind created by the fan directs the sail-powered cars down a path. They will learn through trial-and-error which sail types will work best in utilizing the wind power to drive their car. Chopsticks and newspaper are provided to allow the children to experiment with different shapes and sizes of sails and these sails attach to the vertical supports. Children attach their sails to various attachment points on the provided car bases. During the project we will explain to the children how electrical energy is converted into mechanical energy, then converted to wind energy and back again into mechanical energy. We will also explain why certain sail types work better than others based on their shape and size.

INVESTIGATING RELIABILITY AND ROBUSTNESS IN A LOW-COST ROBOT COLONY

JAIME BOURNE · MECHANICAL ENGINEERING
AUSTIN BUCHAN · ELECTRICAL & COMPUTER ENGINEERING
RYAN CAHOON · COMPUTER SCIENCE
BRIAN COLTIN · COMPUTER SCIENCE
EMILY HART · ELECTRICAL & COMPUTER ENGINEERING
CHI-HSIU HONG · COMPUTER SCIENCE
JAMES KONG · ELECTRICAL & COMPUTER ENGINEERING
ABRAHAM LEVKOY · ELECTRICAL & COMPUTER ENGINEERING
CHRISTOPHER MAR · ELECTRICAL & COMPUTER ENGINEERING
EVAN MULLINIX · ELECTRICAL & COMPUTER ENGINEERING
BRADFORD NEUMAN · COMPUTER SCIENCE
NICOLAS PARIS · ELECTRICAL & COMPUTER ENGINEERING
BENJAMIN POOLE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DAVID SCHULTZ · PHYSICS
JOHN SEXTON · ELECTRICAL & COMPUTER ENGINEERING
KEVIN WOO · ELECTRICAL & COMPUTER ENGINEERING
ANDREW YEAGER · COMPUTER SCIENCE
BRADLEY YOO · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): George Kantor · Robotics Institute
Rangos 2 & 3 / Sigma Xi Group 4, 10:45am

The overarching goal of the Colony project is to maintain a flexible yet inexpensive group of robots for researching emergent behavior and cooperative problem solving. To this end we have implemented several features and behaviors over the years, but rarely have

we been able to operate the entire colony of robots in concert for days at a time. The two main obstacles to this goal are an inconsistency in robot I/O capabilities and the inability to recognize and recover from failure. Through research into stability and robustness we seek to better understand the capabilities of the robots by quantifying their performance and that of the Colony as a whole. Developing this benchmarking system will provide an incredibly useful tool for debugging and assessing the feasibility of future projects.

LEVERS, PULLEYS, AND MECHANICAL ADVANTAGE
CLAYTON CRITES · MECHANICAL ENGINEERING
ROSEMARY LUO · ICES
REBECCA MCAUSLAND · DRAMA
COLIN O'SHEA · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

To better familiarize children with the concept of mechanical advantage, we've devised an activity which will allow for hands on engagement with a pulley-driven see-saw apparatus. During the session the children will interact with the apparatus by pulling a rope attached to pulleys which will raise the weighted end of the see-saw. Children can be seated on both ends of the apparatus, essentially acting as counterweights to change the mechanical advantage. By moving the fulcrum of the see-saw and changing the number of pulleys used to raise a given weight, the children will be able to experience physically the mechanical advantage provided by each setup. This activity will help solidify the basic statics concepts behind both the classic lever and pulley mechanisms.

LOW-COST MOBILE PERFORMANCE MONITORING DEVICE FOR INTEGRATED MECHANICAL AND ELECTRICAL SYSTEMS
MARK FUGE · MECHANICAL ENGINEERING
GIRIDHAR PATHAK · ELECTRICAL & COMPUTER ENGINEERING
CHUNKIT YU · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Kirr Commons-1st Floor, Window side / 3-5pm

When dealing with complex integrated mechanical and electrical systems, identifying important performance information can be difficult or expensive, especially when proper laboratory equipment is unavailable. When performing field tests, you are often interested in monitoring several different aspects of your system and are forced into purchasing many specialized measurement devices. Through our research project we plan to design and develop a low cost, extensible, mobile testing unit that is capable of monitoring several different physical phenomenons simultaneously, removing the need for several independent devices. By combining the monitoring and display functions into one unit with several sensors, we are providing a toolkit by which operators can measure the performance of a basic mechanical/

electrical system without the need for a laboratory setting or expensive equipment. This low-cost solution must provide invaluable monitoring capabilities for small to large scale systems, allowing for fault prevention or for optimization of performance. While there are some pre-existing solutions to performance monitoring, such as LabVIEW, these solutions either are expensive or limit mobility. Our proposed system will incorporate sensors measuring a host of performance metrics such as RPM, current draw, force, and speed, all without needing an external computer. This information will be recorded or displayed for human operators in real time, allowing for inexpensive monitoring of an electric motor system driven by a motor controller. This system will need to be extensible enough for the development of further measurement capabilities, and can act as the basis of future research in mobile testing applications.

MECHANICAL ADVANTAGE LIFTING DEMONSTRATION (GOLDILOCKS AND THE FIVE MECHANICAL ADVANTAGE SYSTEMS)

MAXWELL GUSTAFSON · MECHANICAL ENGINEERING
ALEXANDER MAY · MECHANICAL ENGINEERING
ALEXANDER SCHLICHTING · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

The goal of this interactive demonstration is to teach young students the benefits of mechanical advantage machines. This will be achieved by engaging the children in five methods of mechanical lifting: an Archimedes screw, three pulley systems, and a waterwheel. The children will be led through a story outlining exercises in which they lift a proscribed amount of small, dense objects to a predetermined height; thus teaching the participants about the costs and benefits of mechanical advantage. These costs and benefits include the exchange between: complexity of mechanism and semi-continuous flow, distance of travel and force, and the simplicity of motion versus the ability to rest or stop.

MECHANICAL DESIGN FOR THE GOOGLE LUNAR X PRIZE TEAM AT CARNEGIE MELLON

ERIC BLOOD · MECHANICAL ENGINEERING
Advisor(s): William Whittaker · Robotics Institute
Wean Commons-1st Floor, Connan side / 12-2:30

The Google Lunar X Prize team at Carnegie Mellon University worked to design and build a lunar rover capable of surviving on and traversing across the lunar surface. In the many stage of development, various technical challenges arose. Research in the summer of 2008 addressed these problems. Lunar dust adhesion estimation and dust mitigation techniques were explored to protect critical surfaces from acquiring problematic dust amounts. Lunar wheel designs were created to converge on a proper wheel that can provide the necessary flotation and locomotion for the lunar surface. Additionally, lunar lander tests were conducted to predict

and overcome rover egress obstacles and detail various landing scenarios. These projects were part of the overall mechanical design research that was conducted.

METALLIC MICRO-DROPLETS FROM A MICROFLUIDIC PROCESS

ALBERTO LANDA MONTANO · MECHANICAL ENGINEERING
Advisor(s): Burak Ozdoganlar · Mechanical Engineering
Wean Commons-1st Floor, Connan side / 3-5pm

To achieve the fabrication of a perfectly spherical metallic droplet is a challenging task. To do so when the desired diameter is in the micro scale is a lot more complicated. Being able to obtain perfectly spherical droplets at that size is something that has been attempted in the past but never successfully achieved. My goal for this research is, in collaboration with Profs. Ozdoganlar and Anna and their graduate students, to attempt to accomplish this task. The applications for this technology could range from the pharmaceutical to the manufacturing industries.

MOLECULAR DYNAMICS EXPLORATION OF THE NATURE OF THERMAL TRANSPORT ACROSS MULTIPLE CLOSELY-SPACED INTERFACES

NICHOLAS ROCHE · MECHANICAL ENGINEERING
Advisor(s): Alan McGaughey Mechanical Engineering
Rangos 1 / 12-2:30

Superlattices are composite, periodic structures that consist of layers of several different substances. As a result of this composition, superlattices behave differently than isolated interface or multiple interface structures composed of the same materials. The objectives of the proposed research are to (i) identify how many interfaces are required before the thermal transport in a multiple interface structure converges to the value of a periodic superlattice, and (ii) investigate how interfacial species mixing and interface separation distance influences this transition.

PARALLELIZATION IN GRANULAR FLOW SIMULATION

ALEJANDRO QUEIRUGA · MECHANICAL ENGINEERING
Advisor(s): Cecil Higgs · Mechanical Engineering
Rangos Hallway, 2nd Floor / 3-5pm

Granular flow lubrication involves the flow of granular materials in sliding contacts such as annular or bearing-type. Studying the behavior of granular materials in rough, sliding contacts can lead to the development of granular lubricants that can operate in extreme environments, in which traditional (oil-based) lubricants cannot. It can also lead to a better understanding of wheel-sand traction that is important in the design of space rovers that must navigate the Martian terrain. Through computer simulation, we seek to model the friction and wear in bearings lubricated by dry granules. The computer model is based on a hybrid of cellular automata and rigid body dynamics. Compared to other numerical

methods, this gives a relatively fast simulation. However, full simulations can still take hours. This is a severely limiting factor when trying to generate meaningful data. In our work, we explored two techniques for improving simulation runtime: parallelization in both a shared and distributed memory model, and implementation in a low level language. First, we attempted parallelization under a distributed memory model by modifying the original Mathematica code using gridMathematica. Due to poor performance under this model, we decided to attempt a shared memory model. Because Mathematica does not support this type of parallelization, the code was translated into C. This alone yielded nearly a thousandfold speed up. The C code was then parallelized using OpenMP, a compiler package for automatic shared memory parallelization. With the code implemented in C and running in parallel across only two processing cores, we achieved nearly a two thousandfold speed increase over the original Mathematica code. We will continue improving upon this code base in the near future and run the simulation on a four core machine. We plan on applying these techniques to the computer model developed for Particle Augmented Mixed Lubrication in hopes of achieving the same speed ups on a simulation that currently takes two weeks to complete.

POTENTIAL TO KINETIC ENERGY ROLLER COASTER

JENAE PENNIE · CIVIL AND ENVIRONMENTAL ENGINEERING
BRANDON VAN TASSEL · MECHANICAL ENGINEERING
ROSE WEISBURGH · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

The goal of our project is to show the relationship between potential and kinetic energy, through experimentation. In order to teach this lesson, each child will design a roller coaster. The roller coaster will have several requirements including at least one loop and hill. The roller coaster will only work if the heights of at the initial drop, the hill, and the loop are within a specific set of proportions.

PROOF OF CONCEPT FOR A MINIMALLY INVASIVE ROBOTIC BIOPSY CAPSULE

DEREK WISNIESKI · MECHANICAL ENGINEERING
Advisor(s): Metin Sitti · Mechanical Engineering
Rangos 1 / 12-2:30

The development of a minimally invasive capsule capable of obtaining biopsies from the esophagus will have many clinical advantages including minimal patient discomfort and ease of use for the practitioners. A device of this nature requires three independent systems functioning as one in order to be effective. These systems are a rotational positioning system, an anchoring mechanism, and a biopsy tool. Each of these systems was developed independently with the intention of combining them later into one prototype. This project presents proof of concept for the rotational positioning system and the anchoring

mechanism of the capsule. The rotational positioning system is essential for locating the correct area to biopsy radially within the esophagus. The biopsy tool must be able to be positioned directly over the interesting area of tissue. In order to accomplish this task a two directional pulley system was developed. This simple system allows the practitionier to easily position the biopsy tool roatationally by the use of two lines, each of which rotates the capsule in opposite directions. The next system presented here is the anchoring mechanism for the capsule. The system is crucial because it allows the practitioner to control the translational position of the capsule. The strong peristalisis forces within the esophagus force all objects forward toward the digestive system; however, in order to obtain a biopsy the capsule must be stationary. This requires an anchoring mechanism capable of resisting the peristalisis forces. An inflatable anchoring mechanism approach to this problem is presented here. This approach involves the formation of a ring of flexible adhesive polymer around a hollow cavity in the capsule. The pressure within this cavity is then controlled by an external pneumatic system which inflates the polymer enough that it presses outward against the esophagus surface. The friction created by the polymer against the tissue provides enough friction to resist peristalisis. These two systems combined with the biopsy tool will create a device which will minimize discomfort during esophagus biopsies and allow the practitioners much easier access to difficult biopsy sights.

ROBORCHESTRA IV
LAURA ABBOTT · COMPUTER SCIENCE
ROHAN ALETTY · ELECTRICAL & COMPUTER ENGINEERING
ANDREW BURKS · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING
MATTHEW FIORILLO · PHYSICS
JAYWOO KIM · MECHANICAL ENGINEERING
LESLEY LINNE · COMPUTER SCIENCE
RICHARD PANTALEO · MECHANICAL ENGINEERING
ERICA SANDBOTHE · COMPUTER SCIENCE
MICHAEL SANDBOTHE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING
STEFAN SULLIVAN · MUSIC
GREGORY WILLIAMS · COMPUTER SCIENCE
Advisor(s): Roger Dannenberg · Computer Science
Hoch Commons-2nd Floor, Rangos side / 3-5pm

The RobOrchestra project is dedicated to the creation of music using technology coupled with art. Now in its fourth year, RobOrchestra has created a number of robots with specific musical functions and generated meaningful ways for them to play together cooperatively. This year, RobOrchestra hopes to expand its technological outreach to other instruments as well as creating methods for humans to interact with the robots' performance. In this manner

we will expose the connection between science and art by showing the mathematical complexity of music and the artistic possibilities of robotics.

SEE ACTIVITY: HOW SPEAKERS WORK
SHREY AGGARWAL · MECHANICAL ENGINEERING
JONATHAN MATUSKY · MATERIALS SCIENCE ENGINEERING
DAVID O'CONNOR · MECHANICAL ENGINEERING
JUSTIN YI · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

In this activity, students will learn how electromagnetism and vibrations can be used to produce sound. The students will learn that current, when run through a coil, can produce a magnetic field. Students will also learn how vibrations can be used to produce sound, and how volume and pitch can be altered. Students will build their own speaker by making electromagnetic coils and amplification chambers. They will make the speakers by using different numbers of magnets and coils to vary the volume. They will construct amplification chambers out of cardboard and experiment with different sizes and shapes. In this way, students will learn how the physical properties of a speaker change the volume of the sound.

TANKBOT
CASON MALE · MECHANICAL ENGINEERING
OZGUR UNVER · MECHANICAL ENGINEERING
Advisor(s): Metin Sitti · Mechanical Engineering
Rangos 1 / 12-2:30

A small scale tank robot that climbs up walls and ceilings with treads and active tails.

THERMAL ANALYSIS OF A GLASS-FORMING MEDIUM FOR CRYOPRESERVATION APPLICATIONS
REBECCA LANG · MECHANICAL ENGINEERING
Advisor(s): Yoed Rabin · Mechanical Engineering
Rangos 1 / 12-2:30

Cryopreservation is the preservation of tissues at low temperatures, with applications to transplantation medicine. Cryopreservation via glass formation represents a cutting-edge technology, where the destructive effect of ice crystallization is avoided. In the scope of the current study, a glass-forming medium used for cryopreservation applications was thermally modeled using the finite element program ANSYS. Simulations were conducted for cooling rates typical to cryopreservation in vials, placed in a temperature-controlled freezer. The

results of the simulations were used to gain a better understanding of the developed thermal history within the glass-forming medium during cooling.

UNDERSTANDING THE EFFECTIVENESS OF A BLENDED WING BODY DESIGN RELATIVE TO A BOEING 777

ERIC BLOOD · MECHANICAL ENGINEERING
Advisor(s): Shelley Anna · Mechanical Engineering
Hoch Commons-2nd Floor, Window side / 3-5pm

The Blended Wing Body is a radical airplane design that combines the wing surface and fuselage into one continuous body. This design has a wide-body fuselage that acts as the lifting surface with use of its airfoil profile. Although Blended Wing Bodies have been used previously, they have a long distance that must be covered before they can enter the civilian or military air fleet in large numbers.

URBAN WATERFALL

JOSEPH MEYER · MECHANICAL ENGINEERING
COLIN O'SHEA · MECHANICAL ENGINEERING
RAHOOL PADHYE · MECHANICAL ENGINEERING
FRANCISCO SANTIAGO · MECHANICAL ENGINEERING
Advisor(s): Cecil Higgs · Mechanical Engineering
Rangos 2 & 3 / Sigma Xi Group 4, 11:15am

One of the oldest and most reliable sources of energy is moving water. Waterwheels were the original turbine, and they provided the power necessary for some of the earliest forms of industrialization. Even in this age, flowing water remains a strong source of energy as it has become a strong force in the world of green energy solutions, Dams are the most wide spread means of deriving power from water, but the waterwheel or hydro turbine remains a prevalent aspect of utilizing flowing water. The greatest problem with utilizing flowing water is that it is necessary to have a natural source of water such as a river or waterfall. In a largely urbanized society, this creates an obstacle for utilizing the energy of moving water to its greatest potential. The Urban Waterfall is the solution. The Urban Waterfall would use a building's existing guttering system to create a readily available waterfall. The falling water would spin a Pelton turbine and be deposited back into the drainage system. Although the Urban Waterfall is not designed to be used residentially, it is perfect in a commercial setting. The system would bring the power of the natural waterfall into an urban society that is in desperate need of efficient means of utilizing the natural world to power man's creations and ultimately to fuel his creativity. The Urban Waterfall will do for this society what the waterwheel did for rural artisans prior to the Industrial Revolution.

WATER-CARBON NANOTUBE INTERACTIONS
OTTOLEO KUTER-ARNEBECK · MECHANICAL ENGINEERING
Advisor(s): Alan McGaughey · Mechanical Engineering
Rangos 1 / 12-2:30

An overview of my research into the interactions of water and carbon at the nano-scale in carbon nanotubes at the Nanoscale Transport Phenomena Laboratory will be presented. The research covers water-carbon interactions from creating a new potential function to characterizing the transition to sub-continuum flow.

UNDECIDED

ASME DESIGN PROJECT: REMOTE CONTROLLED MARS ROVER
JOSHUA BLOSSER · MECHANICAL ENGINEERING
JAIME BOURNE · MECHANICAL ENGINEERING
ANDREW BURKS · MECHANICAL ENGINEERING
SAMANTHA CATANZARO · COMPUTER SCIENCE
JACOB COFFELT · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING
MICHAEL CUSHMAN · MECHANICAL ENGINEERING
MEGAN DORITY · MECHANICAL ENGINEERING
BRADLEY HALL · MECHANICAL ENGINEERING
ANDREW HILLENIUS · ELECTRICAL & COMPUTER ENGINEERING
MICHAEL KAHN · COMPUTER SCIENCE
PAUL KENNEDY · ELECTRICAL & COMPUTER ENGINEERING
SZU-CHIEH LU · MECHANICAL ENGINEERING
CHARLES MUNOZ · UNDECIDED
RICHARD PANTALEO · MECHANICAL ENGINEERING
WEI SHI · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING
BENJAMIN SOM-PIMPONG · MECHANICAL ENGINEERING
DAVID STONESTROM · MECHANICAL ENGINEERING
GAURAV VERMA · MECHANICAL ENGINEERING
Advisor(s): Metin Sitti · Mechanical Engineering
Rangos 2 & 3 / Sigma Xi Group 4, 10:00am

The objective of this project is to allow the design group to gain practical knowledge of the mechanical engineering design process and the dynamics of interdisciplinary teamwork. Based on research gathered over several weeks, a team assembled through the American Society of Mechanical Engineers (ASME) and the Robotics Club will develop and produce a theoretical model using a parametric modeling software package and after prototyping and

testing will produce a working physical model. The team will compete in the regional ASME conference in April 2009. The purpose of this project is to develop a remote-controlled robot that will simulate tasks to be performed by future NASA rovers to both mars and the moon. Members of the group will analyze the given problem and come up with solutions designed to maximize efficiency in order to collect and deliver the target objects in accordance with stringent guidelines set forth by ASME. Through the course of this project, the group members will gain valuable skills needed to pursue additional mechanical design projects in the future.

ADVANCE GRATZEL CELL RESEARCH ON ORGANIC DYE APPLICATION

JAMES TANOTO · UNDECIDED
Advisor(s): Elias Towe · Electrical & Computer Engineering
Rangos Hallway, 2nd Floor / 12-2:30

Applications of the dye to widen the spectrum that a Gratzel cell can receive is a common technique. From my previous studies, organic dyes have shown a better performance compared to chemical dyes at hundreth of its price. The problem with it is to preserve and maintain that performance, and that is what is done in this research.

DEFORMABLE WHEELS FOR LUNAR APPLICATIONS

ROSS FINMAN · ELECTRICAL & COMPUTER ENGINEERING
JOEL PAZHAYAMPALLIL · UNDECIDED
Advisor(s): David Wettergreen · Robotics Institute
Rangos 2 & 3 / Sigma Xi Group 4, 10:15am

The mobility system of a vehicle intended to operate on extraterrestrial terrain faces unique challenges and the wheels used are particularly critical. The wheels used on a lunar rover in particular, must withstand temperature changes of over 300 C, cope with lunar soil, navigate over obstacles, and, like any other spacecraft component, be extremely light weight. This project intends to develop deformable glass fiber resin wheels that conform to terrain contours and obstacles, for application with Carnegie Mellon's Red Rover project. The project will also evaluate the effectiveness of this wheel and similar designs for future planetary exploration vehicles.

DEVELOPMENT OF AN OPTIMIZED EXHAUST SYSTEM FOR A FORMULA SAE RACECAR

JOSHUA BLOSSER · MECHANICAL ENGINEERING
MING-YANG HUNG · MECHANICAL ENGINEERING
FEDOR KLESHCHEV · UNDECIDED
MICHAEL LIN · MECHANICAL ENGINEERING
ERICA TUCKER · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Kenji Shimada · Mechanical Engineering

John Wiss · Mechanical Engineering
Kirr Commons-1st Floor, Window side / 12-2:30

This project aims to develop an optimized exhaust system for a Honda CBR600F4i motorcycle engine for use in a Formula SAE racecar. This research will utilize drivetrain simulation software to pre-determine the most appropriate exhaust system for the application. A custom exhaust header, manifold and muffler will be developed to fit within the confines of the Formula SAE racecar. The result will be a quieter car that satisfies noise regulations while having higher performance than when using the stock exhaust system. This will allow Carnegie Mellon Racing (CMR) to produce a more competitive product in the areas of design and performance for the Formula SAE Competition.

FERROFLUID ACTUATION IN ROBOTS
ROHAN ALETTY · ELECTRICAL & COMPUTER ENGINEERING
JOHN BRESSON · COMPUTER SCIENCE
MATTHEW FIORILLO · PHYSICS
RENTARO MATSUKATA · ELECTRICAL & COMPUTER ENGINEERING
ANDREW TAN · UNDECIDED
Advisor(s): Seth Goldstein · Computer Science
Rangos 2 & 3 / Sigma Xi Group 4, 10:30am

An actuator for a robot with no moving parts using solely ferrofluid and magnetism.

HARDWARE DEVELOPMENT FOR BRAIN COMPUTER INTERFACE
SOOHYUN JANG · UNDECIDED
Advisor(s): Jeyanandh Paramesh · Electrical & Computer Engineering
Rangos Hallway, 2nd Floor / 3-5pm

In recent years, researchers have been working intensely to develop methods to restore movements in paralyzed limbs. One promising way to manipulate these paralyzed limbs is by creating an alternative bridge between the brain and the body. A Brain Computer Interface (BCI) is a hardware electronic system that will provide this alternative communication pathway and thus improve the quality of life of people with severe motor disabilities. The major components of BCI include: (1) electrodes to detect neural signals (2) the recording and conditioning electronics which amplifies, filters and digitizes the recorded signals (3) a wireless communications module to transmit the signals to an external device, such as a computer, for analysis and possibly actuation of a prosthetic device.

SYNTHESIS OF CADMIUM SELENIUM NANOPARTICLES

ABIGAIL ONDECK · UNDECIDED
Advisor(s): Nisha Shukla · ICES
Rangos Hallway, 2nd Floor / 3-5pm

The synthesis of nanoparticles has always been an area of interest in the field of science. It takes an exact procedure to form the correct size and shape of nanoparticles consistently. Cadmium selenium nanoparticles is one of the fields that is being studied due to its ability to form in many different sizes and shapes, including rods and tetrapods. There are also many various procedures which may be followed to create the same type of nanoparticles. The goal of this project is to determine which procedure produces the best quality of nanoparticles and how the procedure affects the size and shape of cadmium selenium nanoparticles.

CFA

COLLEGE OF FINE ARTS

ARCHITECTURE

GREENERBILLS
DAVID KENNEDY · ARCHITECTURE
JACOB MOHIN · CHEMISTRY
BENJAMIN SOM-PIMPONG · MECHANICAL ENGINEERING
Advisor(s): Cliff Davidson · Civil and Environmental Engineering
Justin Parisi · Industrial Management
Kirr Commons-1st Floor, Window side / 12-2:30

A Thermodynamics professor at Carnegie Mellon University slyly grinned at his class and offered a dollar to any student who could explain to him the definition of energy. Hands shot up and answers flew back and forth, but after a few moments, the professor, smiling knowingly, returned his bill to his wallet. No one could give a satisfactory definition because energy, particularly in the form of electricity, is an elusive concept. People can neither touch it nor see it and yet it powers our world and is the subject of great debate and controversy. The inability to tangibly grasp electricity is compounded by the fact that energy usage patterns are largely hidden from domestic consumers by utility companies. The problem is that consumers are wasting money and harming the environment through inefficient energy usage because of a lack of information.

This is the problem that we intend to correct. Through a grant from the Mascaro Center for Sustainable Innovation, we have implemented a system that uses our custom interactive website (*greenerbills.net*), social networking, and an electricity metering system to give consumers feedback on their energy usage in a unique way. Greenerbills.net will create an environment where consumers can be aware of their usage through pop-up notifications, stunning visuals. The y can also compete with others in their neighborhood. Studies show that consumers saved 15% in energy costs just by being aware of their usage. Our system goes farther by putting power in the hands of consumers through a psychological model called "norm activation". According to norm activation, consumers must first be aware that there is a problem; they must then realize that they have a role in causing that problem and that they have the power to effect a change. This new consciousness spurs individuals to take action based on motivations such as pressure from friends or family, moral concerns, or the desire to save money. Receiving a monthly bill from a utility company with data that is often difficult to decipher just is not effective. Our system creates an environment for consumers where conserving energy is enjoyable, cost effective, and helpful for the environment.

PATTERNING AND MODULARITY IN ARCHITECTURE
FILIP AGREN · ARCHITECTURE
MAXIMILIAN AROCENA · ARCHITECTURE
ELIZABETH DURAY · ARCHITECTURE
Advisor(s): Charles Rosenblum · Architecture
Class of '87 / Oral 6, 1:40pm

This project seeks to connect theoretical propositions about systematic site relationships to architectural form and experience through a modular, functional and public installation. Through the use of the School of Architecture's fabrication tools and our rigorous investigation of textual precedent we will enter into architectural dialogue with built work and written methodology. We believe that full scale experimentation in the definition of space and experience is the most informative form of research.

ART

Cinema Of The Mechanized
Chin-Chiang Tseng · Art
Advisor(s): Osman Khan · Art
UC Gallery / 3-5pm

Cinema of the Mechanized is an exploration of the intersection between robotics, visual art, and cinema/surveillance. It's a questioning of the spectacle/spectator relationship, and more intimately it asks how each individual structures our humanity in the context of a mediated society.

FROM FRANCE TO PITTSBURGH: THE MAKING OF MR. SHEEP
RYAN WOODRING · ART
Advisor(s): Lowry Burgess · Art
UC Gallery / 3-5pm

I began developing the script for Mr. Sheep while working on a sheep farm in Southern France this past summer. The story I have written follows a simple narrative as it displays the lives of John, Brigit, and their nine year-old son, Gaston, on the farm. The main tension in the film is created by the unrelenting scars that have shown up on the backs of several of the family's seventy sheep. These scars, the combined result of an amateur sheering job, an extremely hot summer, and relentless flies who feast on the unhealed wounds, are slowly killing the sheep. John begins building a shelter for the sheep to protect them from the gnawing flies. The film will cover, in vignette-like style, the routine of the farm, while subtly hinting at a symbolic relationship between the innocent sheep and the fledgling farmer, Gaston.

This connection, posing innocence against the weight of the world, is strengthened at the end of the film when a sheep falls through the bathroom floor and lands on Gaston, sending him to the hospital. Gravity, in this scene, is the cold, dominant force that makes one unsuspecting being (the sheep) fall upon another (Gaston). Mr. Sheep is therefore a journey into a world that, despite its surreal aesthetic and fantastical finale, is quite familiar: a world where physical rules and necessities force innocence into uncomfortable confrontations with the harshness of an impregnable order.

HISTORIC OCCASION
RAYMOND TRIPODI · ART
Advisor(s): Lowry Burgess · Art
UC Gallery / 3-5pm

Stories are vehicles for memory. In sorting through the stories that surround me I hope to better understand my own as it is shaping at this school. My summer's research will explore the Adena and Hopewell cultures that first inhabited the Allegheny county area. My research will also delve into the history of the university, focusing on campus lore with particular interest in the fictitious and absurd. The information gathered will be used to blend both my story with that of Pittsburgh's, culminating in a public art performance with sculptures and motorcycles near the end of my ten weeks.

IMAGING DISASTER
DAWN WELESKI · ART
Advisor(s): Andrew Johnson · Art
UC Gallery / 3-5pm

I propose to investigate the function of the mural in times of political, social, and cultural crisis. Through this research, I wish to distill my own treatment of epic drawings and depict my understanding of disaster. As opposed to tragedy, disaster does not implicate the human as the origin of its path but delineates cosmological and astrological events as established forces. I would like to determine if and how contemporary society generates forums for disaster and if these revelations have achieved the status of topical tragedy or conflict in our present mythologies. Throughout this investigation, I will utilize the human figure as a tool to narrate the contemporary mythology of disaster and attempt to incite a cathartic reaction in my audience through images.

ON THE ORIGINS OF SPECIES
LAUREN HECHT · ART
Advisor(s): Joe Mannino · Art
Regina Miller Gallery / 3-5pm

I intend to create a fictional movie trailer and set of corresponding action figures that focus on the theme of biological evolution. Over the last few years my work has centered on creating original creatures. This project is a continuation of my previous year's work, and it will allow me to flesh out who these creatures are. I intend for the project to last through the entire year, as I will be working in both sculpture and animation. I will produce a two minute 3D-animated trailer in Maya (a 3D animation and modeling software) along with 3D printed figures complete with packaging. I plan to present them together in a gallery setting. By completing this project, I hope to develop a better understanding of where these creatures emanate from, and how they reflect my beliefs on interpersonal dealings. I view this as a unique opportunity to combine my interests in 3D animation and sculpture.

SMOULDER: EVOLUTION OF CHANDELIER

GUANGYUAN SHAN · ART
Advisor(s): Susan Tsu · Drama
UC Gallery / 3-5pm

From the age of rococo, the French Empire used the chandelier as a focal decorative centerpiece for all the rooms in their palaces. This luxury item was their symbol of wealth and status. This precious item has been adapted throughout the history and is now a must-have object for normal households. Designer Eve Dan created chandelier inspired forms by manipulating textiles to redefine the ever-changing sculptural nature of the object.

THE QURAN STAND AND ITS SPIRITUAL SYMBOLISM

DAVID WRIGHT · ART
Advisor(s): Robert Bingham · Art
UC Gallery / 3-5pm

I propose to carve a set of folding bookstands from wood. The book stands will then be donated to the Islamic Center of Pittsburgh which currently has none.

WHY WARHOL?

STEFANIE KIM · ART
Advisor(s): Elaine King · Art
UC Gallery / 3-5pm

The objective of the project is to create limited editions of an art history book for children on Andy Warhol and his involvement with popular culture. In this small volume, I will not only demonstrate the relevance of Warhol's work but also provide a historical context about the man and its influence on future generation of arts.

DESIGN

CRANK THAT
JACOB BEATTY · ICES
MANA HESHMATI · ICES
FEDERICO RIOS · DESIGN
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

Through the application of a mechanism that demonstrates the process of transforming rotational energy into linear energy, young students will learn about mechanical advantage. This mechanism includes a crank and gear system. When the crank is turned, the gear will lift a rack which holds a weight. The weight is too heavy to be lifted by hand, but when using the mechanism, students will realize that it is easy to overcome the forces of gravity. This project teaches the importance of mechanical advantage, and how through turning a set of gears that are attached to a rack, rotational energy can be transferred into linear motion.

MATERIAL SELECTION AND PROCESS USING DIGITAL FABRICATION
ANDREA IRWIN · DESIGN
Advisor(s): Wayne Chung · Design
UC Gallery / 3-5pm

Freshman year one of my professors, Steve Stadelmeier, pulled me aside and talked for nearly half an hour about this whisk constructed from plant fiber. He told me it was happy because the material was "doing what it wanted." Steve continued this was why, despite all the advances in material science, the simple, natural solution prevailed. Three years later and still have yet to forget that man's fascination with this whisk.

Materials are a key decision in the design of a product yet due to time constraints and project deadlines students are rarely given the luxury of comparison. To that end, I am exploring the natural benefits and detriments of several different materials using nontraditional fabrication methods in the architectural Digital Fabrication Lab located in the third basement of Margaret Morrison. As a designer, this exploration will play a key role in my understanding of the qualities and capabilities when making selections in the future. Beyond my own gain, given that the facility is quite new, I hope to provide my work as an example of the capabilities of the shop and available materials. I will also work in direct contact with the shop manager, Zach Ali, to work off of his expertise and submit the digital files and notes to the online fabrication communities for the betterment of the larger design world.

TAILS
DEFNE CIVELEKOGLU · DESIGN
NADEEM HAIDARY · DESIGN
Advisor(s): Stephen Stadelmeier · Design
UC Gallery / 3-5pm

Many of the major conflicts in the world are fueled by a lack of intercultural understanding. In many cases people don't take interest in cultures which are different than their own. The best way to defeat this ethnocentrism is by targeting the next generations. We see value in applying design methods to this problem, using tangible artifacts to address the lack of cultural understanding. Our objective is to represent the world's cultures through a set animals that are significant to the geographical regions of those cultures. Each animal would be crafted to visually portray the materials and the personality of their assigned culture while still maintaining a cohesive appearance for the set. This approach would give people, especially children a glimpse of the similarities and differences in the world around them. Animals are without preconceived political associations and they provide a medium children would want to interact and play with. These interactions will be the building blocks to a cultural knowledge which can be enriched through zoos, museums, books and travel. Support materials, a booklet and a web site, will create this continuity between Tails and the existing resources. While serving the global community, Tails, also benefits us, the designers, in multiple ways. Primarily, we will be challenged to study for m language in a scale we never have before, distilling the visual qualities embedded in countless artifacts over hundreds of years. This process will undoubtedly increase our own knowledge about the world and increase our skill in crafting objects by hand. The introduction of Tails, will bring a renewed interest in craftsmanship and culture to the industrial design field, which has largely forgotten its deep historical roots.

WHY IS GRANDMA GREEN: A STUDY OF ENVIRONMENTAL PRACTICES IN ASIA
CHRISTOPHER CHIEN · DESIGN
Advisor(s): Melissa Cicozi · Design
Wean Commons-1st Floor, Connan side / 12-2:30

"Wasteful" is a term that applies Americans in the global context. Only recently, have more Americans become more environmentally conscious and "green". I studied other countries in Asia (Taiwan) for inspiration on ways to become more environmentally friendly. Last summer, I documented my trip to Taiwan with photos and notes. I interviewed local people and their recycling methods, visited recycling centers, and saw how "Huan Bao" - the Taiwanese term for "Saving the Earth" pervades everyday life. This research project evaluates these environmental practices and suggests how to improve the current environmental crisis.

MAPPING MY CMU
LUTHER YOUNG III · DESIGN
Advisors Wayne Chung · Design
Mark Mentzer · Design
UC Gallery / 3-5pm

Every student at CMU has a unique way that they navigate campus. After receiving the questionnaires from 50 different students, illustrations, animations and models were developed to indicate the way that they navigated campus.

DRAMA

LEVERS, PULLEYS, AND MECHANICAL ADVANTAGE
CLAYTON CRITES · MECHANICAL ENGINEERING
ROSEMARY LUO · ICES
REBECCA MCAUSLAND · DRAMA
COLIN O'SHEA · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

To better familiarize children with the concept of mechanical advantage, we've devised an activity which will allow for hands on engagement with a pulley-driven see-saw apparatus. During the session the children will interact with the apparatus by pulling a rope attached to pulleys which will raise the weighted end of the see-saw. Children can be seated on both ends of the apparatus, essentially acting as counterweights to change the mechanical advantage. By moving the fulcrum of the see-saw and changing the number of pulleys used to raise a given weight, the children will be able to experience physically the mechanical advantage provided by each setup. This activity will help solidify the basic statics concepts behind both the classic lever and pulley mechanisms.

MAGGIE LANE IS MISSING
JEREMY UNGAR · DRAMA
Advisor(s): Gregory Lehane · Drama
McConomy Auditorium / 1-2pm

I want to create a literary cinema, a cinema in which the director - in a leap of faith - shares something essential and private with the audience. In order to endow cinema with the powers of literature, new ways of showing thought must be invented. Adaptation is a powerful resource to drive this invention. In being faithful to the spirit of a piece of great literature, I will (of necessity) not be faithful to its exact events. Instead, I will do what is

necessary to make a new work that attains the same emotional effect as Ambrose Bierce's short story "An Occurrence at Owl Creek Bridge."

THE MEASURE OF A MAN
MATTHEW BIALEK · DRAMA
BARTON CORTRIGHT · DRAMA
ANTHONY MATTANA · DRAMA
KEVIN SERVICE · DRAMA
Advisor(s): Dick Block · Drama
McConomy Auditorium / 10-11am

A study in producing a single-shot film that examines the modern definitions of masculinity. Synopsis: Six men are isolated from the rest of the world and must contend with their own quirks before joining the rest of society.

MUSIC

ROBORCHESTRA IV
LAURA ABBOTT · COMPUTER SCIENCE
ROHAN ALETTY · ELECTRICAL & COMPUTER ENGINEERING
ANDREW BURKS · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING
MATTHEW FIORILLO · PHYSICS
JAYWOO KIM · MECHANICAL ENGINEERING
LESLEY LINNE · COMPUTER SCIENCE
RICHARD PANTALEO · MECHANICAL ENGINEERING
ERICA SANDBOTHE · COMPUTER SCIENCE
MICHAEL SANDBOTHE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING
STEFAN SULLIVAN · MUSIC
GREGORY WILLIAMS · COMPUTER SCIENCE
Advisor(s): Roger Dannenberg · Computer Science
Hoch Commons-2nd Floor, Rangos side / 3-5pm

The RobOrchestra project is dedicated to the creation of music using technology coupled with art. Now in its fourth year, RobOrchestra has created a number of robots with specific musical functions and generated meaningful ways for them to play together cooperatively. This year, RobOrchestra hopes to expand its technological outreach to other instruments as well as creating methods for humans to interact with the robots' performance. In this manner

we will expose the connection between science and art by showing the mathematical complexity of music and the artistic possibilities of robotics. year, RobOrchestra hopes to expand its technological outreach to other instruments as well as creating methods for humans to interact with the robots' performance. In this manner we will

CROSS-COLLEGE
BHA

"PSYCHOPHONIC ODYSSEY"
CHRISTOPHER CORNWELL · BHA
Advisor(s): James Duesing · Art
UC Gallery / 3-5pm

"Psychophonic Odyssey" is a 28 page, 8.5 by 11 inch narrative comic with silkscreened inside and outer covers. This piece breaks from the established conventions of contemporary comics by encapsulating the history of the medium and by incorporating elements of other media and art practices through a meandering pastiche of styles and content. The comic's narrative examines contemporary American culture and juxtaposes it with the country's history, focusing on American mythology of the past and present, folk tales, and popular culture. Through various distribution methods, the final product will ultimately be available from online retailers and stores across the country, but "Psychophonic Odyssey" retains the spirit and idiosyncratic vision of the underground comics practice.

DEATH OF A COUNTRY MAIDEN
GRAHAM SWINDOLL · BHA
Advisor(s): Gregory Lehane · Drama
McConomy Auditorium / 12:30-1:00pm

Is our history part of our reality, and how can we understand it as such? What role does fiction play in this understanding? "Death of a Country Maiden" is a short film, based on the famous 1827 case of The Murder in the Red Barn. This event drew huge public attention, and took on a cultural role similar to tabloid murders of today. The result of this popularity was a string of fictions, stage melodramas, and even films which reduce the crime to a caricature. This film reexamines the smallest actions of the protagonists and their surroundings, seeking to understand both the reality and the fiction of the event. It is an aesthetic and philosophical investigation into the nature of both reality and fiction, and their role in our lives.

EYES OF CHINA
VIVIAN SONG · BHA
Advisor(s): Sharon Dilworth · English
Regina Miller Gallery / 3-5pm

This project will analyze modern China in the research of personal stories taken from various sources, interconnected in their relation to the persecution of Falun Gong in China. My response will be presented through two pieces of visual media; an oil painting, and a screenplay written with the intent of becoming a filmed docudrama. In writing stories inspired by reality and then bringing them to life on canvas, contemporary issues are identified and then evaluated in a powerful integration of the visual within the literary. My goal is to present a worldview so as to depict both the facade of a booming China and its underlying reality with an intensified human rights record as leading to the 2008 Beijing Olympics.

FACE TO FACE
NATHANIEL KRAUSE · BHA
Advisor(s):Sharon Dilworth · English
Brian Staszel · Computer Science
McConomy Auditorium / 12-12:30pm

A short film that explores the interdisciplinary nature of academic life: Three students reach creative blocks when working on their respective projects. Through their social interactions and interactions with each other's work, each comes to a new understanding about their own endeavors.

FICTIONAL AUTOBIOGRAPHY
VICTORIYA KOVALCHUK · BHA
Advisor(s): Timothy Haggerty · Science and Humanities Scholars
Pake / Oral 5 1:20pm

My senior project will is an integration and exhibition of my two fields of study at Carnegie Mellon; communication design and creative writing. My stories and poetry is heavily autobiographical but even though it is fictionalized way beyond truth or actual events, there are certain emotional truths that all of my writing explores. I am compiling a small book of my writings as linked stories, design the book itself, then actually producing it (printing and hand binding it). The end result is an object that embodies both writing and design, and it will symbolize my education at CMU as an undergrad.

HUSBAND AND WIFE
ELIZABETH BARSOTTI · BHA
Advisor(s): Mary Weidner · Art
UC Gallery / 3-5pm

"Husband and Wife" is an interdisciplinary project which explores marriage and gender through art, craft, and writing. Project work includes letterpress books with original poetry, paintings, altered furniture, quilts, and collected objects. Through this work, I explore the disintegration of tradition and traditional modes of living. A fading connection with the earth is one aspect of this exploration, but with it comes an inquiry into the institution of marriage, gender-typical roles, the loss of rural areas to suburban sprawl, and the loss of the singular, handmade object to the mass-produced. The project functions as the capstone to my interdisciplinary degree in the Bachelor's of Humanities and Arts program, and was originally displayed as a two-gallery art exhibit in November 2008.

NON-COMMERCIAL DISTRIBUTION OF MUSIC IN THE UNITED STATES FROM 1992 TO THE PRESENT

BRIAN CALLAHAN · BHA
Advisor(s): Stephen Schultz Music
Pake / Oral 8, 3:00pm

This project focuses on the non-commercial distribution of music in the United States from 1992 to the present. The time period studied begins with the Audio Home Recording Act of 1992. The project also looks at more recent ways to distribute music non-commercially, such as Internet piracy and the Creative Commons license. The project makes the argument that most of the non-commercial distribution of music has occurred in response to the Recording Industry Association of America's lawsuits both against large companies and individuals.

THE BEES ARE DISAPPEARING

ELIZABETH BARSOTTI · BHA
Advisor(s): Terrance Hayes · English
Pake / Oral 11, 4:00pm

"The Bees Are Disappearing" is a collection of free verse poetry that explores gender, domesticity, and nature. It was submitted in Fall 2008 as my H&SS Honors Thesis.

THE LARGE INSTRUMENT

DAVID LASKY · BHA
Advisor(s):Carol Kumata · Art
Regina Miller Gallery / 3-5pm

The Large Instrument is an investigation of how we use objects. They are tools, toys, and artifacts. They can be used to prove that events took place, and they can be used to make events take place. The Large Instrument is a fully interactive monument to the idea of object-based knowledge.

BSA

WNT AND FGF SIGNALING PATHWAY, ORODACIAL CLEFTS AND DENTAL ANOMALIES

ANA KIM · BSA
Advisor(s): Alexandre R. Viera · University of Pittsburgh
Rangos 2 & 3 / Sigma Xi Group 1, 10:00am

Craniofacial anomalies are the most common birth defects in newborns. Cleft lip and palate is one example of craniofacial deformities,which is a common type of congenital anomaly found in newborns; approximately 1 in every 500 to 1000 is born with cleft lip and palate (Murray 2002). The etiology of oral cleft and palate is difficult to study since it is widely variable, influenced by the geographic origin and socioeconomic status. It is suggested that individuals born with orofacial clefts have a shorter lifespan. Also, the correlation between oral clefts and cancer is proposed; individuals born with oral cleft show higher rate of breast cancer, brain cancer and lung cancer. Not only the individual born with oral cleft, but also, parents of children born with oral cleft have higher cancer risk (Nishi et al., 2000; Zhu et al., 2002; Bille et al., 2005). WNT and FGF signaling pathways are complex networks of proteins most known for their roles in embryogenesis and cancer, but also involved in normal physiological processes in adult animals. They play important roles in development, cellular proliferation and differentiation in various species. We hypothesize that genetic variation in genes involved in the WNT and FGF signaling contributes to clefts. Mutations in AXIS inhibition protein 2 (AXIN2) cause oligodontia (MIM 604625) and increased susceptibility to colorectal cancer (Lammi et al., 2004). Mutations in AXIS inhibition protein 1 (AXIN1) are associated with gastric (Pan et al., 2008) and colon cancer (Segditsas and Tomlinson 2006). We will investigate genetic variation in AXIN1, AXIN2 and FGF genes in clefts and study possible interactions between these genes. In the long term, the knowledge of the multiple genetic factors underlying craniofacial birth defects could lead to important changes in genetic counseling for families who have had one or more children with isolated cleft lip and/or cleft palate. The results may provide a chance for an individual to avoid certain exposure that may further contribute to the underlying cancer risk due to genetic background; for example, one my decide not to smoke due to susceptibility to lung cancer.

BIOLOGY AND PSYCHOLOGY

MALDI-TOF MASS SPECTROMETRIC DETECTION OF THE ACIDIC TAIL OF HIGH MOBILITY GROUP BOX PROTEIN-1 [HMGB1] IN HUMAN SERUM AS A BIOMARKER OF METASTASIS

SHELLY KUCHERER · BIOLOGY AND PSYCHOLOGY
Advisor(s): L.J. Sparvero

Rangos 2 & 3 / Sigma Xi Group 1, 10:15am
Class of '87 / Oral 4, 1:00pm

HMGB1 is a damage-associated molecular-pattern molecule (DAMP) that is passively released from the cell during necrosis and is a pro-inflammatory mediator. It is upregulated in many cancers, and its presence in serum is usually associated with poor prognosis and metastatic disease. However, detection and separation of HMGB1 from highly abundant serum proteins can be a challenge. We used a bottom-up proteomics approach to detect biomarkers of HMGB1 with MALDI-TOF Mass Spectrometry. HMGB1 is a 25 kilodalton (kDa) protein with three domains: two basic DNA-binding boxes and an acidic tail composed of 30 glutamic and aspartic acid residues. An acidic tail of that length is found very rarely in Nature, and thus we have used it as a specific marker for HMGB1. Separating HMGB1 from human serum proteins and cleaving the acidic tail for specific detection by Mass Spectrometry is a rapid and sensitive assay for cancer metastasis.

MINDFULNESS IN ADOLESCENTS AT RISK FOR DEPRESSION: LINKS TO DEPRESSIVE AND ANXIOUS SYMPTOMS AND EXECUTIVE FUNCTION

CECILIA WESTBROOK · BIOLOGY AND PSYCHOLOGY
Advisor(s): Dr. Jennifer Silk · WPIC
Rangos 2 & 3 / Sigma Xi Group 6, 10:15am

Mindfulness is a form of nonjudgmental attentional control related to better psychological health and resilience, effective in treatment and relapse prevention of major depressive disorder in adults. Preliminary research in mindfulness interventions for children and adolescents is also promising, but currently there are no widely-available measures for assessing trait mindfulness in this age group. Toward that end, the current study adapted a comprehensive adult mindfulness measure, the Kentucky Inventory of Mindfulness Skills (KIMS), for age-appropriateness within an adolescent sample. The KIMS contains a total score as well as four subscales: Observe, Describe, Nonjudge, and Act with Awareness. The adapted questionnaire was administered to 64 children, 34 of which were at high familial risk for major depressive disorder. Overall reliability for the scale was 0.67, and three of the subscales (Observe, Describe and Nonjudge) were considered reliable with alphas between 0.6 and 0.86. In order to establish construct validity, participants were concurrently assessed on related measures, and it was found that higher scores of mindfulness correlated to lower scores on assessments of depressive and anxious symptomatology, and higher scores on measures of effortful control components of temperament. No relationship was found between mindfulness and rumination. Additionally, a significant interaction was also found such that the negative relationship between mindfulness and depressive symptomatology only occurred for participants with better sustained working memory performance, indicating that the benefits of mindfulness might only be apparent for children or adolescents with better working memory capacity, or greater cognitive function.

SELF-DEFINED

GRAPH AFRICA: A COLLABORATIVE ATTEMPT AT CREATING A HIGH-QUALITY VISUAL KNOWLEDGE REPOSITORY ABOUT AFRICA.

SUSAN LIN · SELF-DEFINED
EDWIN SHAO · BUSINESS ADMINISTRATION
Advisor(s): Edda Fields · History
Rahul Tongia · Engineering and Public Policy
Pake / Oral 7, 2:00pm

Contemporary Africa has been blessed with an incredible diversity of people interested in its past, welfare, and future. Academics, NGOs, and entrepreneurs flock to the continent because of its rich history, intractable challenges, and most importantly, innumerable opportunities. This diversity has resulted in a large potential for collaboration and interdisciplinary work. But it has also created a set of unique communication and informational challenges that grow more complex daily, as additional people enter Africa with their own knowledge and goals. Graph Africa aims to explore how people most effectively learn about Africa, with the aim of becoming a prominent learning tool for Africanists of all backgrounds.

H&SS

HUMANITIES AND SOCIAL SCIENCES

ECONOMICS AND STATISTICS

BRAIN ACTIVITY OF A SEDATED CAT

MICHAEL ALBRECHT · MATHEMATICS
VINITH ANNAM · ECONOMICS AND STATISTICS
NICOLE MATTISON · ECONOMICS AND STATISTICS
Advisor(s): William Eddy · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

We are interested in determining the neural effects of an external visual stimulus on a sedated domestic cat. In this study, researchers make a cat look at a television screen with bars moving across the display, while filming the cat's brain to look for changes. However, the largest changes in the video are not caused by neural activity, but rather by the direct effects of respiration and circulation, which interfere the cat's brain activity. Our objective is to remove these extraneous effects from selected parts of the original data, so that others can study the relationship between the external visual stimulus and the "corrected" data. Our approach uses Fourier analysis to isolate and filter out the periodic effects of respiration and circulation.

ESTIMATING A DEMAND SYSTEM FOR PARENTAL CHOICE IN SCHOOL

AKSHAYA JHA · ECONOMICS AND STATISTICS
Advisor(s): Dennis Epple · Economics
Dowd / Oral 3, 12:40pm

For my senior thesis, I am examining data on the Pittsburgh school system. My specific research question revolves around generating and estimating models of parental choice of school. In essence, the research objective is to understand what factors drive household demand for public education. Broadly speaking, parents may be able to choose between different types of schools such as public, charter and private schools, dependent on such variables as income and geographic location. The dataset utilized for this analysis is composed directly from Pittsburgh school district databases, and is therefore somewhat unique in the comprehensive nature of its coverage. Within the paper, I also investigate effects by neighborhood using information from the 2000 Census. Finally, the primary model in this paper is a "discrete choice model", which was developed in the Industrial Organization literature in order to estimate demand systems for differentiated products.

STATISTICAL MODELS FOR CORRECTING CCD NOISE

ROBERT CHEANEY · MATHEMATICS
DONGMIN LEE · SCIENCE AND HUMANITIES SCHOLARS
SAMANTHA MARINO · MATHEMATICS
KATHRINE SAPEGA · ECONOMICS AND STATISTICS
Advisor(s): William Eddy · Statistics
David Friedenberg · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

A charge-coupled device (CCD) is a main component of a digital camera that creates a digital image by converting light into an electrical charge. The CCD consists of a silicon dioxide layer and an array of electron potential wells. When a photon hits the silicon dioxide layer, just above an electron well, the released electrons are trapped inside the well. Each electron well is then sequentially converted and stored digitally as a pixel in the image. During this process, various effects such as dark current, inaccurate pixel values, photon noise, and sensitivities due to manufacturing processes commonly occur. These effects tend to alter the individual pixel values in the image, thus creating excess image noise. Several images of the inside of a lens cap were taken to explicitly show the current effects of an individual camera. The primary objective of this study was to estimate these effects by producing a function that can be used to correct CCD related noise in other images taken by this camera.

THE FEDERALIST PROJECT

VASUDHA CHANANA · MATHEMATICS
HEE-WON CHANG · STATISTICS
ALEXANDRA CHARNAS · MATHEMATICS
DANIEL LIM · ECONOMICS AND STATISTICS
CASSANDRA STUDER · STATISTICS
Advisor(s): William Eddy · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

The Federalist Papers are a series of articles written before the Revolutionary War, advocating the ratification of the United States. It serves as a primary source for interpretation of the Constitution. Federalist data consists of 77 papers of which the authors of 65 are known: 51 papers are written by Alexander Hamilton and 14 papers are written by James Madison. Our project is to classify the author of 12 unknown papers by examining the writing techniques of each author. We model the data through regression trees, Linear Discriminant Analysis, Principal Component Analysis, and fitted General Linear Models, using the representational effects used in each paper with 18 possible predictor variables.

UNITED STATES CENSUS: DIRECT VERSUS SYNTHETIC DUAL SYSTEMS ESTIMATION FOR THE POST-ENUMERATION SURVEY
STEPHANIE BECHT · SCIENCE AND HUMANITIES SCHOLARS
EDDY CHIANG · ECONOMICS AND STATISTICS
DANIEL FRANK · STATISTICS
KANY KANG · ECONOMICS AND STATISTICS
CASSANDRA STUDER · STATISTICS
Advisor(s): William Eddy · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

This project is concerned with the United States census. The Census is vital because its results are used for re-appropriating seats in the House of Representatives as well as determining the amount of funding that states receive. Thus it is clear that ensuring the numbers accurately reflect those of people living in the United States is of paramount importance. Inevitably, some people will be missed in the counts. To correct this, we can utilize capture-recapture methods to improve the estimates delivered by the census. The question then becomes whether all individuals are missed equally, or whether racial, socioeconomic, and other conditions make some people more likely to be left out of the count than others. We therefore compare two methods of estimation that differ in that one assumes all people are missed equally, and the other assumes certain types of individuals with various characteristics are more or less likely to be missed than others.

ENGLISH

A FIELD GUIDE TO TRAPPED ANIMALS WINTER MELON SOUP
SALLY MAO · ENGLISH
Advisor(s): Terrance Hayes · English
Jane McCafferty · English
Class of '87 / Oral 12, 4:20pm

'A Field Guide to Trapped Animals' is a collection of poems that intimate breaking open the self, breaking open the forces that circumscribe the self, and breaking the lines that shape and contain. It is about fluidity, wanderlust, weird creatures without voices, badgers, sharks, and humans.

'Winter Melon Soup' is a collection of prose -- fiction, nonfiction, essays -- that touch upon smallness, estrangement, heartbreak, and the curious places one can end up -- in a familiar space filled with wonder, or in a faraway place finding the familiar.

I would like to present my pieces by performance or spoken word rather than simple reading, and I want it to b an interactive experience,wherein the audience can participate and laugh.

CIVIC PARTICIPATION AND COMMUNITY DEVELOPMENT AMONG PITTSBURGH'S LATINO POPULATION
CLAIRE MORGENSTERN · ENGLISH
Advisor(s): Kenya Dworkin y Mendez · Modern Languages
Pake / Oral 4, 1:00pm

Over the last decade, Pittsburgh has witnessed the exponential growth of its Hispanic community. While the population of the city overall continues to decline, the Latino population has actually increased, bringing with it the potential for growth and renewal in the region. Meanwhile, political and community leaders struggle to build institutions that will serve the needs of this growing population. My thesis, based on extensive research and interviews with local community leaders and Hispanic residents, will discuss who these new immigrants are and how they are integrated into the already-existing social and economic structure, while tying this phenomenon to overall population trends occurring regionally and nationally.

WHAT THE BEST OF US LACK
CASEY TAYLOR · ENGLISH
Advisor(s): Sharon Dilworth · English
Pake / Oral 12, 4:20pm

The project is a collection of short fiction using different narrative devices to profile certain human constants that bind us: violence and discomfort.

ETHICS, HISTORY & PUBLIC POLICY

FROM MOTHER TO DAUGHTER
TOKIEA FITZGERALD · ETHICS, HISTORY & PUBLIC POLICY
Advisor(s): Charlee Brodsky · Design
Pake / Oral 6, 1:40pm

Diversity of families and economic status is an issue on campus that needs to be explored. My photographic narrative depicting my mother and my life at CMU is the beginning of this broader discussion.

***SEE-SAW.ORG*: THE BALANCE OF MUSIC AND FILM - A WEB BASED COLLABORATION OF ARTISTS THROUGH USER-CENTERED DESIGN**
STEVEN HILLENIUS · INFORMATION SYSTEMS

ALIF SAJAN · ETHICS, HISTORY & PUBLIC POLICY
Advisor(s): Mark Mentzer · Design
Pake / Oral 10, 3:40pm

Last fall we furthered our progress in building a creative environment for student musicians and filmmakers, where they can effectively work together making it possible to contribute to each others' work. Based on experience, we know individuals who are well-versed in writing music and have been asked several times to write scores for student films. This brought about the question of what if filmmakers could hear or have access to how many great musicians there are at CMU and use their music in their films, if permitted to do so. Now that we had the right question, we needed a thoughtful process to achieve a successful collaboration. In order to appropriately meet the needs of filmmakers and musicians we conducted research. This research consisted of shadowing musicians and filmmakers with the focus on the current methodology of distributing films and music. From this we modeled their workflow and developed design concepts that coincide with our research. With this, we believe that we have the tools to effectively do what is needed next: implementation. From here on, we plan to take our findings very seriously and continue to implement this project independently under the name, *see-saw.org*.

HISTORY

AN 'OCULAR DEMONSTRATION' OR 'TREMENDOUS TREASURE'?: NATIONALIST AND UNIONIST CONFLICT OVER JUDICIAL GARB DURING THE FOUNDATION OF THE FREE STATE
JAMES DOUGHERTY · HISTORY
Advisor(s): David Miller · History
Pake / Oral 1, 12:00pm

Following the ratification of the Anglo-Irish Treaty in 1922, one of the Free State government's first challenges was the creation of an independent judiciary--one that was both independent enough from Britain for the Nationalists and independent enough from the Executive for the Unionists. Unsurprisingly, given their different worldviews, neither side felt that their concerns were being adequately addressed. The result was an intense debate where the point of contention was the wigs and gowns of judges. Politicians and legal experts alike debated what judges in the new independent nation should wear. Should the Executive cast aside the ermine robes and horse hair wigs that had been donned by jurists appointed by a foreign power for centuries in favor of an Irish one that harkened back to the days of brehons? Or would the Nationalist Executive defer to the bench and let judges choose their own attire in the interest of judicial independence? This debate was not simply about fashion. The controversy over judicial garb was indicative of two larger issues being considered in the process of creating a new judiciary--judicial independence and Irish

independence. This project analyzes this debate in terms of a clash of personalities between the leading legal experts of the Nationalist and Unionists camps.

PREVENTION POINT PITTSBURGH: A PUBLIC HEALTH INITIATIVE AND ITS LOCAL IMPACT

MARK RUDNICK · HISTORY
Advisor(s): Caroline Acker · Art
Dowd / Oral 8, 3:00pm

Prevention Point Pittsburgh, western Pennsylvania's only needle exchange program, has lived through a turbulent history in the thirteen years since its establishment. My senior honors thesis has involved researching the history of the organization and its development from a small, underground, and illegal organization into a legitimate non-profit with full legal status and (relative) acceptance into the public health system of Allegheny County. In documenting that development, I have been concerned with analyzing the numerous struggles the organization has faced in its attempt to carry out its life-saving mission, and the ways in which drug policy, public health policy, and local and national politics have served to complicate Prevention Point's story.

RUSSIA'S NEW POWER: RUSSIAN NATURAL GAS AND EUROPE'S ENERGY SECURITY

NICHOLAS COLE · HISTORY
Advisor(s): Silvia Borzutzky · Social & Decision Sciences
Class of '87 / Oral 9, 3:20pm

In the early 1990s Russia's gas monopoly, Gazprom, inherited all of the Soviet Union's natural gas resources. The most important of these resources, besides gas of course, are the pipelines left over from the Soviet era. These pipelines run across Russia and the former Soviet Union, and also into Europe. Since Gazprom is owned by the Russian state, some fear that Russia will use its power over gas transportation to Europe for political ends. The fact that Europe gets approximately 30 percent of its energy from Russian natural gas serves to strengthen these fears. This project examines the actual feasibility of Russia using gas for political gain, in addition to examining the current issues facing the Russian gas industry and its relationship with Europe in the future.

INFORMATION SYSTEMS

LINE SCAN!!!

DANIEL BURROWS · ELECTRICAL & COMPUTER ENGINEERING
KEVIN HUNG · INFORMATION SYSTEMS
YOUNG HO KIM · STATISTICS
Advisor(s): William Eddy · Statistics
David Friedenberg · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

Line scan is a technology currently used to monitor brain activity using a laser. Research has been done on small live animal using this technology. However, each line scan does not occur instantaneous, so the results contain systematic movements of the animal's breathing and heart beat. Our goal is to remove these systematic movements and create an accurate representation of the animal's brain.

SEE-SAW.ORG: THE BALANCE OF MUSIC AND FILM - A WEB BASED COLLABORATION OF ARTISTS THROUGH USER-CENTERED DESIGN

STEVEN HILLENIUS · INFORMATION SYSTEMS
ALIF SAJAN · ETHICS, HISTORY & PUBLIC POLICY
Advisor(s): Mark Mentzer · Design
Pake / Oral 10, 3:40pm

Last fall we furthered our progress in building a creative environment for student musicians and filmmakers, where they can effectively work together making it possible to contribute to each others' work. Based on experience, we know individuals who are well-versed in writing music and have been asked several times to write scores for student films. This brought about the question of what if filmmakers could hear or have access to how many great musicians there are at CMU and use their music in their films, if permitted to do so. Now that we had the right question, we needed a thoughtful process to achieve a successful collaboration. In order to appropriately meet the needs of filmmakers and musicians we conducted research. This research consisted of shadowing musicians and filmmakers with the focus on the current methodology of distributing films and music. From this we modeled their workflow and developed design concepts that coincide with our research. With this, we believe that we have the tools to effectively do what is needed next: implementation. From here on, we plan to take our findings very seriously and continue to implement this project independently under the name, *see-saw.org*.

THE GLOBALLY PERSONALIZED FORUM: AN EXPLORATION OF GROUP CONVERSATION AND COMMUNITY COLLABORATION THROUGH DIGITAL TOOLS

DANIEL SCHULTZ · INFORMATION SYSTEMS
Advisor(s): Larry Heimann · Information Systems
Dowd / Oral 11, 4:00pm

With social networking sites like Facebook and Twitter picking up steam, the tone of the Internet has been increasingly individual-centric. Although tracking specific social ties can be useful, these sites fail to reflect group dynamics, community involvement, or social cliques. The result of this oversight is a "social revolution" that has so far resulted in nothing more than a slew of glorified Rolodexes. This project explores some opportunities provided by the idea of community networking. The designed system outlines several group-oriented communication tools with twists that allow for collaborative conversation across the communities it hosts.

WHITE PRINT

DANIEL LAGROTTA · INFORMATION SYSTEMS
ROBERT LEE · PHYSICS
Advisor(s): Stephen Garoff · Physics
Kirr Commons-1st Floor, Window side / 12-2:30

We want to investigate multiple materials for use in commodity-hardware printers to find a way of printing light text on dark-color substrates. We take an interdisciplinary approach to this problem, as we want to research the science behind printing and ink, as well as possible commercialization opportunities for printing light text on dark-color materials.

MODERN LANGUAGES

ENHANCING JAPANESE KANJI ACQUISITION IN NON-NATIVE READERS

CAITLINN CORK · MODERN LANGUAGES
Advisor(s): Keiko Koda · Modern Languages
Wean Commons-1st Floor, Connan side / 3-5pm

Research shows the effects of a specially-designed literacy-acquisition program on non-native readers of Japanese.

PHILOSOPHY

MECHANISMS OF STATISTICAL LEARNING: WORD-LENGTH EFFECTS

ALEXANDRA KRONSTEIN · PHILOSOPHY
Advisor(s): Erik Thiessen · Psychology
Rangos 2 & 3 / Sigma Xi Group 6, 10:30am

The present study sought to determine whether adults demonstrate and advantage for learning monosyllabic, bisyllabic, or trisyllabic words in a statistical learning word segmentation task. Despite the breadth of studies investigating the powerful ability of statistical learning across species (Hauser et al., 2001), ages (Saffran et al., 1996), and domains (Kirkham et al., 2002), the mechanisms underlying statistical learning are still not fully understood (Perruchet & Pacton, 2006; Conway & Christiansen, 2005). Three different theories of statistical learning (associative, Bayesian, and chunking) make different predictions about whether word length plays a role in the formation of internal representations. Both associative and Bayesian theories of statistical learning predict word-length effects, whereas chunking theories of statistical learning predict no word-length effects. The results of this investigation provide a starting point for differentiating between the three theories of statistical learning.

PSYCHOANALYSIS IN THE SOVIET UNION

ALEXANDRA KRONSTEIN · PHILOSOPHY
Advisor(s): Wendy Goldman · History
Dowd / Oral 7, 2:00pm

This paper explores the major issues facing the development of psychoanalysis in the Soviet Union. The secondary literature on psychoanalysis in Russia encompasses a breadth of personalities, ideologies, and methodologies. However, accounts of this discipline are often colored by the political or national bias of the historian writing them, making it difficult to establish a narrative independent of such biases. By using different viewpoints drawn from the secondary literature, I will focus on the facts generally agreed upon by all historians. I also examine their conflicting viewpoints on the rise and fall of psychoanalysis in the Soviet Union and raise critical questions about the nationalist bias embedded in these viewpoints. This paper raises larger questions about the East-West cultural dynamic and the extent of the influence of the Soviet State.

SEGMENTING THE SIGNAL: A CROSS-AGE COMPARISON OF SPEECH AND TONE STIMULI

ALEXANDRA KRONSTEIN · PHILOSOPHY
Advisor(s): Erik Thiessen · Psychology
Dowd / Oral 6, 1:40pm

The present study sought to extend the findings of an "embeddedness constraint" on statistical learning in the visual domain (Fiser & Aslin, 2005) to the auditory domain. In this set of experiments, we explored the possible manifestations of an embeddedness constraint on speech and tone sequences in studies with adult and infant participants. An embeddedness constraint operant in the linguistic domain could benefit learners by helping them to circumvent the "combinatorial explosion" that arises from large amounts of complex data. This constraint could also prove useful in language acquisition tasks, such as word segmentation, allowing learners to advance more quickly to higher-order tasks, such as semantic and syntactic categorization. Furthermore, findings of an embeddedness constraint on both speech and tone stimuli might suggest that this constraint is broadly domain-general. Present results do not indicate an embeddedness constraint on speech or tone input in adults. However, pending studies with infants may suggest that the existence of the embeddedness constraint is itself constrained by maturation or by cognitive experience with language.

PSYCHOLOGY

AGREEMENT IN MARRIED COUPLES: THE EFFECTS OF ADULT ATTACHMENT

JOY XU · PSYCHOLOGY
Advisor(s): Brooke Feeney · Psychology
Kirr Commons-1st Floor, Window side / 3-5pm

In support interactions between two people the level of agreement between the amount of support provided and the amount of support received can have important implications about the quality and the effectiveness of the interaction. Marriage relationships, due to their intensity and intimacy, may be especially prone to misunderstandings in communication leading to disagreement. These discrepancies can then lead to both short-term and long-term negative consequences. The purpose of this study was to investigate the extent to which attachment style predicts the extent to which married couples agree about whether specific support behaviors occurred during an interaction. Married couples (N = 190) from the Pittsburgh community were recruited to serve as participants. Two types of analyses of agreement was done (interval and categorical), then the attachment style of both partners was used to predict agreement.

CHILD REARING PRACTICES OF PARENTS OF CHILDREN WITH CANCER AND PARENTS OF COMPARISON CHILDREN: PERSPECTIVES OF PARENTS AND PROFESSIONALS

LAUREN FEIERSTEIN · PSYCHOLOGY
Advisor(s): Dr. Robert Noll · University of Pittsburgh Director, Child Development Unit, Children's Hospital of Pittsburgh
Dowd / Oral 12, 4:20pm

Obtained self-reports of parenting practices from 94 mothers and 67 fathers of children with cancer, and equivalent number of controls using the Child-rearing Practices Report (CRPR). Same age/sex controls were recruited from the classrooms of the children with cancer. In addition, CRPR ratings were obtained from experts in pediatric oncology based upon their prediction of how a parent of a child with cancer would respond. The experts predicted differences in the areas of over-involvement, discipline, worry about the child, nutritional concerns, and others. Results from parents showed some differences from control families that differed based on gender of parent, but not full agreement with the experts. Discussion focuses on explanations for these differences and areas for intervention.

CHILDREN'S MEMORY FOR AND JUDGMENT OF STEREOTYPICAL AND COUNTER-STEREOTYPICAL FAVORITE COLOR INFORMATION

JESSICA ROBINS · PSYCHOLOGY
Advisor(s):Chante Cox-Boyd · Psychology
Rangos 2 & 3 / Sigma Xi Group 6, 10:45am

Pink is for girls and blue is for boys, so says the traditional adage. But what about the boy who likes pink, or the girl who likes blue? This study aimed to assess the effect of color stereotypes on children's memory and judgment. Children from two preschools were told the favorite colors of stimulus children, then asked to distribute colored toys to these children, and to verbally recall their favorite colors. Children more accurately remembered a male's favorite color when it violated color stereotypes, whereas they remembered a female's favorite color equally in stereotypical and counter-stereotypical situations. Additionally, when given counter-stereotypical favorite color information, children recalled more favorite colors than they correctly distributed. Thus, results showed that mere violation alone is not sufficient to make counter-stereotypical preferences memorable; a violation must be particularly abnormal in order to be salient. Moreover, even when counter-stereotypical preferences are remembered, they are likely to be ignored in favor of traditional stereotypes by other children.

COLOR ME THIS: AN INVESTIGATION OF PRIMING MANIPULATIONS IN THE DCCS TASK IN PRE-SCHOOL AGED CHILDREN

SAMANTHA CREIGHAN · PSYCHOLOGY
Advisor(s): Anna Fisher · Psychology
Hoch Commons-2nd Floor, Window side / 3-5pm

Many researchers have explained childrenÃÂ½s failure of the DCCS task in different ways. In this task, children are presented with a card varying on two dimensions (shape and color). In the first half of the task, they are asked to sort by one of the dimensions, and after many trials, they are asked to switch and begin to sort the cards based on the other dimension. Even though there is evidence that the child is aware that he is supposed to switch rules, 3-year old children fail to reflect this in their behavior. One explanation for this is the Cognitive Complexity and Control theory, which states that children this young

are unable to form the complex hierarchy of rules required for completing this task. Another explanation states that children fail at this task because they are unable to properly inhibit their previous behavior, even though they know that their behavior should be changed. A third mechanism to explain this phenomenon is the competing memory systems view. It is argued that humans have multiple memory systems that work differently, yet sometimes compete. Working memory is the information that is currently being processed whereas latent memory builds up when a certain behavior is repeated over time. The current project hopes to provide a manipulation that will help discriminate between the alternate viewpoints and provide support for the competing memory systems view. The task will contain a priming manipulation that will help to prime the new dimension, thus making the switch easier for three-year old children. The task will be a standard version of the DCCS task, however between the pre-switch phase where participants sort by one dimension, and the post-switch phase where they have to make the switch, participants will receive a break where they will complete an activity to prime the new dimension. For example if switching from shape to color, the child will sort by shape, then color a coloring page using only the colors that must be used in the color sorting phase. It is predicted that the priming manipulation will help children succeed on this task.

DOES SPEECH READING AFFECT WORD SEGMENTATION IN INFANCY?

JACLYN WAINER · PSYCHOLOGY
Advisor(s): Erik Thiessen · Psychology
Hoch Commons-2nd Floor, Window side / 3-5pm

Previous studies performed with adult participants show that the benefits of speech reading extend to word segmentation tasks that have been used to study language acquisition (Sell & Kaschak, submitted). In this study we are exploring whether or not watching the articulatory motions of a speaker also helps 7- and 12-month-old infant learn language. During training, infants heard a speech stream from a made-up language, and saw either a green ball bouncing asynchronously with the speech stream, or a video of the speaker producing the language, synchronized with the speech. Our goal in this experiment is to see if infants will learn more by watching the mouth movements of the speaker compared to solely hearing her. In the present study, infants showed a familiarity preference. This may be indicative of learning, but can be difficult to interpret. New stimuli, using infant-directed speech, have been created such that infants are better able to learn the language, which should lead to a novelty preference.

ENCODING OF EQUATION FEATURES RELATES TO CONCEPTUAL AND PROCEDURAL KNOWLEDGE OF ALGEBRA

JENNIFER OLSEN · PSYCHOLOGY
Advisor(s): Julie Booth · Human Computer Interaction Inst.
Hoch Commons-2nd Floor, Rangos side / 12-2:30

Previous research has shown that conceptual knowledge of features in algebraic equations (e.g., equals sign, variables, negative signs) affects procedural performance in Algebra; students who hold misconceptions about those key features have difficulty solving and learning to solve equations. One potential mechanism behind this difficulty is that misconceptions regarding the importance and meaning of problem features lead to misencoding of those features when they are present in an equation that students are attempting to solve. For younger students, difficulty with encoding the structure of equivalence problems is associated with use of erroneous strategies for solving such problems; it is likely that difficulty encoding problem features leads to similar issues for older students solving algebraic equations.

The main purpose of the present study was to explore how encoding of features in algebraic equations relates to both students' conceptual and procedural knowledge for solving those equations. We hypothesize that students who misencode problem features will demonstrate poorer conceptual knowledge about those features and have greater difficulty solving equations than students who encode problems correctly. We focus on three features that are especially important for early equation-solving: the equals sign, variables, and negative signs.

Thirty-two middle school students (sixth through eighth graders) who were enrolled in an Algebra I class for the following school year participated in this quasiexperimental study. All participants completed a battery of measures in the same order, including an encoding task in which they were briefly shown a series of simple equations and asked to recreate each equation as they remembered it immediately after it disappeared from the screen. This was followed by a conceptual test in which they answered questions about specific problem features (e.g., what does = mean in a problem, is $3x = 4$ equivalent to $4 = 3x$, etc.) and a procedural test in which they solved one- and two-step algebraic equations (e.g., $5 = x + 7$, $8/k = 4$).

Results from this study showed that participants who make more encoding errors solve fewer equations correctly; there was also a trend toward correlations in which these students demonstrate poorer conceptual knowledge of variables and the equals sign. Misencoding the equals sign was associated with fewer procedural problems solved correctly and a trend toward poorer conceptual knowledge of the equals sign. Students who encoded more variables incorrectly solved fewer equations correctly and demonstrated poorer conceptual knowledge of variables; they also displayed poorer knowledge of the equals sign. Similar analyses on encoding of negative signs yielded no significant correlations.

Results from this experiment are consistent with the prediction that students' difficulty encoding algebraic equations is associated with poor conceptual and procedural knowledge for solving those equations. Correct encoding and conceptual understanding of problem features may both be necessary for learning to solve equations correctly, as students need to notice and comprehend these features in order to manipulate them correctly while solving problems.

GENDER STEREOTYPES: REAL OR FANTASY

CLAIRE ANDRZEJEWSKI · PSYCHOLOGY
Advisor(s): Brooke Feeney · Psychology
Hoch Commons-2nd Floor, Rangos side / 12-2:30

Using Dr. Brooke Feeney's Newlywed study data, I attempted to answer the question:Do traditional gender stereotypes really exist? The Newlywed study had couples engage in discussion and game activities. For this particular project, the couples' goal discussions were analyzed. In particular, various communication and support variables were objectively (research assistant) and subjectively (self-reported) recorded for each member of the couple. Tests were then conducted to detect the existence of gender differences amongst the objective codes, as well as the subjective codes.

GROWING THROUGH ATTACHMENT: HOW DO ATTACHMENT STYLES AFFECT GOAL STRIVINGS, EXPLORATION, AND GROWTH?

ASHLEY REID · PSYCHOLOGY
Advisor(s): Brooke Feeney · Psychology
Wean Commons-1st Floor, Connan side / 12-2:30

The research question being proposed is "Which types of support are most effective for secure, avoidant, and anxious attachment styles to make progress toward their autonomous goals while in a committed romantic relationship?" The study will involve newlywed couples within their first year of marriage being videotaped discussing their most important autonomous goal. During the second, follow-up year participants rank the support of their partner and their progress towards achieving their goal. It is predicted that each attachment style performs optimally under certain support conditions: avoidant under Lack of Support, anxious under Overly Involved support, and Secure under Healthy Support. These results provide advancement in understanding secure base processing by the support-recipient.

INFANTS' ABILITY TO LEARN THAT ANIMATES POSSESS 'VITAL FORCES'

SARAH DEWATH · PSYCHOLOGY
Advisor(s): David Rakison · Psychology
Class of '87 / Oral 5 1:20pm

Previous studies have shown that preschoolers endorse abstract reasons as causally responsible for familiar biological events for animals (e.g.,, energy causes movement) but not for machines (Gelman & Gottfried, 2005). These biological phenomena are often explained by vitalistic explanations within a nave theory of biology (Morris, Taplin, & Gelman, 2000). Understanding the distinction in the categorization of energy and motion of animates and inanimates is important in assessing the role of energy production and transfer. In this study, I examined whether infants categorize animates and inanimates by their differences in energy and motion. Infants at 12-13 and 16 months of age were habituated to a casual event between an agent and recipient ball, modeled after Michotte (1963).

IS INFORMATION ABOUT ME ACCURATE? THE IMPORTANCE OF UNBIASED SOURCES

EMILY GARBINSKY · PSYCHOLOGY
Advisor(s): Carey Morewedge · Social & Decision Sciences
Hoch Commons-2nd Floor, Rangos side / 3-5pm

People are always seeking to learn more about themselves. Whether new information is generated by oneself or obtained from external sources, the potential always exists for self-serving biases to taint the meaningfulness and accuracy of that information. Information generated by the self is often biased to perceive oneself in a more favorable light (Kunda, 1990). Information obtained from outside sources may be biased by external sources' own interests (Pronin, Gilovich, & Ross, 2004; Pronin, Kruger, Savitsky, & Ross, 2001). To further complicate the matter, soliciting information from external sources is already an act of selection in itself--one may choose to reject unfavorable information (Ditto, Scepanksy, Munro, Apanovitch, & Lockhart, 1998; Morewedge & Norton, in press) or when presented with multiple sources of information, choose to listen to the source that is most favorable.

I suggest that people sometimes overemphasize the importance of an unbiased source and minimize the importance of choosing a (potentially biased but) knowledgeable source of information. The study examined this hypothesis in the context of interpersonal evaluation. Participants received false (positive) personality feedback about themselves from a stranger whom they expected to meet, which was generated by the stranger in a method that is difficult to filter (e.g., randomly) or was generated by the stranger after he or she engaged in careful deliberation.

Participants were expected to be more sensitive to the potential bias of the source than the quality of information it provides. In other words, participants should think their partner is biased if they could potentially have filtered the information they provided. Not only should participants prefer information from sources with less bias (and accountability), when participants expect to meet the partner providing them with feedback, they should (ironically) prefer information randomly generated than information generated through careful deliberation.

JAM VS. JELLY: HOW CHILDREN REASON ANALOGICALLY WITH SYNONYMS AND SEMANTICALLY SIMILAR WORDS

SHEELA RAMESH · PSYCHOLOGY
Advisor(s):Anna Fisher · Psychology
Dowd / Oral 2, 12:20pm

Synonyms, or multiple labels for the same object, are a fundamental component of a mature lexicon, and the ability to reason with them is critical in lexical understanding. Children's ability to name an object by multiple semantically similar labels (i.e. synonyms) has been documented by the age of two; however, the ability to reason using semantically similar

labels remains sparsely investigated. Because it is unclear what level of understanding is present in children and how this develops, the present study expands our understanding of children's ability to utilize semantically similar labels in 2 relational reasoning tasks. In Experiment 1, four-year-olds were presented a base pair of related words (e.g., castle:rock), then given a partially completed target word-pair (castle: ?) to complete with a label that made the target word-pair relationally identical to the base word-pair (e.g., stone). Additional response options included a label that was thematically related (king) and an unrelated label (milk). In Experiment 2, the same semantic relationships were explored by presenting the labels in stories with prompt questions. Results indicated that 4-year-olds exhibited difficulty reasoning with semantically similar labels in an abstract task, but were successful when the task provided a familiar context for reasoning. Implications are discussed.

PERCEPTIONS OF DEPRESSION IN MEN AND WOMEN

MATTHEW WARD · PSYCHOLOGY
Advisor(s): Vicki Helgeson · Psychology
Hoch Commons-2nd Floor, Window side / 12-2:30

Studies on perceptions of depression have historically found depressed men to be evaluated more negatively than depressed women by perceivers. This study tested that assertion, as well as the extent to which three theories--gender-role socialization theory, empathy theory, and the potential mate hypothesis--could explain any differences in perceptions of depression in men and women. Women participants (n = 94) ranged in age from 22 to 61 (M = 36.04, SD = 11.38). They completed an online questionnaire in response to a vignette character who varied in sex, sexual orientation, and depressive status. Taken collectively, most findings supported the potential mate hypothesis, namely that nondepressed males received the most positive ratings from female perceivers, and depressed males received the most negative ratings from female perceivers. Participants' own depression was also found to affect perceptions of depression.

THE ORIGINS OF SNAKES AND SPIDER FEAR: HOW INFANTS LEARN TO ASSOCIATE EVOLUTIONARY FEAR-RELEVANT STIMULI WITH PAIRED STIMULI

JESSICA JANKOWITSCH · PSYCHOLOGY
Advisor(s): David Rakison · Psychology
Class of '87 / Oral 10, 3:40pm

The ability to survive infancy is one of the greatest determining factors to whether or not an individual will pass on their genetic material. Recent studies have found evidence that infants possess evolved spider and snake detection mechanisms that may have aided in our early ancestors' abilities to detect, learn about, and avoid these predators to ensure survival. Pairing threatening and non-threatening categories of pictures with stimuli consisting of positive and negative facial expressions have demonstrated that infants' perceptual templates for predatory animals allow for greater associative learning in females than in males. There is little

research indicating whether these sex differences will carry over into paired non-emotional, arbitrary stimuli, if these learning patterns are found more so in those who are capable of self-locomotion, and whether the results will demonstrate a connection between phobias later in life. Infants of seven and eleven months of age were tested to investigate these topics. Significant results may be found in infants' preferential look times and timed responses to habituation and test trials, as well as questionnaire responses from parents. By determining the predictors and patterns early on that lead to severe phobic anxieties, it may be later possible to produce intervention, treatment, and counseling to prevent the emergence of phobias.

SELF-DEFINED

VEHICLE PROPULSION DYNAMICS
JONATHAN BATES · SELF-DEFINED
ALEXANDER HANSON · ICES
AANCHAL RAJ · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

Using a simple mousetrap powered vehicle, children will be challenged to find propulsion configurations that meet distance and power objectives. This is accomplished by a modular car design with multiple gears mounted to the rear axle and variable length lever arms. Children will be asked to collaborate in pairs to achieve greatest distance on flat ground, up a ramp, and to win in a race. The exhibit will reinforce basic propulsion, energy conservation, and mechanical advantage concepts. It will also provide a template for iterative design. The ability to rapidly change configurations will allow for multiple attempts at the same objective. The concepts behind engineering design are further developed by the optimization process.

SOCIAL & DECISION SCIENCES

EMOTIONALITY IN TEXT AS PREDICTOR OF BEHAVIOR
ELLIOT ONN · SOCIAL & DECISION SCIENCES
Advisor(s): Carey Morewedge · Social & Decision Sciences
Wean Commons-1st Floor, Connan side / 12-2:30

The present research demonstrates how the emotional content of search terms and their eventual results affects the breadth of a user's search for information. We observed the quantity of results selected by users. In a random sample of queries from the Microsoft LiveSearch search engine, 7,021 queries were evaluated using a dictionary with valence and arousal ratings. The number of search results selected was regressed on the valence and arousal of the search terms. We additionally observed user's selection of results based on the position in the search results. Using the same sample, result placement was regressed on the valence and arousal level of the search terms. Results from quantity of search results selected shows that negative search terms result in an overall larger number of selections made than positive search terms. For position-based selections, we found that the selection of the first result is affected by an interaction of valence and arousal. Specifically, users were unaffected by the arousal level of negative search terms, but appeared to be more likely to search deeper on the page when they searched for less arousing positive information. These results suggest that the emotional content associated with a search query may lead users to be more or less discriminating in their acceptance of information and may influence the impact of placement on result selection.

EXPERIMENTING WITH HEAT CONDUCTION

MICHAEL FOX · MECHANICAL ENGINEERING
DANIEL SAWL · SOCIAL & DECISION SCIENCES
JACOB SIBILSKI · MECHANICAL ENGINEERING
GAURAV VERMA · MECHANICAL ENGINEERING
Advisor(s): Susan Finger · Civil and Environmental Engineering
Connan / 12:30-3:30pm

The purpose of our project is to engage students in learning about the transfer of thermal energy. Children will be able to perform experiments on how different materials conduct heat. The children will learn why certain materials are used to conduct heat and why others are used as insulators. They will achieve this by designing walls made of different materials, with one side touching a heat source and the other touching a thermometer. The students will observe how various materials enhance or inhibit heat conduction by observing the differences in temperature. The children will be able to see how heat, like electricity, can flow through objects, and how material affects heat flow.

HOW TO COMBAT PLAGIARISM IN ACADEMIA (AND HOW NOT TO)

JESSICA DICKINSON GOODMAN · SOCIAL & DECISION SCIENCES
Advisor(s): Joseph Devine · History
Kirr Commons-1st Floor, Window side / 3-5pm

Everyone has heard about students cheating, a Rip, Mix, Burn approach to homework. Professors and Administrators struggle to preserve the reputation of their institutions as well as the Intellectual Property of their students. How does one combat plagiarism with so many

sources for an unscrupulous student to draw from? This poster will evaluate the current state of both technical and non-technical solutions to academic plagiarism and produce a conclusion on the overall costs and benefits of several methods.

POETRY AND PROSE PERFORMANCES PROJECT

JESSICA DICKINSON GOODMAN · SOCIAL & DECISION SCIENCES
Advisor(s): Lawrence Powell · Student Affairs
Class of '87 / Oral 7, 2:00pm

The Poetry and Prose Performances Project explores the uses of YouTube as a forum for educational resources for students who find reading difficult. I want to give students who learn better by listening the opportunity to enjoy great literature for free.

This project builds on the work I did Fall semester 2008 as the Posner Intern, making videos for audio recordings of fifteen sonnets by Shakespeare and some of "Huckleberry Finn". This semester I am recording videos of short stories by O Henry, Charlotte Perkins Gilman, Oscar Wilde, poetry by T.S. Eliot and Robert Frost, and "Peter Pan" by J.M. Barrie. In addition, I have been open sourcing all documents, observations, and theories surrounding the project to the project blog: *pfour.wordpress.com*.

RELIGIOUS IDENTITY AND SOCIAL OPINION: A STATISTICAL LOOK AT HOW FAITH IS APPLIED

KATHERINE SHAFER · SOCIAL & DECISION SCIENCES
Advisor(s): David Miller · History
Hoch Commons-2nd Floor, Rangos side / 3-5pm

Religion is an influential factor in shaping the opinions of American people. It touches individuals and also drives political policies on a larger scale. Using data from the National Opinion Research Center's General Social Survey from 1976 to 2006, this project investigates how religious affiliation can be used as a predictive element in determining positions on three controversial topics in American politics: abortion, war and homosexuality. It also traces religious views of these issues over time by comparing changes in age, year and cohort. The results from this project provide a basic model with strong predictive power for abortion, war and homosexuality alike. As expected, it shows that religion is one of the very strongest factors which correlate with opinion on these social issues.

THE PREFERENCE OF NATURAL MUSICAL TONES VERSE SYNTHETIC TONES

LINDSAY ZEPEL · SOCIAL & DECISION SCIENCES
Advisor(s): Erik Thiessen · Psychology
Hoch Commons-2nd Floor, Rangos side / 3-5pm

Studies have been done which demonstrate that infants prefer natural human speech to simplified sine-wave speech. One particular study done by Vouloumanos and Werker (2004) demonstrated that infants, even as young as newborns, prefer listening to natural human speech to sine-wave speech. This preference for natural speech might be due to the evolutionary mechanism of preferring speech, or it might be due to the overall preference for complex input to simple input. My research sees whether this preference for complex input to simple input is the same when using musical stimuli. If infants show a preference for naturalistic tones over simplified tones, it will be consistent with hypotheses arguing that infants' preference for natural speech over sine-wave speech arises from a general preference for more complex input. But if we find no preference between our different musical stimuli, it will reinforce the claim that infants' preference for natural human speech arises from an evolutionary mechanism that is specific to speech.

U.S. - RUSSIAN RELATIONS 2000-2008

LAUREN WINCHESTER · SOCIAL & DECISION SCIENCES
Advisor(s): Silvia Borzutzky · Social & Decision Sciences
Class of '87 / Oral 11, 4:00pm

This paper will analyze U.S.-Russian bilateral relations from 2000-2008. It will give an overview of the foreign policy objectives of both nations followed by an examination of the bilateral relationship in areas such as arms reduction, nonproliferation, missile defense, terrorism, the Iraq war, U.S. involvement in former Soviet states, Russia's relations with critical nations, and the Georgia-Russia conflict of August 2008. Each of these subsections will show that there are points of contention, but also opportunities to work cooperatively. The objective of this paper is to illustrate that U.S.-Russian relations have deteriorated significantly since their relatively high point in 2001, and although there were opportunities for collaboration on areas of common interests, they were not fully exploited because U.S. foreign policy was focused on the war in Iraq. Though U.S. foreign policy has been largely unresponsive to the resurgence of Russia, relations are not yet damaged beyond repair. The U.S. can begin to forge a new relationship with Russia by collaborating on nonproliferation issues, renewing bilateral negotiations on arms control such as the Strategic Arms Reduction Treaty, and utilizing international organizations to which Russia is a party whenever it is in U.S. interest.

UNCONSCIOUS ORIGINS OF THE SPREADING EFFECT

THERESA KELLY · SOCIAL & DECISION SCIENCES
Advisor(s): Carey Morewedge · Social & Decision Sciences
Hoch Commons-2nd Floor, Rangos side / 12-2:30

After choosing, people exhibit a spreading of alternatives whereby the chosen alternative is rated more positively and the rejected alternative is rated more negatively than originally indicated. People are assumed to engage in this reassessment of attitudes to reduce cognitive dissonance/discomfort that stems from considering the negative features of the chosen

alternative and the positive features of the rejected alternative. Whereas most dissonance research has examined its possible conscious origins, surprisingly little research has examined the possibility that dissonance is due to unconscious processes. We tested whether the act of rejecting an alternative might engender response inhibition toward the stimulus, which would suggest the spreading of alternatives is due to an unconscious process. Research participants rated stimuli before and after making choices between equally liked stimuli and completing a go/no-go reaction time task with the chosen and rejected stimuli. Although we did not find response inhibition for the rejected alternatives or response facilitation for the chosen alternatives, we did find evidence that the presence of the chosen and rejected stimuli influenced the ease with which the go/no-go signals were processed by the participants, supporting the assumption that an automatic process may play some role in the spreading of alternatives.

STATISTICS

DEVELOPMENT OF OSCILLATORY SIGNALS DURING MEMORY-GUIDED EYE MOVEMENTS

JOHNNY KANG · STATISTICS
WONCHEUL KIM · MATHEMATICS
SAMUEL VENTURA · MATHEMATICS
Advisor(s): William Eddy · Statistics
David Friedenberg · Statistics
Kirr Commons-1st Floor, Window side / 3-5pm

Studies of neuron activity in non-human primates can show the degree to which oscillatory signals develop while a subject is making memory-guided eye-movements (saccades). The subject's neuron activity is recorded both when nothing is happening (the control or "Base" data) and when it is making a saccade to one of eight different targets (the saccade or "Memory" data). The extent to which oscillatory signals develop during memory-guided eye-movements is seen by comparing these two data sets. The research explores this by highlighting the differences in these data for the Base and Memory data for eight different targets the primate is remembering. The project will discuss the extent of these differences and draw conclusions from them.

EARLY PANCREATIC CANCER DETECTION

JASON BLAHOVEC · MATHEMATICS
MAURA FITZGERALD · STATISTICS
MANISHA JOHARY · BUSINESS ADMINISTRATION
KEVIN KWAN · BUSINESS ADMINISTRATION
CASSANDRA STUDER · STATISTICS

Advisor(s): William Eddy · Statistics
Hoch Commons-2nd Floor, Rangos side / 3-5pm

Pancreatic cancer is a disease where abnormal cells grow in the pancreas and disrupt the growth of healthy tissue. Early detection of pancreatic cancer is extremely important as the cancer develops rapidly, spreading from the pancreas to surrounding organs and lymph nodes. This disease has the lowest survival rate of all major cancer types. Pancreatic cancer can be diagnosed by measuring the level of Cancer-Antigen 19 (CA19-9) in a patient's blood. This approach, however, is not very efficient for early detection, as CA19-9 levels are consistently detected only once the cancer has advanced to a late stage. Current research aims at analyzing several chemical levels (biomarkers) in patient blood to find a combination that gives useful information on the presence of the disease in early stages. Through our statistical analysis, we strive to develop an accurate, concise classification model that identifies specific biomarkers most useful in detecting signs of pancreatic cancer early. This test may then be added into a routine medical examination with minimal extra cost.

GALAXY CLASSIFICATION

DANIEL FRANK · STATISTICS
Advisor(s): Peter Freeman · Statistics
Kirr Commons-1st Floor, Window side / 3-5pm

This project is concerned with the classification of galaxies whose spectra exhibit strong emission lines caused by bursts of star formation in their disk, the presence of an active nuclei in their cores, or both. A current method of classification measures the strengths of certain lines and uses various ratios of these strengths to determine a single galaxy type, ignoring both the possibility of a mixture and the uncertainty in estimated strengths. We have developed a data-analysis pipeline in which we measure emission line strengths at seven localized regions in approximately 1,000 Sloan Digital Sky Survey (SDSS) galaxy spectra and make a preliminary classification. The line strengths inhabit a complex manifold in seven-dimensional space. We use a non-linear analogue of principal components analysis, diffusion mapping, to transform these data into a natural coordinate system where we may perform, e.g., logistic regression with our preliminary classification as the response. The resulting model, which allows for a mixture of classification types, may then be applied to the entire SDSS galaxy spectra database.

LINE SCAN!!!

DANIEL BURROWS · ELECTRICAL & COMPUTER ENGINEERING
KEVIN HUNG · INFORMATION SYSTEMS
YOUNG HO KIM · STATISTICS
Advisor(s): William Eddy · Statistics
David Friedenberg · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

Line scan is a technology currently used to monitor brain activity using a laser. Research has been done on small live animal using this technology. However, each line scan does not occur instantaneous, so the results contain systematic movements of the animal's breathing and heart beat. Our goal is to remove these systematic movements and create an accurate representation of the animal's brain.

MEG'S AND MUSIC OF THE MIND
MICHAEL DORKO · MATHEMATICS
ROBIN LAZRUS · MATHEMATICS
CASSANDRA STUDER · STATISTICS
JUYEON YU · STATISTICS
Advisor(s): William Eddy · Statistics
Kirr Commons-1st Floor, Window side / 12-2:30

Magnetoencephalography (MEG) is an imaging technique used to measure magnetic fields caused by electric current in the brain and used to identify locations of brain activity. At the Pittsburgh MEG center, a human subject was exposed to auditory stimuli and the corresponding magnetic data was recorded. The purpose of our project is to determine if the magnetic field in the brain changed as different tones were played, in particular if the field resonated with the tone. This research has further applications including localizing sources of seizures of epileptics and other similar neurological disorders.

THE FEDERALIST PROJECT
VASUDHA CHANANA · MATHEMATICS
HEE-WON CHANG · STATISTICS
ALEXANDRA CHARNAS · MATHEMATICS
DANIEL LIM · ECONOMICS AND STATISTICS
CASSANDRA STUDER · STATISTICS
Advisor(s): William Eddy · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

The Federalist Papers are a series of articles written before the Revolutionary War, advocating the ratification of the United States. It serves as a primary source for interpretation of the Constitution. Federalist data consists of 77 papers of which the authors of 65 are known: 51 papers are written by Alexander Hamilton and 14 papers are written by James Madison. Our project is to classify the author of 12 unknown papers by examining the writing techniques of each author. We model the data through regression trees, Linear Discriminant Analysis, Principal Component Analysis, and fitted General Linear Models, using the representational effects used in each paper with 18 possible predictor variables.

UNITED STATES CENSUS: DIRECT VERSUS SYNTHETIC DUAL SYSTEMS ESTIMATION FOR THE POST-ENUMERATION SURVEY

STEPHANIE BECHT · SCIENCE AND HUMANITIES SCHOLARS
EDDY CHIANG · ECONOMICS AND STATISTICS
DANIEL FRANK · STATISTICS
KANY KANG · ECONOMICS AND STATISTICS
CASSANDRA STUDER · STATISTICS
Advisor(s): William Eddy · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

This project is concerned with the United States census. The Census is vital because its results are used for re-appropriating seats in the House of Representatives as well as determining the amount of funding that states receive. Thus it is clear that ensuring the numbers accurately reflect those of people living in the United States is of paramount importance. Inevitably, some people will be missed in the counts. To correct this, we can utilize capture-recapture methods to improve the estimates delivered by the census. The question then becomes whether all individuals are missed equally, or whether racial, socioeconomic, and other conditions make some people more likely to be left out of the count than others. We therefore compare two methods of estimation that differ in that one assumes all people are missed equally, and the other assumes certain types of individuals with various characteristics are more or less likely to be missed than others.

MCS

MELLON COLLEGE OF SCIENCE

BIOLOGICAL SCIENCES

19F MRI DETECTION OF ACUTE CARDIAC ALLOGRAFT REJECTION USING IN SITU PERFLUOROCARBON LABELING OF IMMUNE CELLS

DANIELLE EYTAN · BIOLOGICAL SCIENCES
Advisor(s):Chien Ho · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 1, 10:30am

Organ transplantation is the preferred treatment of end-stage organ failure, however the transplant recipient faces a lifetime of immunosuppressive therapy and the threat of losing the organ due to immunological rejection. The current gold standard for diagnosing cardiac rejection following transplantation is to obtain a myocardial biopsy sample to detect the infiltration of immune cells to the graft. Biopsy is not only an invasive procedure, but it is also prone to sampling errors. Therefore, a more sensitive and non-invasive technique to monitor organ rejection and provide personalized patient care is needed. We are developing MRI techniques using a heterotopic cardiac transplantation model in rats to non-invasively detect and stage organ rejection. One approach is to label immune cells with MRI contrast agents and detect the accumulation of labeled cells by in vivo MRI. In this study we are evaluating a novel formulation of a fluorine-based cellular contrast agent. Transplant recipients are given a direct i.v. injection of the fluorine contrast agent. Immune cells, such as macrophages, take up the contrast agent in situ and the accumulation of labeled cells can be detected in vivo by 19F MRI. A conventional 1H MR image provides anatomical context. The results show that this technique is sensitive to the labeled cells, and histopathology confirmed that the particles had been taken up by macrophages infiltrating the sites of rejection. Correlating the 19F signal with the number of immune cells at the site of rejection may provide a sensitive method for detecting and staging rejection, and potentially may lead to clinical application for personalizing immunosuppressive therapy following cardiac transplantation.

BASE OF THE THUMB DOMAIN HAS A ROLE IN EPITHELIAL SODIUM CHANNEL (ENAC) GATING

DEBTIRTHO GHOSH · BIOLOGICAL SCIENCES
Advisor(s): Amy Burkert · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 3, 10:30am

Epithelial sodium channels (ENaCs) mediate Na+ transport in the distal nephron and in both airways and alveoli. The regulation of Na+ transport in these areas is crucial for controlling extracellular volume and blood pressure, and airway surface liquid volume. ENaCs are inhibited by external Na+, a process referred to as Na+ self-inhibition that reflects a reduction in channel open probability. The extracellular domains of ENaC subunits likely have a key role in regulating ENaC gating in response to external Na+. ENaC shares limited homology with acid sensing ion channels (ASICs). Proton gating of ASIC1 has been proposed to involve conformational changes to ultimately affect a Trp residue at the base of the thumb domain. We examined whether a Tyr residue at the base of the thumb domain of all three ENaC subunits, at a location homologous to the Trp residue in ASIC1, affects ENaC gating. Na+ self-inhibition was measured in Xenopus oocytes expressing wild type channels, as well as channels with an alpha Y418, beta Y356 or gamma Y375 mutation. The alpha Y418 mutation significantly reduced Na+ self-inhibition, whereas the beta Y356 or gamma Y375 mutants were similar to wild type. Our results suggest that the base of the thumb of the alpha subunit has a role in regulating channel gating in response to external Na+.

DEVELOPMENT OF A FLUORESCENT PROTEASE BIOSENSOR BASED ON A SINGLE CHAIN VARIABLE FRAGMENT

GREGORY NEWBY · BIOLOGICAL SCIENCES
Advisor(s): Peter Berget · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 3, 10:15am

Proteases are important enzymes that cleave other proteins, often by recognizing and cutting specific sequences of amino acids. They are necessary during animal development for proper cell signaling and for removing unwanted cells through apoptosis. Many viruses and bacteria also require their own specialized proteases when infecting a human host. I have developed a molecular tool that releases a fluorescent signal in the presence of an active protease so that researchers will be able to detect and determine the location of protease activity. This tool is a single-chain variable fragment (scFv) protein, consisting of two globular domains connected by a long, flexible amino acid linker. When this protein, called FITC-E2, is intact, it can bind to fluorescein dye and quench its natural fluorescence. I inserted the amino acid recognition sequence for target proteases into the linker of FITC-E2, so that when the protease is active in solution, it will cleave the two globular domains of FITC-E2 apart and release the bound fluorescein. This will result in an increase of fluorescent signal that can be detected in the laboratory. My tool can be used in the development of treatments that inhibit pathogen proteases or in determining the roles of proteases in animal development.

DOES CAUSAL AMBIGUITY AFFECT EXPLORATORY PLAY IN PRESCHOOL CHILDREN?

BRIAN GOLDFAIN · ELECTRICAL & COMPUTER ENGINEERING
ANDREA POON · BIOLOGICAL SCIENCES
Advisor(s): Anna Fisher · Psychology
Rangos 2 & 3 / Sigma Xi Group 6, 10:00am

People are often faced with ambiguity in everyday situations. At the same time, young children are very poor at recognizing empirical indeterminacy (or ambiguity); they almost never confuse determinate event for indeterminate, but they often consider empirically indeterminate events to be determinate (Fay & Klahr, 1996). However, recent work by Shulz and Bonawitz (2007) suggests that ambiguity affects exploratory play in 4- to 5-year-old children. Specifically, causal ambiguity about how an object works resulted in reduced novelty preference. Conclusions of this study are contrary to the results of many other studies suggesting that 4- to 5-year-old children are poor at recognizing empirical indeterminacy. The present study present a set of follow-up experiments designed to investigate whether exploratory play in children is affected by causal ambiguity.

EFFECT OF STRESS HORMONES ON CELL CYCLE REGULATION IN BREAST CANCER CELLS

PARTH DALAL · BIOLOGICAL SCIENCES
Advisor(s): Adam Linstedt Biological Sciences
Kirr Commons-1st Floor, Window side / 12-2:30

Breast cancer is the second most common cancer diagnosed on the planet. It is the leading cause of death worldwide in women between the ages of 40 and 55 years. Although chemotherapy comprises part of a successful cancer treatment, in many cases, as many as 50% of patients do not benefit from this regimen because their breast cancer cells become resistant to the chemotherapy. The hypothesis to be tested is that stress hormones, such as norepinephrine, epinephrine, and cortisol, will interfere with adriamycin cytotoxicity. To examine this hypothesis, breast cancer cells (MDA-MB-231) will be grown in DMEM growth medium and treated with the chemotherapeutic drug adriamycin, which acts to inhibit mitosis and kills cells as a result of intercalation of DNA. We will examine the effects on cell cytoxocity by assessing cell viability using the MTT (3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay and determine the effects on apoptosis using flow cytometry. Further, we aim to identify key protein targets of adriamycin such as topiosomerase by Western Blot analysis.

FACES VERSES WORDS: FLIP SIDES OF THE BRAIN?

LAUREN LORENZI · BIOLOGICAL SCIENCES
Advisor(s): Marlene Behrmann · Psychology
Hoch Commons-2nd Floor, Window side / 12-2:30

We examine the claim that the processing of faces and of words is not mediated by separate domain-specific subsystems specialized for a particular class of inputs, but rather that the same computational principles apply in both cases but played out over different representations. An implication of this latter account is that there are trading relations or a division of labor between the two hemispheres, with graded specialization for faces and words in the right and left hemisphere, respectively, and that, within an individual, the extent of specialization in each hemisphere is an outcome of an underlying competition across face/word representation.

Thus, individuals who have a greater hemispheric asymmetry for one class should show an equivalent asymmetry for the second class. We mapped out the relative hemispheric specialization in a large group of individuals in a paradigm that evaluated the advantage for across-field versus within-field discrimination for faces and for words. With this, we calculated the correlation between two asymmetry indices, one for faces and one for words. The findings support the view that the hemispheric organization within individuals reflects the outcome of the face/word representational competition.

FUNCTIONAL ANALYSIS OF A NON-EXONIC RECURSIVE SPLICE SITE BY GENE REPLACEMENT

STEVEN REILLY · BIOLOGICAL SCIENCES
Advisor(s): A. Javier Lopez · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 2, 10:00am

Genes with long introns tend to have complex expression and play important roles in development and disease. Recursive splicing has been proposed to facilitate expression of the genes through effects on accuracy/efficiency of splicing and/or processivity of transcription through long introns. This hypothesis is based on the frequency of recursive splice sites in Drosophila, which is much higher than expected at random, on their specific enrichment in introns longer than 5-10 kb, and on their strong Phylogenetic conservation in other insect species. Furthermore, although some recursive splice sites mediate alternative splicing decisions, the majority in Drosophila appear to be non-exonic, so their sequential use as a 3-ss and 5-ss does not affect the structure of the mRNA. To test the hypothesis that recursive splicing contributes to the correct and/or efficient expression of genes with long introns, we have deleted a well-characterized non-exonic recursive splice site (RP3) in the middle of a 50-kb intron in the Ultrabithorax gene. A two-step gene replacement strategy using ends-in homologous recombination was used in order to delete RP3 in the context of the intact gene at its normal chromosomal location. The mutant shows no evidence of gain of function, arguing against a negative regulatory role for RP3 by mediating the alternative splicing of an NMD-triggering exon. Instead deletion of RP3 leads to a mild loss-of-function phenotype, but preliminary results indicate that expression or integrity of the Ubx locus is destabilized, leading to occasional somatic clones with strong phenotypes. Additionally, the white marker which is incorporated near RP3 during the first step of gene replacement is strongly silenced, but 5- deletions generated by occasional non-homologous end-joining during the second step reactivate expression, suggesting a silencing role for sequences near RP3. Thus the role of RP3 at Ubx may be more complex than originally envisioned. I will describe further characterization of the developmental and molecular phenotypes associated with the deletion of RP3.

GENETIC POLYMORPHISMS ASSOCIATED WITH SCHIZOPHRENIA AFFECT ALTERNATIVE SPLICING OF THE HUMAN DOPAMINE REUPTAKE TRANSPORTER

KATHLEEN MCCANN · BIOLOGICAL SCIENCES

Advisor(s): A. Javier Lopez · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 1, 10:45am

The transporter protein DAT (encoded by gene SLC6A3) plays a critical role in re-uptake of the neurotransmitter dopamine from synapses in the brain. In this way it helps control the intensity and duration of dopaminergic signaling. Accordingly, DAT has been implicated in schizophrenia, bipolar disorder, ADHD, and ParkinsonÃ¢ÂÂs disease. Previous studies identified statistical associations between common DNA sequence variations (single-nucleotide polymorphisms: SNPs) within the third intron of SLC6A3 and risk for schizophrenia in two large Caucasian samples (Talkowski et al 2008). The location of these SNPs prompted us to examine the SLC6A3 sequence for possible alternatively spliced exons whose inclusion in mRNA might be affected by the polymorphisms. Using a primate-specific computational model, we predicted a novel 108 nt cassette exon (Ã¢ÂÂE3bÃ¢ÂÂ) within intron 3. This exon was flanked within 600 nucleotides by four schizophrenia-associated SNPs, three of which fell within computationally predicted splicing regulatory signals. We verified alternative splicing of E3b using minigene constructs in transfected cells, including a human neural cell line. We also verified alternative splicing of exon E3b in endogenous SLC6A3 transcripts from adult human brain using RT-PCR assays. E3b introduces multiple in-frame premature stop codons into the SLC6A3 mRNA and thus truncates the DAT protein. This suggests that E3b serves a negative regulatory function to control the level of DAT expression. Accordingly, the mRNA form that contains E3b is detected in multiple brain regions, including those where DAT protein is not expressed, whereas the form that lacks E3b is detected only in regions that express DAT protein, such as the substantia nigra. The premature stop codons in E3b are predicted to trigger nonsense-mediated decay of the mRNA, which would thus only accumulate to low levels (as observed), and this can explain why the exon had not been discovered previously. The importance of E3b is underscored by its conservation among primates and many other placental mammals. Analysis of minigene constructs bearing either risk-associated or non-risk haplotypes revealed that the risk-associated alleles at the flanking SNP positions are associated with increased inclusion of E3b in cell transfection assays. This is consistent with the hypothesis that risk-associated SNPs contribute to schizophrenia by reducing the expression of functional DAT, which in turn should lead to increased dopaminergic activity.

IDENTIFYING MOLECULAR COMPONENTS UNDERLYING THE MECHANICAL FORCES THAT GENERATE CELL SHAPE CHANGES DURING VENTRAL FURROW FORMATION IN DROSOPHILA MELANOGASTER EMBRYOS

OLGA STRACHNA · BIOLOGICAL SCIENCES

Advisor(s): Jonathan Minden · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 2, 10:15am

Ventral furrow formation (VFF) is an important morphological event involved in gastrulation of D. melanogaster embryos. Mutations in the VFF pathway cause the embryos to develop a defective ventral furrow, where the homologous morphogenetic event in

mammals is neurulation, or the development of the neural tube. VFF is preceded immediately by cellularization and we speculate that there may be specific molecules from cellularization that may affect the process of ventral furrow formation. In order to find the specific molecules involved in VFF, I am using mutant analysis, inhibitor injection, and molecules tagged with GFP to determine the roles of these molecules in the development of the ventral furrow. I'm also using a method of end-on imaging, which was developed in the Minden lab, to image wildtype, mutant, and GFP labeled embryos by using a confocal microscope and analyzing the development of the ventral furrow in D.melanogaster embryos in vivo.

MECHANISMS INVOLVED IN THE REGULATION OF THE SEA STAR POST ORAL LOBE

MEGAN MARTIK · BIOLOGICAL SCIENCES
Advisor(s): Veronica Hinman · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 2, 10:30am

Gene regulatory network (GRN) models show the connections between regulatory genes and regulatory DNA. The process of the development of animal body plans is illustrated primarily by GRNs. They describe how the embryo is spatially divided into different domains during development. Each domain is fated to form a particular cell type or body part. Since GRNs describe development of body plans, divergences in the architecture of GRNs underlie evolution in the development of different domains in different animals. I have been studying the expression patterns of two genes, gbx and nk1 in the sea urchin, Strongylocentrotus purpuratus, and the sea star, Asterina miniata. The distinct territory within which they are expressed, I've named the "post oral lobe" due to its location in a ring of ectoderm around the larval anus in both embryos. Using double fluorescence in situ hybridization (DFISH) I am able to distinguish between overlaps in gene expression of a variety of other transcription factors with gbx and nk1 and whether the post oral lobe derives from a purely ectodermal or endodermal domain. I have found that there is a distinct boundary in expression between AmNk1 and AmOtx, but there is an overlap in expression between AmNk1 and AmFoxJ1. I am currently working with two morpholino anti-sense oligonucleotides (MASO) designed to block the translation of the nk1 transcript and the other to block the translation of the foxj1 transcript in the sea star. Micro-injection of the MASOs will allow me to determine the phenotypic and gene expression differences observed when normal nk1 or foxj1 function is perturbed, thereby determining the regulatory role that these genes have in sea star development. I am especially interested to see if nk1, gbx, and otx genes are cross-regulated as they are known to be in vertebrate embryos and also because of the cogent DFISH results. Also, I am interested to see if foxj1 up-regulates nk1 as it is known to do in sea urchins. This would demonstrate that the GRN subcircuit involving these genes has been conserved for 100s of millions of years.

NOVEL GENOMIC VARIATION IN THE RELAXIN GENES

LAUREN CAMPBELL · BIOLOGICAL SCIENCES
Advisor(s): Gordon Rule · Biological Sciences
Hoch Commons-2nd Floor, Rangos side / 3-5pm

The goal of this study was to characterize two novel relaxin hormones, recently discovered by Dr. David Finegold and Robert Nicholls. While the classically regarded role of relaxin as a hormone of parturition in non-primate species is widely accepted, relaxin also has roles in human embryo implantation, placentation, and lactation. Through Dr. Finegold and Robert Nicholls' studies of an unusual patient, t(3;14), with pulmonary lymphangiectasia having a novel de novo balanced translocation, they observed that the two genes (RLN1 and RLN2) for the peptide hormone, relaxin, have a copy number variation (CNV) previously not described. Their preliminary studies indicated that the deletion and duplication CNVs are polymorphic in the human population and lead to novel fusion genes of relaxin HI (RLN1) and relaxin H2 (RLN2); therefore, there are four varieties of relaxin hormones in humans rather than the two previously recognized hormone isoforms. The goal of my research was to clone and sequence the de novo RLN2-RLN1 fusion gene from patient t(3;14). To achieve this goal, I performed PCR on genomic DNA from the individual of interest in order to amplify the fusion or deletion gene fragment. I then extracted the fragment from the agarose gel and TA cloned the result. The TA clone was sent to a UPMC laboratory for sequencing, which allowed us to analyze the recombination breakpoint positions. This study has not yet yielded any results concerning the sequence of the de novo fusion genes.

POLYKETIDE SYNTHASE: HORIZONTAL GENE TRANSFER AND THE EVOLUTION OF NEW FUNCTIONS

CHARLOTTE JENNINGS · BIOLOGICAL SCIENCES
Advisor(s):Veronica Hinman · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 2, 10:45am

Horizontal gene transfer is a monkey wrench in an evolutionary tree. It is the process by which an organism acquires genetic material from another organism via lateral transfer, rather than by vertical descent. The newly acquired genetic information may then be acted on by evolutionary forces which may give rise to new functions.

The polyketide synthase (pks) gene is an interesting candidate for studies regarding the evolution of a new function. This gene is responsible for producing pigment in a variety of organisms. Homologs of this gene are found across the tree of life - from single-celled organisms to animals, including the sea urchin. Oddly, however, the sequence of the sea urchin homolog is most closely related to that of a fungus!

We have cloned pks in the sea star, Asterina miniata. We are primarily interested in studying the expression patterns of this gene because we hypothesize that the presence of pks in animals may be due to horizontal gene transfer. Furthermore, it may function differently in

the sea star than in the sea urchin, despite that these two organisms are evolutionarily closely related. For instance, we have evidence that pks is expressed in an embryonic stage in both organisms, yet only the sea urchin larvae produce pigment. This leads us to believe that the newly acquired gene has evolved a different function.

ROLE OF HPV-16 E7 IN MODULATING SCF UBIQUITIN LIGASE ACTIVITY

LEON ZHENG · BIOLOGICAL SCIENCES
Advisor(s): Gordon Rule · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 2, 11:00am

Human papillomavirus (HPV)-associated neoplasms are frequently aneuploid and exhibit cell division errors caused by centriole overduplication. The high-risk HPV type 16 (HPV-16)-associated carcinomas overexpresses two viral oncoproteins, E6 and E7. The function of the E6 oncoprotein is to inactivate p53; the role of E7 oncoprotein is more complex and eventually leads to disruption of pRB/E2F signaling pathway. In U2OS cells, E7 mediates centriole overduplication and formation of multiple daughter centrioles surrounding a single maternal centriole ("centriole flowers"). Recently, studies have shown that Cullin 1 (CUL1), a member of the SKP1-Cullin-F-box (SCF) ubiquitin ligase complex, plays a role in the regulation of centriole overduplication. Remarkably, silencing CUL1 by siRNA or overexpression of a dominant-negative mutant of CUL1 not only modulates SCF ubiquitin ligase activity but also induces the formation of "centriole flowers" and hence mimics the effects of the HPV-16 E7 on centriole biogenesis. However, the mechanism by which this occurs is still poorly understood. The Cullin-associated and neddylation-dissociated 1 (CAND1) gene plays a key role in inhibiting the activity of CUL1, and it is hypothesized that E7 may participate in the regulation and activation of CAND1. In the past few months, we have discovered a connection between E7, CUL1, and the CUL1 inhibiting protein, CAND1, in the regulation of centriole duplication by (1) measuring an increased expression of CAND1 protein by western blots in E7 expressing cells, (2) analyzing spatial and temporal regulation of CAND1 by immunofluorescence microscopy, and (3) testing for possible direct interaction between E7 and CAND1 that may stabilize the complex with CUL1. These experiments provide insight into the mechanisms of HPV-16 E7 induced centriole overduplication as well as normal regulation of centriole biogenesis.

STAR NANO-POLYMER DELIVERY OF ENCAPSULATED SIRNAS FOR TARGETED MRNA KNOCK DOWN

TAHLIA WOLFGANG · BIOLOGICAL SCIENCES
Advisor(s): Abiraman Srinivasan · Biomedical Engineering
Rangos 2 & 3 / Sigma Xi Group 1, 11:00am

Bone Tissue Engineering Center, Biomedical Engineering Department, Carnegie Mellon University: Tahlia Wolfgang, Patricia Shaw, Berengere Pena, Joanna Hong, Bangshuang

Zhu, Jeffrey Hollinger, Abiraman Srinivasan. Department of Chemistry, Carnegie Mellon University: Kryztof Matyjaszewski, Haifeng Gao, Daniel Siegwart.

Heterotopic ossification (HO) is the abnormal formation of true bone in soft tissue. Various forms of HO are seen in patients with spinal cord injuries, traumatic brain injuries, blunt trauma, or amputees. HO can occur in muscle, tendon, ligament or fat tissues and may cause severe debilitating pain. Currently, surgical resection is the only preferred clinical procedure for HO treatment. Due to the severity and prevalence of this disorder, and the number of civilian and combat related amputations, clinicians are in great need of an effective therapeutic approach.

HO is caused due to increased expression of Bone Morphogenetic Protein (BMP) in the amputation site which results in abnormal differentiation of osteoprogenitor stem cells that lie dormant in soft tissue. As key osteoblast differentiation factors, RUNX2 and OSX play a vital role in osteoblast differentiation and ossification. Therefore this project aims to effectively deliver anti-RUNX2 and anti-OSX short interference Ribonucleic Acids (siRNAs) using a neutral STAR nano-polymer with and without GRGD peptide delivery system, to target and degrade native RUNX2 and OSX mRNAs within the cell for the inhibition of BMP induced HO.

SPATIAL AND TEMPORAL CHARACTERIZATION OF PROTEOBACTERIA IN THE PITTSBURGH WATER DISTRIBUTION SYSTEM

ALLISON RETOTAR · BIOLOGICAL SCIENCES
Advisor(s): Jeanne VanBriesen · Civil and Environmental Engineering
Rangos 2 & 3 / Sigma Xi Group 1, 11:15am

Currently, data exist that provide seasonal data on alpha, beta, and gamma proteobacteria populations in the Pittsburgh water distribution system. By sampling drinking water (bulk water) on a monthly basis at three locations, a more specific spatial and temporal model can be established. The goal is to create a model that will allow a faster, quantitative mechanism by which to assess adverse events within the distribution system rather than testing for individual contaminants. Locations 26P, BT3, and LR4 are located downstream of drinking water chlorination points. By filtering 10 liters of water from each of the locations, sufficient DNA was obtained for analysis by quantitative polymerase chain reaction (QPCR) with specific primers for alpha, beta, gamma, and total bacteria. At this time, monthly data have been obtained for September through January. Relative populations and quantities of alpha, beta, gamma, and total bacteria will be established for each location. Until recently, only seasonal samples were collected. Collection at multiple locations at monthly intervals will allow more specific characterization of these populations, allowing rapid detection of adverse events within the distribution system.

STAT3 AS A THERAPEUTIC TARGET FOR ENDOTHELIAL CELLS IN THE TREATMENT OF HEAD AND NECK SQUAMOUS CELL CARCINOMA

JONAH KLEIN · BIOLOGICAL SCIENCES
Advisor(s): Brooke McCartney · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 1, 11:30am

Despite advances in diagnosis and treatment of head and neck squamous cell carcinoma (HNSCC), there has been little change in the prognosis. With approximately 50,000 new cases each year, we demand better treatment options. Newly developed treatments for HNSCC malignancies target cell surface receptors associated with tumor cell growth and angiogenesis. The epidermal growth factor receptor (EGFR) significantly contributes to tumor growth and is a promising therapeutic target. Additionally, the vascular endothelial growth factor receptor (VEGFR) on endothelial cells is the key mediator of tumor angiogenesis, a necessary process for tumor survival. There have been several clinical trials investigating the use of agents targeting EGFR, VEGFR or both receptors. But, these agents have limited specificity and a common mediator of both pathways has not yet been found. Signal transducer and activator of transcription 3 (Stat3) is a transcription factor downstream of EGFR mediating proliferation, invasion, migration, and survival in cancer cells. Stat3 has been shown to be a promising therapeutic target. Through the use of biochemical and functional assays, we demonstrate that Stat3 plays an additional role in endothelial cells mediating VEGFR signaling and angiogenesis. Our data suggests that Stat3 is downstream of VEGFR and that its inhibition in endothelial cells potentiates an anti-angiogenic effect through decreased proliferation, induced apoptosis, decreased migration, and decreased tubule formation. Combining the angiogenic role in endothelial cells and tumorigenic role in cancer cells, we demonstrate that Stat3 inhibition could be an efficacious treatment for the entire tumor microenvironment.

TESTING FOR MANGANESE BINDING TO THE MANGANESE-REGULATED GOLGI PROTEIN GPP130

HEATHER CHALFIN · BIOLOGICAL SCIENCES
Advisor(s): Adam Linstedt · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 3, 10:00am

Trace amounts of manganese are always present in cells and necessary for life, but greater concentrations lead to cell death. Manganese poisoning is associated with neurological disorders such as ParkinsonÃ¢ÂÂs disease, yet the mechanism of manganese-induced cell death is unknown. It is known that the delocalization of Golgi body protein GPP130 to endosomes, where it is degraded, is the most acute and strongest change in response to elevated manganese concentrations. GPP130 normally cycles to the plasma membrane and back to the Golgi without degradation via the bypass pathway, and certain regions of the proteinÃ¢ÂÂs lumenal coiled-coil domain mediate this trafficking. Manganese binding to GPP130 may disrupt its normal trafficking, causing its relocalization and degradation. As a test, we expressed the GST-tagged coiled-coil domain of GPP130 in E.coli, purified it on

glutathione agarose beads, and developed a formaldoxime colorimetric assay to detect manganese binding. The coiled-coil domain actually bound less manganese than beads alone or GST-only beads. To compensate for the lack of a positive control, to investigate the other domains of GPP130, and to measure the specificity of manganese binding, we next assayed binding of GPP130 present in cell extracts to ion-coordinated beads. We propose that by quantifying GPP130 binding to manganese, nickel, and calcium beads and varying the competing presence in solution of either 100 mM or 500 mM divalent cations, we will be able to test for specific binding of manganese to GPP130.

THE EFFECTS OF HUMAN VERSUS VIDEO INSTRUCTION

LENA YOO · BIOLOGICAL SCIENCES
Advisor(s): Anna Fisher · Psychology
Rangos 2 & 3 / Sigma Xi Group 6, 11:00am

With technology advancing daily, various schools are using videotapes and computer software programs as options to teach various important concepts. This study attempts to show whether the presence of a human being has a beneficial effect on the children's ability to follow direction of a simple task. This is an important study because while video instruction is prevalent in today's society, it has not yet been explicitly checked whether teaching via video enhances, hinders or otherwise has no effect on its audience. 4-5 year olds were studied at the Children's School at Carnegie Mellon University. Half the children were taught via a video; the other half of the children were taught in person. The task was a simple task involving the recreation of shapes with sticks shown by the instructor. The hypothesis in this experiment is that, between a human instructor and a video instructor, there will be a difference in children's ability to imitate, based on accuracy of how well the children can complete the task shown to them.

THE EFFECTS OF STRESS AND COPING STYLES IN ADOLESCENTS WITH TYPE 1 DIABETES.

RICHARD CHANG · BIOLOGICAL SCIENCES
Advisor(s): Vicki Helgeson · Psychology
Hoch Commons-2nd Floor, Window side / 12-2:30

This health psychology project explored the relationship of daily stress and blood glucose in adolescents with diabetes. Researchers mainly focus on chronic long term stressors in adults with diabetes, rarely is the focus on both diabetic adolescents, and daily stressors. Diabetes is a complex disease to manage due to the daily regimen that each patient must undergo to prevent negative health consequences. Stress is one factor that may influence their adherence to the regimen. The two goals of the study were: (1) to examine the relation between stressful daily events and mood on blood glucose levels in adolescents, and (2) to examine the moderating effects of chronic life events and coping styles on this relation. To accomplish this we conducted daily interviews with 20 adolescents with diabetes for a week.

We collected information about coping style, chronic stressors, daily stressors, mood, and blood glucose levels.

TYPE 2 DIABETES: A COUPLES STUDY

KIRSTIE FUNG · BIOLOGICAL SCIENCES
Advisor(s): Vicki Helgeson · Psychology
Hoch Commons-2nd Floor, Window side / 3-5pm

This experiment is designed to examine how the spousal relationship is related to the health behavior of people with Type 2 diabetes. This study is investigating how people take care of their diabetes and how spouses and partners communicate about diabetes. The management of Type 2 diabetes involves making drastic life style changes. For instance, patients with type 2 diabetes usually have to change their diets and the amount of physical activity they perform. They also have to take either oral medication or administer insulin. Research has shown that family members play an important role in a patient's disease management. Marital satisfaction and family stress are contributors to personal health and good disease management. Spouse or partner involvement in patient's caretaking, diet control, and stress control may contribute positively or negatively to a patient's diabetes management. Participants consist of 21 patients with Type 2 diabetes and their spouse or partner. Participants completed a brief questionnaire that consists of questions related to their health behavior, partner communication, and marital quality.

UNDERSTANDING MICROTUBULE DYNAMICS AT THE CORTEX OF SYNCYTIAL DROSOPHILA EMBRYOS USING TIRF MICROSCOPY

ORR ROZOV · BIOLOGICAL SCIENCES
Advisor(s): Brooke McCartney · Biological Sciences
Rebecca Webb · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 2, 11:30am

Coordinated cytoskeletal rearrangements in complex higher organisms are not well understood. The Drosophila syncytial embryo is a great in vivo model system for studying cytoskeletal organization. We have developed a new technique for visualizing cytoskeletal organization in the syncytial embryo using Total Internal Reflection Fluorescence (TIRF) microscopy. TIRF is a useful imaging technique for the visualization of cortical cytoskeletal dynamics because of its limited axial resolution and high signal-to-noise ratio. We have observed a significant peak of cortical microtubule activity in late anaphase. Using time lapse images generated with TIRF microscopy, we have developed a number of assays to elucidate the behavior of cortical microtubules. These assays evaluate the orientation, behavior, and duration of microtubules at the cortex in both wild type and mutant embryos. The data we collected has revealed interesting trends including the tendency of microtubules from wild type embryos to be oriented perpendicularly when nearing the cortex while embryos null for RhoGEF2 approach in a more parallel orientation. In addition, wild type microtubules remained at the cortex longer than microtubules in APC2 or RhoGEF2 mutants, suggesting

that the mutant microtubules are less stable. TIRF microscopy is a useful technique for the analysis of cytoskeletal dynamics in the early Drosophila embryo.

WNT-DEPENDENT CHANGES IN CELL FATE AND TISSUE MORPHOGENESIS IN THE WING IMAGINAL EPITHELIUM RESULT FROM LOSS OF THE DROSOPHILA HOMOLOGUES OF THE APC TUMOR SUPPRESSOR

KELLIE KRAVARIK · BIOLOGICAL SCIENCES
Advisor(s): Brooke McCartney · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 2, 11:45am

Mutations in the human tumor suppressor Adenomatous polyposis coli (APC) are linked to both inherited and sporadic cases of colon cancer. APC is a negative regulator of Wnt signal transduction where it functions as part of the destruction complex to target -catenin/Armadillo for proteolytic degradation. Accumulated evidence favors a model whereby disruption of APC function leads to polyposis both through ectopic activation of Wnt signaling and through the disruption of APCÃÂ¢ÃÂÃÂs Wnt-independent cytoskeletal functions. To determine the cellular consequences of complete loss of APC function in a model epithelium, we generated APC2 APC1 (APC) double null clones in the Drosophila wing imaginal disc. We have shown that loss of APC function leads to Wnt-dependent apical constriction and outpocketing in the larval wing imaginal epithelium. The outpocketing is position dependent, as APC null clones outpocket in the ventral pleura, and dorsal and ventral hinge, but clones in the wing pouch and in the proximal hinge exhibit little or no outpocketing by late third instar. Here we show that by 6 hr after puparium formation (APF) some clones within the wing blade have extruded basally and are trapped between the developing blades of the wing. In the adult, clones in the blade typically exhibit a cell fate transformation and produce margin bristles, and these clones are occasionally associated with wing blisters. The invagination of APC mutant tissue we observed 6 hr APF suggested the clones would produce cuticle between the blades of the adult wing, but such cuticle was not recovered. To test the hypothesis that the invaginated APC mutant tissue was eliminated by apoptosis before the production of cuticle, we blocked apoptosis in APC mutant clones by coexpressing p35. Using a combination of brightfield and scanning election microscopy we have shown that some APC mutant clones expressing p35 are invaginated in the adult wing producing pits containing margin bristles. To understand the behavior of the invaginated APC mutant tissue, we are following APC mutant clones throughout pupal development. As the earliest manifestation of polyposis in the mouse colon is invagination and basal extrusion, we predict that the imaginal disc will be a powerful model to address the role of Wnt signaling in cellular and tissue morphogenesis both in normal development and in tumorigenesis.

SIRNA ENCAPSULATION AND DELIVERY BY DEGRADABLE CATIONIC STAR NANO-POLYMERS

PATRICIA SHAW · BIOLOGICAL SCIENCES
Advisor(s): Abiraman Srinivasan · Biomedical Engineering
Rangos 2 & 3 / Sigma Xi Group 1, 11:45am

Ectopic bone formation or Heterotrophic Ossification (HO) is promoted by bone morphogenetic protein (BMP). BMPs are recognized as the pivotal molecules for normal bone healing as well as osteoinduction (ectopic bone or HO). We reason that ectopic bone (i.e., osteoinduction) is mechanistically equivalent to HO. Consequently, we emphasize the importance of exploiting a biologically driven strategy that will abrogate BMP signaling. Shutting down BMP signaling with siRNAs will provide a solution to the clinically vexing problem of HO at amputation stump sites.

RUNX2 and OSX are two of the key osteoblast differentiation transcription factors that lead to bone formation. This project aims to knock-down the RUNX2 and OSX mRNA using anti-RUNX2 and anti-OSX short interference Ribonucleic Acids (siRNAs) using a degradable cationic STAR nano-polymer with and without GRGD peptide delivery system to target and degrade native RUNX2 and OSX mRNAs within the cell for the inhibition of BMP induced HO.

CHEMISTRY

AN INVESTIGATION OF VIRAL PARTICLES FROM HK97 AND P22 DURING VARIOUS STAGES OF MATURATION USING A CRYODETECTOR-BASED MALDI-TOF MASS SPECTROMETER

ERIC STOLOFF · CHEMISTRY
Advisor(s): Mark Bier · Chemistry
Hoch Commons-2nd Floor, Window side / 12-2:30

The objective of this study was to use a matrix-assisted laser desorption ionization/ time of flight mass spectrometer (MALDI-TOF MS) with cryodetectors to not only analyze certain complex virus molecules, but also to further investigate the feasibility of using this equipment to analyze high-mass ions in general. I used the MALDI-TOF MS (MacromizerTM, Comet, Flamatt, Switzerland) to analyze the HK-97 virus (a phage that infects E. coli and other bacteria) at different points in its maturation, and investigated the effects of different matrix solutions on the distribution of ion peaks.

ATMOSPHERIC THERMAL DISSOCIATION OF PROTEINS USING ELECTROSPRAY IONIZATION MASS SPECTROMETRY

CATHERINE VINCI · CHEMISTRY

Advisor(s): Mark Bier · Chemistry
Rangos 2 & 3 / Sigma Xi Group 3, 11:00am

Protein analysis mass spectrometry (MS) often requires a bottom-up approach which means digestion by an enzyme such as trypsin to disassemble the protein into smaller peptides before analysis. I propose protein analysis by a top-down approach which uses thermal energy to cause fragmention. This methodology could help in protein identification, conformation, and post-translational modification analysis. The protein in the thermal dissociation approach is first ionized by electrospray and then sprayed into a lined ceramic tube that is electrically heated to induce fragmentation. The fragments, now at atmospheric pressure will enter the mass spectrometer for analysis. In this manner proteins could potentially be identified and or sequenced with additional mass spectrometry/mass spectrometery (MS/MS) analysis, and their 3-D structure realized through a real-time heating and fragment characterization experiment.

CHARACTERIZATION OF AQUEOUS STABILITY AND CATALYTIC ABILITY OF A NEW TAML FAMILY: D STAR

CAMLY TRAN · CHEMISTRY

Advisor(s): Terrence Collins · Chemistry
Rangos 2 & 3 / Sigma Xi Group 3, 11:15am

Tetra amido macrocyclic ligand (TAML) ÃÂÃÂ® catalysts are used to speed up oxidation reactions and is an example of anenvironment-friendly catalyst. TAML catalysts have several useful properties that enable them to be highly effective and green. The main family of TAML catalyst is called TAML B*. Within the past 4 years, a new family of TAML catalysts has been synthesized and has been given the name TAML D*. TAML D* catalysts have been characterized extensively using UV-Vis spectrometry, particularly in two areas: aqueous stability and catalytic ability. Kinetics analysis of TAML D* was completed by observing the exponential decrease of either the catalyst for aqueous studies or the substrate for catalytic studies. Orange II dye was the substrate. Varying concentrations of Orange II dye and hydrogen peroxide were mixed in a cuvette with the TAML catalysts at a wide range of pHs. The kinetic results of these experiments have been comparable to the B* series.

DEFENSIN MIMIC PREPARED FROM Y-PEPTIDE NUCLEIC ACID SCAFFOLD EXHIBITS POTENT ANTIMICROBIAL ACTIVITIES

ROBERT MEEHAN · CHEMISTRY

Advisor(s): Danith Ly · Chemistry
Rangos 2 & 3 / Sigma Xi Group 3, 10:45am

Peptides offer a vast source of possibility for drug usage due to their synthetic simplicity and large sequence space. However, they lack conformational rigidity making them ineffective at binding to targets with high affinity and selectivity. In nature a system has been developed

which opposes this obstruction in which linear peptides are organized into cyclic and knotted structures. This system helps maintain the function of the peptide while increasing its binding affinity, selectivity, and stability. An example of this is rhesus ÃÂ¸-defensin, a cyclic peptide discovered in rhesus macaques, which contains a tridisulfide ladder. -defensin has been shown to exhibit antibacterial, antifungal, and antiviral activity. More specifically, it has demonstrated potent ability to hinder or impede HIV infection. For these reasons -defensin and similar molecules have drawn attention for development as antibiotics and, possibly, anti-HIV drugs. Though chemical synthesis of -defensin and similar molecules is possible, it is insufficient in producing large quantities in high purity because of the nonselective and difficult-to-control disulfide bond formations which, as stated, must occur in the tridisulfide ladder configuration. Based on the predicted mechanism of action of -defensins anti- microbial activity, in which the peptide interacts with the cell membrane and either kills the host or prevents interaction with mammalian cells, we hypothesized that simpler homologues could be made that replace the non-selective disulfide bonds with highly stable and selective Watson-Crick base-pairings. Theoretically, retaining the basic three-dimensional structure of -defensin should cause the homologues to have similar antimicrobial capabilities. To test this hypothesis, -defensin analogues will be synthesized using alanine modified y-peptide nucleic acid. The synthesized molecules will then be analyzed to determine if they exhibit conformational and thermal stability under physiological conditions. Once the stability of the molecules is confirmed, the antimicrobial ability of the analogues will be compared with authentic -defensin to determine the effectiveness of the homologues to be used as antibacterial drugs.

DEVELOPMENT OF A FRET BASED PROTEIN KINASE C BIOSENSOR

LAURA KOCSIS · CHEMISTRY
Advisor(s): Catalina Achim · Chemistry
Hoch Commons-2nd Floor, Window side / 12-2:30

Biosensors can be used to detect various types of biological reactions by determining the phosphorylation activity of the kinase in the cell, as well as be used in screening kinase inhibitors and identifying suitable kinase substrates. In this research, a protein kinase C biosensor is being studied, which plays a role in controlling the cell cycle as a messenger in signaling pathways. If we can understand more about the protein kinase C through this biosensor, this knowledge can be applied to other kinases and more can be learned about the complex signaling pathways that govern our biological reactions.

The protein kinase C biosensor we are developing is a peptide that consists of ten amino acids, with one end containing a Cy5 acceptor fluorophore and the other end containing a Cy3 donor fluorophore. In the center of the strand is a Proline amino acid, which causes the strand to take on a hairpin-like structure, bringing the two fluorophores in close proximity to each other so that energy is quenched between the two fluorophores and no fluorescence, or light emission, occurs. It is believed that when Zn(II), or other divalent cations, are added to a phosphorylated biosensor, the peptide will take on a tighter hairpin conformation, allowing

for the flurophores to come closer to each other, and Fluorescence Resonance Energy Transfer (FRET) measurements can be made.

The overall goal of this study is to add protein kinase C to this biosensor and study its activation, or phosphorylation, of the biosensor so that we can obtain a better idea of the cell signaling processes. This project, however, focused on first the determination of the purity of nine previously synthesized peptide strands, re-purification of the strands if necessary, studying of spectrophotometric titrations to determine how the ligands of the strand bind to Zn(II) metal ions, and studying of the changes of absorbance and fluorescence characteristics of the peptide strands in the presence of metal cations.

GREENERBILLS
DAVID KENNEDY · ARCHITECTURE
JACOB MOHIN · CHEMISTRY
BENJAMIN SOM-PIMPONG · MECHANICAL ENGINEERING
Advisor(s): Cliff Davidson · Civil and Environmental Engineering
Justin Parisi · Industrial Management
Kirr Commons-1st Floor, Window side / 12-2:30

A Thermodynamics professor at Carnegie Mellon University slyly grinned at his class and offered a dollar to any student who could explain to him the definition of energy. Hands shot up and answers flew back and forth, but after a few moments, the professor, smiling knowingly, returned his bill to his wallet. No one could give a satisfactory definition because energy, particularly in the form of electricity, is an elusive concept. People can neither touch it nor see it and yet it powers our world and is the subject of great debate and controversy. The inability to tangibly grasp electricity is compounded by the fact that energy usage patterns are largely hidden from domestic consumers by utility companies. The problem is that consumers are wasting money and harming the environment through inefficient energy usage because of a lack of information.

This is the problem that we intend to correct. Through a grant from the Mascaro Center for Sustainable Innovation, we have implemented a system that uses our custom interactive website (*greenerbills.net*), social networking, and an electricity metering system to give consumers feedback on their energy usage in a unique way. Greenerbills.net will create an environment where consumers can be aware of their usage through pop-up notifications, stunning visuals. The y can also compete with others in their neighborhood. Studies show that consumers saved 15% in energy costs just by being aware of their usage. Our system goes farther by putting power in the hands of consumers through a psychological model called "norm activation". According to norm activation, consumers must first be aware that there is a problem; they must then realize that they have a role in causing that problem and that they have the power to effect a change. This new consciousness spurs individuals to take action based on motivations such as pressure from friends or family, moral concerns, or the desire to save money. Receiving a monthly bill from a utility company with data that is often

difficult to decipher just is not effective. Our system creates an environment for consumers where conserving energy is enjoyable, cost effective, and helpful for the environment.

INVESTIGATION OF TRANSMEMBRANE DOMAIN OF GLUTAMATE RECEPTOR AND HOMOLOGY MODEL OF TETRAMERIC GLUR0

JANGHYUN LEE · CHEMISTRY
Advisor(s): Maria Kurnikova · Chemistry
Hoch Commons-2nd Floor, Rangos side / 3-5pm

The ionotropic glutamate receptors (GluR) are a family of ligand-gated ion channels that regulate neurotransmission in the central nervous system. GluR dysfunctions are related to neurodegenerative disorders, such as Parkinson's and Alzheimer's diseases. The prokaryotic receptor (GluR0) is approximately 15% homologous to the set of three eukaryotic receptors defined by their agonist as: AMPA, kainate, and NMDA. The prokaryotic and eukaryotic receptors are thought to share the same tetrameric multi-domain protein structure consisting of an N-terminal ligand binding domain (LBD) which has been independently crystallized and pore forming transmembrane (TM) domain for which the structure has not been solved. The TM domain is ~20% homologous to the potassium channel family of proteins, and it is suggested that GluR0 is possibly an evolutionary linker between the potassium channels and the eukaryotic GluRs. A full homology model of GluR0 has been constructed based on known structures of GluR0 LBD and the semi-open KirBac3.1 and NaK potassium channels. The ion pore of the GluR0 model was fit to the experimentally measured pore size of GluR2 (AMPA). In addition, the M4 segment of GluR2 is thought to play a major role in stabilizing the protein in the membrane environment. Given that GluR0 lacks this stabilizing M4 segment, it is hypothesized that the hydrophobicity of peripheral helices in the transmembrane domain of GluR0 may provide insight into understanding the more complex structure and function of GluR2.

KINETICS OF FETAMLS

RIDDHI ROY · CHEMISTRY
Advisor(s): William Ellis · Chemistry
Hoch Commons-2nd Floor, Window side / 12-2:30

One of the biggest problems of environment today is the pollution that comes from industrial effluents from factories. FeTAMLs, which stands for iron(III) complexed to tetra amido macrocyclic ligands, are catalysts that are used to break down dyes released into the environment through wastewater from dye manufacturers into non-toxic products. Through this research project, I further investigated the kinetic properties of the catalysis by FeTAMLs.

SYNTHESIS AND ANALYSIS OF CYANINE BASED "LIGHT-UP" PROBES

COURTNEY SOBERS · CHEMISTRY
Advisor(s): Bruce Armitage · Chemistry
Rangos 2 & 3 / Sigma Xi Group 3, 11:30am

The "light up" probes presented are a subclass of environmentally sensitive fluorogenic dyes composed of cyanine dyes and their derivatives. For these projects, a light up probe is defined as a dye that has little to no fluorescence when placed in solution. When placed in a restrictive environment the fluorescence of the molecule increases significantly due to an increase in molecular rigidity. This property allows them to serve as in vivo and in vitro molecular probes or biomarkers. The cyanine dyes, Thiazole Orange (TO), Dimethyl Indole Red (DIR) and Pseudoisocyanine (PIC), have potential as biomarkers. The aforementioned cyanine dyes have been modified, sterically and electrostatically, to prevent intercalation into dsDNA. The altered dyes also have very weak non-specific binding to negatively charged nucleic acids as well as bovine serum albumin. This suggests that these molecules could be used in vivo as they can be modified to have high target specificity, with minimal fluorescence due to non-specific binding. Other modifications include inducing shifts in absorption and emission wavelengths, as well as allowing for linkage to peptide nucleic acid (PNA) or naturally occuring biomolecules, such as biotin. This project covers the optimization of the synthesis of several TO derivative derivatives, the development of a FRET molecular probe using a derivative of DIR and pyranine, analysis/characterization of PIC, and finally, the synthesis of novel DIR dye derivatives designed to absorb at longer wavelengths.

THE ANALYSIS OF BIOMACROMOLECULES BY MATRIX-ASSISTED LASER DESORPTION IONIZATION (MALDI) MASS SPECTROMETRY WITH RESPECT TO FRAGMENTATION AND CHARGE STATES

GEORGE LEONARD · CHEMISTRY
Advisor(s): Mark Bier · Chemistry
Rangos 2 & 3 / Sigma Xi Group 3, 11:45am

A scanning tunnel junction (STJ) based matrix-assisted laser desorption ionization time of flight (MALDI-TOF) mass spectrometer was used to study the effects of different matrix compositions on the fragmentation and charge states of macromolecular protein complexes. The STJ cryodetector is 100% efficient at high m/z ratios and is capable of discerning the charge state of ions. Measurements were taken for multiple proteins and protein structures, showing the relationship between charge state, fragmentation and signal level for large biomacromolecules.

MATHEMATICS

BRAIN ACTIVITY OF A SEDATED CAT

MICHAEL ALBRECHT · MATHEMATICS
VINITH ANNAM · ECONOMICS AND STATISTICS
NICOLE MATTISON · ECONOMICS AND STATISTICS
Advisor(s): William Eddy · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

We are interested in determining the neural effects of an external visual stimulus on a sedated domestic cat. In this study, researchers make a cat look at a television screen with bars moving across the display, while filming the cat's brain to look for changes. However, the largest changes in the video are not caused by neural activity, but rather by the direct effects of respiration and circulation, which interfere the cat's brain activity. Our objective is to remove these extraneous effects from selected parts of the original data, so that others can study the relationship between the external visual stimulus and the "corrected" data. Our approach uses Fourier analysis to isolate and filter out the periodic effects of respiration and circulation.

DEVELOPMENT OF OSCILLATORY SIGNALS DURING MEMORY-GUIDED EYE MOVEMENTS

JOHNNY KANG · STATISTICS
WONCHEUL KIM · MATHEMATICS
SAMUEL VENTURA · MATHEMATICS
Advisor(s): William Eddy · Statistics
David Friedenberg · Statistics
Kirr Commons-1st Floor, Window side / 3-5pm

Studies of neuron activity in non-human primates can show the degree to which oscillatory signals develop while a subject is making memory-guided eye-movements (saccades). The subject's neuron activity is recorded both when nothing is happening (the control or "Base" data) and when it is making a saccade to one of eight different targets (the saccade or "Memory" data). The extent to which oscillatory signals develop during memory-guided eye-movements is seen by comparing these two data sets. The research explores this by highlighting the differences in these data for the Base and Memory data for eight different targets the primate is remembering. The project will discuss the extent of these differences and draw conclusions from them.

EARLY PANCREATIC CANCER DETECTION

JASON BLAHOVEC · MATHEMATICS
MAURA FITZGERALD · STATISTICS
MANISHA JOHARY · BUSINESS ADMINISTRATION

KEVIN KWAN · BUSINESS ADMINISTRATION
CASSANDRA STUDER · STATISTICS
Advisor(s): William Eddy · Statistics
Hoch Commons-2nd Floor, Rangos side / 3-5pm

Pancreatic cancer is a disease where abnormal cells grow in the pancreas and disrupt the growth of healthy tissue. Early detection of pancreatic cancer is extremely important as the cancer develops rapidly, spreading from the pancreas to surrounding organs and lymph nodes. This disease has the lowest survival rate of all major cancer types. Pancreatic cancer can be diagnosed by measuring the level of Cancer-Antigen 19 (CA19-9) in a patient's blood. This approach, however, is not very efficient for early detection, as CA19-9 levels are consistently detected only once the cancer has advanced to a late stage. Current research aims at analyzing several chemical levels (biomarkers) in patient blood to find a combination that gives useful information on the presence of the disease in early stages. Through our statistical analysis, we strive to develop an accurate, concise classification model that identifies specific biomarkers most useful in detecting signs of pancreatic cancer early. This test may then be added into a routine medical examination with minimal extra cost.

MEG'S AND MUSIC OF THE MIND

MICHAEL DORKO · MATHEMATICS
ROBIN LAZRUS · MATHEMATICS
CASSANDRA STUDER · STATISTICS
JUYEON YU · STATISTICS
Advisor(s): William Eddy · Statistics
Kirr Commons-1st Floor, Window side / 12-2:30

Magnetoencephalography (MEG) is an imaging technique used to measure magnetic fields caused by electric current in the brain and used to identify locations of brain activity. At the Pittsburgh MEG center, a human subject was exposed to auditory stimuli and the corresponding magnetic data was recorded. The purpose of our project is to determine if the magnetic field in the brain changed as different tones were played, in particular if the field resonated with the tone. This research has further applications including localizing sources of seizures of epileptics and other similar neurological disorders.

STATISTICAL MODELS FOR CORRECTING CCD NOISE

ROBERT CHEANEY · MATHEMATICS
DONGMIN LEE · SCIENCE AND HUMANITIES SCHOLARS
SAMANTHA MARINO · MATHEMATICS
KATHRINE SAPEGA · ECONOMICS AND STATISTICS
Advisor(s): William Eddy · Statistics
David Friedenberg · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

A charge-coupled device (CCD) is a main component of a digital camera that creates a digital image by converting light into an electrical charge. The CCD consists of a silicon dioxide layer and an array of electron potential wells. When a photon hits the silicon dioxide layer, just above an electron well, the released electrons are trapped inside the well. Each electron well is then sequentially converted and stored digitally as a pixel in the image. During this process, various effects such as dark current, inaccurate pixel values, photon noise, and sensitivities due to manufacturing processes commonly occur. These effects tend to alter the individual pixel values in the image, thus creating excess image noise. Several images of the inside of a lens cap were taken to explicitly show the current effects of an individual camera. The primary objective of this study was to estimate these effects by producing a function that can be used to correct CCD related noise in other images taken by this camera.

THE FEDERALIST PROJECT
VASUDHA CHANANA · MATHEMATICS
HEE-WON CHANG · STATISTICS
ALEXANDRA CHARNAS · MATHEMATICS
DANIEL LIM · ECONOMICS AND STATISTICS
CASSANDRA STUDER · STATISTICS
Advisor(s): William Eddy · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

The Federalist Papers are a series of articles written before the Revolutionary War, advocating the ratification of the United States. It serves as a primary source for interpretation of the Constitution. Federalist data consists of 77 papers of which the authors of 65 are known: 51 papers are written by Alexander Hamilton and 14 papers are written by James Madison. Our project is to classify the author of 12 unknown papers by examining the writing techniques of each author. We model the data through regression trees, Linear Discriminant Analysis, Principal Component Analysis, and fitted General Linear Models, using the representational effects used in each paper with 18 possible predictor variables.

PHYSICS

BUILDING A BETA GUN
BENJAMIN GREER · PHYSICS
ALEX MARAKOV · PHYSICS
Advisor(s): Reinhard Schumacher · Physics
Rangos 2 & 3 / Sigma Xi Group 4, 11:30am

It is traditionally difficult to obtain a low energy electron beam in the MeV range because most natural sources have continuous beta decay distribution. The purpose of this project is to

create a portable nearly mono-energetic beta ray(electron) spectrometer for use in nuclear and particle physics experiments. To do this, we will investigate using rare earth magnets to create a strong magnetic field in a small volume and the use of plastics to reduce gamma emissions in the beam pipe. A sodium iodide crystal will be used to determine the quality of the mono-energetic electron beam. This device will be invaluable for testing particle physics detectors by the Medium Energy Physics Group.

ENVIRONMENT MAPPING WITH A LOW-COST ROBOT COLONY
JAIME BOURNE · MECHANICAL ENGINEERING
AUSTIN BUCHAN · ELECTRICAL & COMPUTER ENGINEERING
BRIAN COLTIN · COMPUTER SCIENCE
SIYUAN FENG · COMPUTER SCIENCE
CHI-HSIU HONG · COMPUTER SCIENCE
JAMES KONG · ELECTRICAL & COMPUTER ENGINEERING
CHRISTOPHER MAR · ELECTRICAL & COMPUTER ENGINEERING
VICTOR MARMOL · COMPUTER SCIENCE
EVAN MULLINIX · ELECTRICAL & COMPUTER ENGINEERING
BRADFORD NEUMAN · COMPUTER SCIENCE
BENJAMIN POOLE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DAVID SCHULTZ · PHYSICS
JOHN SEXTON · ELECTRICAL & COMPUTER ENGINEERING
KEVIN WOO · ELECTRICAL & COMPUTER ENGINEERING
ANDREW YEAGER · COMPUTER SCIENCE
BRADLEY YOO · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s):George Kantor · Robotics Institute
Pake / Oral 3, 12:40pm

Environment mapping is the process of constructing a map with features relevant to a task without any initial knowledge of the environment. The Colony project would like to implement a mapping behavior with our low-cost colony of robots. Our goal for this research is enabling the robots to cooperatively construct a map of a simple two-dimensional environment with some coordination from a central computer. Key aspects of this research will involve making the best use of multiple, distributed, mostly autonomous agents while still gaining an accurate representation of their environment. This work is a continuation of previous Colony project research, and will serve as a foundation for future endeavors.

FERROFLUID ACTUATION IN ROBOTS
ROHAN ALETTY · ELECTRICAL & COMPUTER ENGINEERING
JOHN BRESSON · COMPUTER SCIENCE
MATTHEW FIORILLO · PHYSICS

RENTARO MATSUKATA · ELECTRICAL & COMPUTER ENGINEERING
ANDREW TAN · UNDECIDED
Advisor(s): Seth Goldstein · Computer Science
Rangos 2 & 3 / Sigma Xi Group 4, 10:30am

An actuator for a robot with no moving parts using solely ferrofluid and magnetism.

HIV-1 FUSION PEPTIDE AND ITS INTERACTIONS WITH A T-CELL MEMBRANE MODEL
CHIH YUEH CHAN · PHYSICS
Advisor(s): Stephanie Tristram-Nagle · Physics
Rangos 2 & 3 / Sigma Xi Group 4, 12pm

The exploration of the mechanism of HIV-1 viral infection is of urgency and of utmost importance. For humanity to conquer this virus, we must understand its properties and behavior. The fusion peptide (FP23) is on the N-terminus of gp41 and is known to cause the fusion of the HIV and host cell membranes, thus allowing viral infection. Specifically, I want to understand the behavior of the fusion peptide from HIV-1 and how it interacts with a model of a T-cell host membrane. The Nagle lab uses high intensity x-rays at the Cornell High Energy Synchrotron Source (CHESS) to obtain high resolution x-ray data of fully hydrated fluctuating bilayers, such as they occur in the human body. The x-ray data analysis determines both material properties, such as bilayer bending, and structure. The project will determine how the FP23 inserts into a model of the host cell membrane and how it increases bilayer bending.

HIGHLY UNIFORM MICRO-CAVITY ARRAYS IN FLEXIBLE ELASTOMER FILM
SHAUN SWANSON · PHYSICS
Advisor(s): Shelley Anna · Mechanical Engineering
Wean Commons-1st Floor, Connan side / 3-5pm

Uniform hexagonal arrays of spherical micro-cavities are created in an elastomer film in a one-step process. The cavities are the imprints of water droplets condensed from saturated vapor in a heated closed container. The saturated vapor arises from evaporation of water from a reservoir within the container. Competition between droplet growth and curing of the elastomer film determines the structure of the resulting pattern.

INVESTIGATING RELIABILITY AND ROBUSTNESS IN A LOW-COST ROBOT COLONY
JAIME BOURNE · MECHANICAL ENGINEERING
AUSTIN BUCHAN · ELECTRICAL & COMPUTER ENGINEERING
RYAN CAHOON · COMPUTER SCIENCE

BRIAN COLTIN · COMPUTER SCIENCE
EMILY HART · ELECTRICAL & COMPUTER ENGINEERING
CHI-HSIU HONG · COMPUTER SCIENCE
JAMES KONG · ELECTRICAL & COMPUTER ENGINEERING
ABRAHAM LEVKOY · ELECTRICAL & COMPUTER ENGINEERING
CHRISTOPHER MAR · ELECTRICAL & COMPUTER ENGINEERING
EVAN MULLINIX · ELECTRICAL & COMPUTER ENGINEERING
BRADFORD NEUMAN · COMPUTER SCIENCE
NICOLAS PARIS · ELECTRICAL & COMPUTER ENGINEERING
BENJAMIN POOLE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DAVID SCHULTZ · PHYSICS
JOHN SEXTON · ELECTRICAL & COMPUTER ENGINEERING
KEVIN WOO · ELECTRICAL & COMPUTER ENGINEERING
ANDREW YEAGER · COMPUTER SCIENCE
BRADLEY YOO · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): George Kantor · Robotics Institute
Rangos 2 & 3 / Sigma Xi Group 4, 10:45am

The overarching goal of the Colony project is to maintain a flexible yet inexpensive group of robots for researching emergent behavior and cooperative problem solving. To this end we have implemented several features and behaviors over the years, but rarely have we been able to operate the entire colony of robots in concert for days at a time. The two main obstacles to this goal are an inconsistency in robot I/O capabilities and the inability to recognize and recover from failure. Through research into stability and robustness we seek to better understand the capabilities of the robots by quantifying their performance and that of the Colony as a whole. Developing this benchmarking system will provide an incredibly useful tool for debugging and assessing the feasibility of future projects.

PUTTING CONSTRAINTS ON COSMOLOGICAL PARAMETERS USING SUPERNOVA DATA

REBECCA REESMAN · PHYSICS
Advisor(s):: Andrew Zentner · University of Pittsburgh
Rangos 2 & 3 / Sigma Xi Group 5, 10:15am

Supernova data can be used to put constraints on cosmological parameters. The best values are chosen by minimizing the variation in observations. The current cosmological model (Lambda-CDM) defines cosmological parameters such as ÃÂÃÂ©matter. We are also interested in the equation of state term, w, along with the nuisance variable M, the absolute magnitude.

ROTATING SPHERICAL ROBOTIC EXPLORER (ROSPROBE) DYNAMICALLY STABLE MOTION AND SENSING INSIDE RIGID SPHERICAL HOUSING

JOSHUA CAPUTO · ELECTRICAL & COMPUTER ENGINEERING
DAVID STONE · PHYSICS
Advisor(s): Metin Sitti · Mechanical Engineering
Hoch Commons-2nd Floor, Window side / 12-2:30

Through funding from SURG and SURF, the ROSPROBE concept of a robot housed inside a rigid spherical shell which causes rolling of the shell through the use of a single drive wheel has gone through several iterations. Here we present the latest iteration of the robot and discuss the results of the project thus far. The current iteration of the robot is capable of turning while in motion and has overcome major problems with the predictability of motion and the quality of shell construction. We believe ROSPROBE now provides a viable mobile robotic platform and future research aims to implement computer control to enable exploration of complex environment

ROBORCHESTRA IV

LAURA ABBOTT · COMPUTER SCIENCE
ROHAN ALETTY · ELECTRICAL & COMPUTER ENGINEERI
ANDREW BURKS · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING
MATTHEW FIORILLO · PHYSICS
JAYWOO KIM · MECHANICAL ENGINEERING
LESLEY LINNE · COMPUTER SCIENCE
RICHARD PANTALEO · MECHANICAL ENGINEERING
ERICA SANDBOTHE · COMPUTER SCIENCE
MICHAEL SANDBOTHE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING
STEFAN SULLIVAN · MUSIC
GREGORY WILLIAMS · COMPUTER SCIENCE
Advisor(s): Roger Dannenberg · Computer Science
Hoch Commons-2nd Floor, Rangos side / 3-5pm

The RobOrchestra project is dedicated to the creation of music using technology coupled with art. Now in its fourth year, RobOrchestra has created a number of robots with specific musical functions and generated meaningful ways for them to play together cooperatively. This year, RobOrchestra hopes to expand its technological outreach to other instruments as well as creating methods for humans to interact with the robots' performance. In this manner we will expose the connection between science and art by showing the mathematical complexity of music and the artistic possibilities of robotics.

TESTING A GENERIC COARSE-GRAINED MODEL FOR PROTEIN FOLDING AND AGGREGATION

DAVID STONE · PHYSICS
Advisor(s): Tristan Bereau · Physics
Markus Deserno · Physics
Rangos 2 & 3 / Sigma Xi Group 5, 10:30am

We test a computer model for folding basic protein units (e.g. beta hairpins and alpha helices). The model has an intermediate level of resolution and focuses on basic structure such as hydrogen bonds and hydrophobicity of the protein units. We write scripts to run massive simulations that fold these protein units in the computer model at different temperatures. We analyze the simulation data and look at the folding times of the units and the statistical parameters characterizing these folding times. We look for agreement of the statistical parameters we obtain with other protein folding models that have been successful in folding proteins consistent with observed molecules. It appears this coarse-grained model produces results comparable with higher resolution models.

WHITE PRINT

DANIEL LAGROTTA · INFORMATION SYSTEMS
ROBERT LEE · PHYSICS
Advisor(s): Stephen Garoff · Physics
Kirr Commons-1st Floor, Window side / 12-2:30

We want to investigate multiple materials for use in commodity-hardware printers to find a way of printing light text on dark-color substrates. We take an interdisciplinary approach to this problem, as we want to research the science behind printing and ink, as well as possible commercialization opportunities for printing light text on dark-color materials.

SCS

SCHOOL OF COMPUTER SCIENCE

COMPUTER SCIENCE

"SHARE OR NOT TO SHARE? - THE BENEFITS OF THE USE OF TABLET PC FLASH CARDS APPLICATION IN AN EDUCATIONAL SETTING"

YOUNGJOO JEONG · COMPUTER SCIENCE
Advisor(s): Ananda Gunawardena · Computer Science
McKenna / Oral 1, 12:00pm

The goal of this research is to explore the benefits of the use of the Tablet PC Flash Cards application as a possible collaborative learning tool in an educational setting. A Tablet PC is a computer that has a touch or pen-enabled screen that allows the users to write or draw on the screens instead of typing on a keyboard or using the mouse. Being able to use a digital pen as an input device is especially useful in drawing and writing math equations. Tablet PC Flash Cards application was created to enhance learning by providing an easy mechanism to create the cards and an intelligent testing algorithm to more effectively study the material. In this research, we measured how much of study material individuals cover when creating the flash cards and whether multiple students cover a wider range of materials. Also, the participants inclusion and exclusion criteria for the material were measured. The participant's teacher also created flash cards which were used as the control group. The findings of this research would let us know whether sharing the deck with others would be beneficial and it will determine how to recreate this application as a better collaborative learning tool.

A BIOLOGICALLY PLAUSIBLE, HIERARCHICAL, UNSUPERVISED NEURAL NETWORK FOR LEARNING INVARIANT REPRESENTATIONS OF VISUALLY PRESENTED OBJECTS

CARL DOERSCH · COMPUTER SCIENCE
Advisor(s): Tai-Sing Lee · Computer Science
Peter/Wright / 12-2:30

Learning to recognize objects visually is a task that comes easily to humans, even though the same object can project many different views onto the retina in the eye, and even though we are often not told explicitly when two different images depict the same object. Modern computer vision algorithms still struggle with both of these problems, and the underlying neural mechanism that allows this sort of learning is still unknown. In this research, I have explored Trace Learning, a biologically plausible algorithm for training hierarchical neural

networks. Trace Learning exploits a property of the visual world: that the identity of an object will not change for a number of milliseconds, even though the image of that object may change. Therefore, Trace Learning can be used to learn invariant representations in the object, by learning to be invariant over short time frames. Preliminary experiments have shown that Trace Learning can be used to learn representations of the letters 'A' and 'B' that do not change when the position of the letter is changed. Future work explore invariance learning with respect to more complex stimuli and deformations.

ASME DESIGN PROJECT: REMOTE CONTROLLED MARS ROVER

JOSHUA BLOSSER · MECHANICAL ENGINEERING
JAIME BOURNE · MECHANICAL ENGINEERING
ANDREW BURKS · MECHANICAL ENGINEERING
SAMANTHA CATANZARO · COMPUTER SCIENCE
JACOB COFFELT · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING
MICHAEL CUSHMAN · MECHANICAL ENGINEERING
MEGAN DORITY · MECHANICAL ENGINEERING
BRADLEY HALL · MECHANICAL ENGINEERING
ANDREW HILLENIUS · ELECTRICAL & COMPUTER ENGINEERING
MICHAEL KAHN · COMPUTER SCIENCE
PAUL KENNEDY · ELECTRICAL & COMPUTER ENGINEERING
SZU-CHIEH LU · MECHANICAL ENGINEERING
CHARLES MUNOZ · UNDECIDED
RICHARD PANTALEO · MECHANICAL ENGINEERING
WEI SHI · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING
BENJAMIN SOM-PIMPONG · MECHANICAL ENGINEERING
DAVID STONESTROM · MECHANICAL ENGINEERING
GAURAV VERMA · MECHANICAL ENGINEERING
Advisor(s): Metin Sitti · Mechanical Engineering
Rangos 2 & 3 / Sigma Xi Group 4, 10:00am

The objective of this project is to allow the design group to gain practical knowledge of the mechanical engineering design process and the dynamics of interdisciplinary teamwork. Based on research gathered over several weeks, a team assembled through the American Society of Mechanical Engineers (ASME) and the Robotics Club will develop and produce a theoretical model using a parametric modeling software package and after prototyping and testing will produce a working physical model. The team will compete in the regional ASME conference in April 2009. The purpose of this project is to develop a remote-controlled robot that will simulate tasks to be performed by future NASA rovers to both Mars and the moon. Members of the group will analyze the given problem and come up with solutions designed to maximize efficiency in order to collect and deliver the target objects in accordance with stringent

guidelines set forth by ASME. Through the course of this project, the group members will gain valuable skills needed to pursue additional mechanical design projects in the future.

ADVANCES IN BIOENGINEERING THROUGH THE USE OF COMPUTER GAMES

ALEXANDER CHIA · COMPUTER SCIENCE
Advisor(s):Adrien Treuille · Computer Science
Peter/Wright / 12-2:30

Foldit is a game which attempts to use human computation to solve problems in bioengineering. Made to be user friendly, fun, yet powerful, foldit enables users to explore the complex science of protein folding or even design new proteins and contribute to the frontiers of technology.

ANALYSIS OF UNCERTAIN DATA: SMOOTHING OF HISTOGRAMS

ANKUR SARIN · COMPUTER SCIENCE
Advisor(s): Eugene Fink · Language Technologies Inst
Peter/Wright / 12-2:30

We consider the problem of converting a set of numeric data points into a smoothed approximation of the underlying probability distribution. We describe a representation of distributions by histograms with variablewidth bars, and give a greedy smoothing algorithm based on this representation.

APATITE: ASSOCIATIVE BROWSING OF APIS

DANIEL EISENBERG · COMPUTER SCIENCE
Advisor(s): Brad Myers · Human Computer Interaction Inst.
Peter/Wright / 12-2:30

As modern software becomes increasingly complex, programming often relies on the effective usage of APIs. However, learning how to use new APIs can be difficult, in part because they are large and can be difficult to explore using existing tools. Although current object-oriented API documentation is usually organized by class, programmers frequently have a desired action or method in mind without knowing which class it might belong to. Developers often struggle to determine which of an API's many classes and methods are the important ones to pay attention to, spending considerable time looking at obscure and irrelevant parts of APIs and significantly lessening productivity. To help with these problems, we designed Apatite, an API browsing tool that lets programmers browse by association, investigating which packages, classes, and methods are commonly used together. Apatite also allows browsing by actions and properties and uses statistics from search engines to provide weighted views of the most relevant items. We used an iterative

design process to help tailor the tool to programmers' needs, and a preliminary user study suggests that it offers advantages over existing tools.

ASSISSTIVE EDUCATION FOR THE AURALLY IMPAIRED

WENNIE TABIB · COMPUTER SCIENCE
Advisor(s): Mary Bernardine Dias · Robotics Institute
Rangos Hallway, 2nd Floor / 3-5pm

The project's aim is to help the aurally impaired gain from educational opportunities using technology that focuses specifically on their needs.

AUTONOMOUS MULTI-ROBOT EXPLORATION AND COVERAGE

VICTOR MARMOL · COMPUTER SCIENCE
Advisor(s): Mary Bernardine Dias · Robotics Institute
Balajee Kannan · Robotics Institute
Class of '87 / Oral 1, 12:00pm

Autonomous exploration and coverage are a important research topics that seek to develop approaches for efficient mapping and traversal of environments. Exploration and coverage by multiple robots is not only more useful but also more difficult in some ways. This research discusses some popular approaches to autonomous exploration such as behavioral, potential field, random, and frontier exploration. It also examines a variety of approaches used today for autonomous coverage. Some of these approaches for exploration and coverage are implemented and tested using groups of robots. Through testing we were able to objectively measure the performance of the approaches against each other and against a human-led approach. A few of the tested methods exhibited excellent performance during our tests. These methods even out performed the human-led approach.

COGNITIVE AGENTS IN ADVERSARIAL DOMAINS

JEFFREY SANDER · COMPUTER SCIENCE
Advisor(s): Christian Lebiere · Psychology
Hoch Commons-2nd Floor, Window side / 12-2:30

Historically, computers are superior to humans only at games which they can make an exhaustive search of. While this methodology leads to effective players for simple and well-defined games such as Chess and Checkers, it can make little progress with more complex, strategic games where the paths to victory are not as clearly marked. Many modern video games exemplify this and often lead to developers either allowing computer agents to cheat or avoiding them entirely. Here we propose a continuation of an existing, but still largely unexplored line of research in which we dive into the cognitive processes which allow people

to quickly learn to compete in novel environments. Although for this project we will focus on one particular environment it is our hope that our results will generalize well to others.

CORRECTING FOR RESPIRATORY MOTION IN CT SCANS

BENJAMIN POOLE · COMPUTER SCIENCE
Advisor(s): Mei Chen · Unknown
Rangos Hallway, 2nd Floor / 3-5pm

Recent advances in CT technology have allowed for perfusion (blood flow) analysis of tumors over time. These tumor perfusion measurements have the potential to characterize tumor biology and aid in differential diagnosis. However, computing accurate perfusion measurements requires a constant anatomic image position, which is very difficult to achieve in a breathing patient. In order to compensate for this motion, the position of the tumor had to be identified and corrected at each time step. Segmentation of the tumor was achieved through morphological operations and active contour models. The segmented tumor was then realigned to remain in a constant location throughout the time series. Preliminary results show that this algorithm is able to segment a variety of lung tumors and properly correct for respiratory motion.

DECIDING STATEMENT IN FIRST ORDER LOGIC USING AUTOMATA IMPLEMENTED WITH BDDS

SAM TETRUASHVILI · COMPUTER SCIENCE
Advisor(s): Klaus Sutner · Computer Science
Peter/Wright / 12-2:30

We are trying to decide statements in first order logic concerning Elementary Cellular Automata using NFAs. We implement these NFA using space efficient BDDs. We hope that this will allow us to decide more statements in first order logic.

DESIGNING A SYSTEM FOR DYNAMIC DISPLAY AND EVALUATION OF CELL ACTIVITY

JINYU LIU · COMPUTER SCIENCE
Advisor(s): An An Liu · Robotics Institute
Rangos Hallway, 2nd Floor / 3-5pm

By manually labeling cell activities such as cell mitosis and cell apoptosis, we can then compare those results to detected results and perform statistical analysis, and perhaps even make underlying biological assertions. The goal of this system is to be able to display a sequence of cell images and be able to run a detection algorithm on it, while plotting a variety of data at the same time in a separate frame (such as actual (labeled) mitosis count

versus detected mitosis count). The system should also be able to parse in data files and perform statistical calculations such as mean or median, for example computing the average mitotic length of a set of cell images.

DIRECT ZERO KNOWLEDGE PROOFS

JEREMIAH BLOCKI · COMPUTER SCIENCE
Advisor(s): Manuel Blum · Computer Science
McKenna / Oral 2, 12:20pm

A Zero-Knowledge Proof is an interactive protocol which allows one party (the prover) to prove a statement (S) to another party (the verifier) without revealing anything beyond the truth of S. If S is true then the prover should always be able to convince the verifier that the statement is true without revealing anything else. If S is false then the verifier should be able to catch the prover cheating with high probability. For example, Oded Goldreich found a protocol which allowed the prover to convince a verifier that a graph G is k-colorable without revealing anything else. Consequently, all languages in NP are known to have Zero-Knowledge Proofs because they can be reduced to Graph Coloring. However, there are no known direct Zero-Knowledge Proofs for many NP-Complete languages. I present direct Zero-Knowledge Proof protocols for Subset Sum, Clique, SAT and Integer Programming.

ENHANCING OUTPATIENT EDUCATION WITH A MOBILE PATIENT INFORMATION SYSTEM

ANTHONY HUGH · COMPUTER SCIENCE
Advisor(s): Ananda Gunawardena · Computer Science
Peter/Wright / 12-2:30

When people go to the docto's office, they often have very little information as to what's wrong with them. Once the patient has begun talking to the doctor, valuable time is wasted while the doctor explains a lot of small terminology the patient doesn't understand. In some instances, this can even lead to the patient not being completely informed about what's wrong because of time constraints and/or he or she is too embarrassed to ask about things they couldn't understand. This project aims to fix this problem by educating the patient before he or she talks to the doctor. The project extends the earlier work done by an HCI undergraduate project done at CMU using the Children's Hospital of Pittsburgh Outpatient clinic. The extended system allows patients to learn about more about their disease and cures that could apply to their situation. While waiting to see the doctor, patients naturally write questions they have about their health such as symptoms or problems they're having. The system recognizes patients writing and dynamically generate relevant information.

We hope the proposed system will improve the doctor-patient interaction and will lead to better outpatient care.

ENVIRONMENT MAPPING WITH A LOW-COST ROBOT COLONY
JAIME BOURNE · MECHANICAL ENGINEERING
AUSTIN BUCHAN · ELECTRICAL & COMPUTER ENGINEERING
BRIAN COLTIN · COMPUTER SCIENCE
SIYUAN FENG · COMPUTER SCIENCE
CHI-HSIU HONG · COMPUTER SCIENCE
JAMES KONG · ELECTRICAL & COMPUTER ENGINEERING
CHRISTOPHER MAR · ELECTRICAL & COMPUTER ENGINEERING
VICTOR MARMOL · COMPUTER SCIENCE
EVAN MULLINIX · ELECTRICAL & COMPUTER ENGINEERING
BRADFORD NEUMAN · COMPUTER SCIENCE
BENJAMIN POOLE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DAVID SCHULTZ · PHYSICS
JOHN SEXTON · ELECTRICAL & COMPUTER ENGINEERING
KEVIN WOO · ELECTRICAL & COMPUTER ENGINEERING
ANDREW YEAGER · COMPUTER SCIENCE
BRADLEY YOO · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s):George Kantor · Robotics Institute
Pake / Oral 3, 12:40pm

Environment mapping is the process of constructing a map with features relevant to a task without any initial knowledge of the environment. The Colony project would like to implement a mapping behavior with our low-cost colony of robots. Our goal for this research is enabling the robots to cooperatively construct a map of a simple two-dimensional environment with some coordination from a central computer. Key aspects of this research will involve making the best use of multiple, distributed, mostly autonomous agents while still gaining an accurate representation of their environment. This work is a continuation of previous Colony project research, and will serve as a foundation for future endeavors.

FAWN: A FAST ARRAY OF WIMPY NODES
KEE TEE LAWRENCE TAN · COMPUTER SCIENCE
Advisor(s): David Andersen · Computer Science
Peter/Wright / 12-2:30

This project presents a new cluster architecture for lowpower data-intensive computing. FAWN couples low power embedded CPUs to small amounts of local flash storage, and balances computation and I/O capabilities to enable efficient, massively parallel access to data. The key contributions of this paper are the principles of the FAWN architecture and the design and implementation of FAWN-KV-a consistent, replicated, highly available, and high-performance key-value storage system built on a FAWN prototype. Our design centers around purely log-structured datastores that provide the basis for high performance on flash storage, as

well as for replication and consistency obtained using chain replication on a consistent hashing ring. Our evaluation demonstrates that FAWN clusters can handle roughly 400 key-value queries per joule of energy - two orders of magnitude more than a disk-based system.

FAST FOOD RECOGNITION THROUGH COMPUTER VISION

ANLU WANG · COMPUTER SCIENCE
Advisor(s): Mei Chen · Unknown
Rangos Hallway, 2nd Floor / 3-5pm

We wanted to apply techniques of computer vision to recognition of food. This has many different applications in the world, such as being able to get nutritional information of a food item just by taking a picture of it, or automatic tracking of consumed items. We decided to start my tackling a smaller subset of foods. My portion of the project involved creating a database and interface to help access the data.

FERROFLUID ACTUATION IN ROBOTS

ROHAN ALETTY · ELECTRICAL & COMPUTER ENGINEERING
JOHN BRESSON · COMPUTER SCIENCE
MATTHEW FIORILLO · PHYSICS
RENTARO MATSUKATA · ELECTRICAL & COMPUTER ENGINEERING
ANDREW TAN · UNDECIDED
Advisor(s): Seth Goldstein · Computer Science
Rangos 2 & 3 / Sigma Xi Group 4, 10:30am

An actuator for a robot with no moving parts using solely ferrofluid and magnetism.

FINE-GRAINED CONTROL OF FLUID MOTIFS

ALFRED BARNAT · COMPUTER SCIENCE
Advisor(s): Nancy Pollard · Robotics Institute
Kirr Commons-1st Floor, Window side / 12-2:30

Our goal is to allow an animator to control the small-scale behavior of a simulated incompressible fluid. Traditionally, the options available have been to either allow the fluid simulation to run freely or to define a full keyframe for a simulated fluid to conform to. Instead, we would like to allow n animator to provide a small-scale motif to the simulator, resulting in a stylized fluid which behaves as the animator desires without modifying the parameters of the simulation itself. Ideally, we would like to develop a model which can be applied simultaneously with traditional keyframe animation in order to obtain a simulation which can conform to an animators vision on both a large and small scale.

FOLDIT GAME DESIGN

MING YAO · COMPUTER SCIENCE
Advisor(s): Adrien Treuille · Computer Science
Peter/Wright / 12-2:30

Foldit is a science game which lets players help biochemists by folding proteins. This game presents the unfolded proteins in the form of puzzles, utilizes human's intuition on 3d shape solving to tackle the problem much faster than computers. This project focuses on the design and implement the interface and interaction of this game.

GPU-BASED OPTIMIZATIONS FOR IMAGE RETARGETING

PHILIPPE AJOUX· COMPUTER SCIENCE
JACKSON DAVIS · COMPUTER SCIENCE
Advisor(s): Alexei Efros · Computer Science
Wean Commons-1st Floor, Connan side / 12-2:30

Recently, much research has been focused on the newly-realized computing power of GPUs. Due to the highly parallel work of graphics generation, GPUs are well suited for high-performance parallel computing, especially jobs involving significant amount of mathematics. We intend to study various ways of optimizing a port of the Seam Carving Image Retargeting algorithm to CUDA, a language for GPU programming. This project, when completed, will provide insight not only into the application and analysis of similar CUDA-based projects, but also into the feasibility of potential applications which would be written to take advantage of our found optimizations.

GUI TOOLS FOR ROBOT VISION

JEPHTHAH LIDDIE · COMPUTER SCIENCE
Advisor(s):David Touretzky · Computer Science
Rangos Hallway, 2nd Floor / 3-5pm

By building upon code previously written by Xinghao Pan, this project aims to make object recognition through the use of a camera by robots and accessible and easy to use. The accuracy of the program in various situations has also been evaluated, for successful integration into robot systems.

INK-BASED COLLABORATIVE NETWORK FOR SMALL GROUP INTERACTIONS

MIN GYEW KIM · COMPUTER SCIENCE
Advisor(s): Ananda Gunawardena · Computer Science
Peter/Wright / 12-2:30

Collaborative Drawing application for tablet PC was developed as part of the pen-based computing class. The application allows a small group of users to collaborate by sharing a canvas. All users make ink strokes on the same canvas, have the authority to change others strokes as they would on a shared piece of paper.

INVESTIGATING RELIABILITY AND ROBUSTNESS IN A LOW-COST ROBOT COLONY

JAIME BOURNE · MECHANICAL ENGINEERING
AUSTIN BUCHAN · ELECTRICAL & COMPUTER ENGINEERING
RYAN CAHOON · COMPUTER SCIENCE
BRIAN COLTIN · COMPUTER SCIENCE
EMILY HART · ELECTRICAL & COMPUTER ENGINEERING
CHI-HSIU HONG · COMPUTER SCIENCE
JAMES KONG · ELECTRICAL & COMPUTER ENGINEERING
ABRAHAM LEVKOY · ELECTRICAL & COMPUTER ENGINEERING
CHRISTOPHER MAR · ELECTRICAL & COMPUTER ENGINEERING
EVAN MULLINIX · ELECTRICAL & COMPUTER ENGINEERING
BRADFORD NEUMAN · COMPUTER SCIENCE
NICOLAS PARIS · ELECTRICAL & COMPUTER ENGINEERING
BENJAMIN POOLE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DAVID SCHULTZ · PHYSICS
JOHN SEXTON · ELECTRICAL & COMPUTER ENGINEERING
KEVIN WOO · ELECTRICAL & COMPUTER ENGINEERING
ANDREW YEAGER · COMPUTER SCIENCE
BRADLEY YOO · ELECTRICAL & COMPUTER ENGINEERING
Advisor(s): George Kantor · Robotics Institute
Rangos 2 & 3 / Sigma Xi Group 4, 10:45am

The overarching goal of the Colony project is to maintain a flexible yet inexpensive group of robots for researching emergent behavior and cooperative problem solving. To this end we have implemented several features and behaviors over the years, but rarely have we been able to operate the entire colony of robots in concert for days at a time. The two main obstacles to this goal are an inconsistency in robot I/O capabilities and the inability to recognize and recover from failure. Through research into stability and robustness we seek to better understand the capabilities of the robots by quantifying their performance and that of the Colony as a whole. Developing this benchmarking system will provide an incredibly useful tool for debugging and assessing the feasibility of future projects.

INVESTIGATION OF THE ORDERINGS OF THE "HALLMARKS OF CANCER"

DEEPA SATHAYE · COMPUTER SCIENCE
Advisor(s): Christopher Langmead · Computer Science
Peter/Wright / 12-2:30

The purpose of this research is to determine the relationships between various cancer markers described by "The Hallmarks of Cancer" by Hanahan and Weinberg. This paper simplifies the progression of cancer to a limited number of traits. These individual markers are seen as key traits necessary for triggering the onset of malignant growths. The markers are defying normal mitosis, ignoring growth-inhibition signals, escaping dependence on external growth stimulation, causing extra vascularization, becoming mobile and invasive, and disabling the safety mechanisms that normally detect mutation and trigger apoptosis. A cancer simulation tool, CancerSim, is utilized by providing simulated time occurrences of each marker within body of cells. The output from the model simulation provided data to test relationships among individual markers. From these relationships gathered and their time occurrences, new information about early-onset and late-onset cancers may be gathered. In addition, changing some of the initial parameters, such as mutation rates and telomere lengths, may lead to differences in the relationships among the markers. From the relationships, it may be possible to understand how the order of development of the markers affect a malignant tumor progression.

LANGUISHING OLD LANGUAGES: C, ATTRIBUTES AND TYPE SYSTEMS (LOLCATS)

ROBERT ARNOLD · COMPUTER SCIENCE
JACOB POTTER · COMPUTER SCIENCE
Advisor(s):Frank Pfenning · Computer Science
Peter/Wright / 12-2:30

Statically typed languages provide some guarantee of well-formed programs' correctness. Many statically typed languages such as SML and C# provide high level features and abstractions which are often not found in systems languages like C which are weakly typed. We incrementally introduce some of these higher level language features and stronger typing without also introducing any runtime performance overhead or decreasing the power of systems languages for common usage scenarios.

LEARNING ABOUT RELATED TASKS WITH HIERARCHICAL MODELS

ANDREW MAAS · COMPUTER SCIENCE
Advisor(s): James Bagnell · Robotics Institute
McKenna / Oral 3, 12:40pm

One of the hallmarks of human learning is the ability to apply knowledge learned in previous situations to novel scenarios. In contrast, many machine learning algorithms are

explicitly designed to train and test on a single, unchanging distribution of examples. My work is aimed at better understanding how we can extend machine learning algorithms as to enhance their ability to use knowledge from previous experience in novel situations. My project explores two domains where the ability to leverage knowledge learned in previous situations enables performance improvements and new capabilities within a task domain. First, I explore the domain of learning real-world concepts with Bayesian networks. Second, I focus on the domain of signal classification, specifically for detecting seizure events in EEG data recorded from patients with epilepsy. In both of these domains, my approach relies on storing knowledge in a hierarchy with multiple levels of abstraction.

LOCAL MOTIF CONTROL OF FLUIDS

ZEYANG LI · COMPUTER SCIENCE
Advisor(s): Nancy Pollard · Robotics Institute
Rangos 2 & 3 / Sigma Xi Group 5, 11:00am

Current fluid simulation technique in computer graphics offers only macro scale control such as keyframing. This project explores a technique that will allow the user to control fluids using small scale patterns. These patterns will automatically emerge as the fluid evolves.

LUNCH PARTNER

JASON LEE · COMPUTER SCIENCE
Advisor(s): Mark Stehlik · Computer Science
Peter/Wright / 12-2:30

While there have been many recent innovations and developments in various areas of technology, two of the most significant today are social networking and mobile devices. Using the Internet as a medium, social networking has brought people from all over the world much closer to each other. Mobile devices such as smartphones, with increasingly powerful capabilities, are providing easy access to the Web and much more directly into the userÃ¢ÂÂs hand. In light of such advancements in mobile devices, numerous efforts to integrate the benefits of social networking into the mobile environment are in progress. This project is one of those efforts. Lunch Partner is an application that allows users to find someone to have lunch with. It uses the userÃ¢ÂÂs own profile data and looks for another user in the area with a profile that matches a set of criteria specified by the user. If both usersÃ¢ÂÂ profiles satisfy each otherÃ¢ÂÂs target profiles, V-cards are exchanged and the users can meet. Users can specify whether they want to find complete strangers or people within their social network, i.e. a friend of a friend. Due to the nature of wireless transmission and the information exchanged between users, there are numerous security and privacy issues that need to be considered for the application. There are various cryptographic algorithms that can be applied, but their complexity is such that it is not feasible to implement them within the period of four months. Such issues remain for further research.

MILLEE: MOBILE AND IMMERSIVE LEARNING FOR LITERACY IN EMERGING ECONOMIES

MANOJ DAYARAM · COMPUTER SCIENCE
Advisor(s): Matthew Kam · Human Computer Interaction Inst.
Peter/Wright / 12-2:30

The MILLEE project targets the importance of second language acquisition in the developing world by using cellphones to make education accessible. Starting its sixth year, the project aims to expand its semester long pilot study in India to a full academic year by targeting the whole Class V syllabus. My project involves aiding in this expansion by providing an informal cost syllabus for programming low cost cell phones, looking how to program low cost cellphones efficiently, and creating a game curriculum for prototype development.

MACHINE LEARNING FOR MOBILE DEVICE LOCATION SERVICES

NIKHIL THIRUVENGADAM · COMPUTER SCIENCE
Advisor(s): Charlie Garrod · Computer Science
Peter/Wright / 12-2:30

Current technologies to monitor transit infrastructure are expensive and require a large initial investment. Location-aware mobile devices, however, are increasingly ubiquitous and provide an opportunity to monitor existing transportation systems cheaply without deploying new static infrastructure. A key challenge is to reduce the power consumption of a mobile device's location services while monitoring transit systems. In this project we use mobile phones to monitor the Pittsburgh Port Authority bus network. We combine data from multiple on-phone sensors (GPS, cell-tower triangulation, wireless network detection, and an accelerometer) and use machine learning to help monitor the mobile phone's location as it moves within the bus network. We expect that our use of non-traditional sensor data will allow us to accurately determine the phone's location in this constrained environment, while reducing power consumption compared to existing phone location services.

MODEL CHECKING CELLULAR AUTOMATA

JOSEPH GERSHENSON · COMPUTER SCIENCE
Advisor(s): Klaus Sutner · Computer Science
McKenna / Oral 4, 1:00pm

Simple aspects of the evolution of one-dimensional cellular automata can be captured by the first-order theory of phasespace, which uses one-step evolution as its main predicate. Formulas in this logic can thus be used to express statements such as "there exists a 3-cycle" or properties of the global map such as surjectivity. Since this theory has been shown to be decidable by using two-way infinite B-chi automata, it is possible to evaluate these formulas by manipulating the B-chi automata. The goal of this research is to build a system which can evaluate these statements, and to report on the results as well as the tractability of larger problems.

NEIGHBORHOOD AWARE NETWORKING

JAMES MOFFATT · COMPUTER SCIENCE
Advisor(s): Tim Hoffman · Computer Science
Rangos Hallway, 2nd Floor / 3-5pm

Peer-to-Peer downloads are common these days and perform well for standard file transfers. When naively applied to video-on-demand, p2p performs significantly worse. Other researchers have developed methods which have calculated improvements in this application. The purpose of this research was to develop software which would allow these improvements to be visualized by playing back a movie in time specified by the p2p VoD trace file.

NEIGHBORHOOD AWARE NETWORKING - A NEIGHBORHOOD-WIDE MEDIA CENTER

RAM RAGHUNATHAN · COMPUTER SCIENCE
Advisor(s): Tim Hoffman · Computer Science
Mike Kaminsky · Computer Science
Konstantina Papagiannaki · Computer Science
Rangos Hallway, 2nd Floor / 3-5pm

In this project, I try to find a method to harness the personal wireless networks present in a neighborhood to produce a fast and robust content delivery system, in this case a neighborhood-wide media center. To do this, I worked together with Intel Research Pittsburgh to design and implement a media center in a lab setting. The implementation's performance was then analyzed in different situation.

PERSPECTIVES SSL AUTHENTICATION

ETHAN JACKSON · COMPUTER SCIENCE
Advisor(s): David Andersen · Computer Science
Peter/Wright / 12-2:30

Perspectives is a new approach to help clients securely identify Internet servers in order to avoid "man-in-the-middle" attacks. Perspectives is simple and cheap compared to existing approaches because it automatically builds a robust database of network identities using lightweight network probing by "network notaries" located in multiple vantage points across the Internet.

POLICY-BASED AFS PERMISSIONS

ANTON BACHIN · COMPUTER SCIENCE
Advisor(s): Frank Pfenning · Computer Science
Peter/Wright / 12-2:30

An authorization logic allows AFS permissions to be inferred from a formally stated policy. A policy may contain rules such as "if k is an instructor for course c during semester S, and d is a directory for course c, then k has full permissions for directory d during semester S." Policies of this form are translated to regular AFS permissions by an interpreter that attempts to infer all current facts about permissions. Permissions are then justified by their proofs, which record the reasoning by which permissions are granted.

POWER ALLOCATION IN SERVER FARMS

JUSTIN HURLEY · COMPUTER SCIENCE
Advisor(s): Anshul Gandhi · Computer Science
Peter/Wright / 12-2:30

In the U.S. alone, server farms consume $4.5 billion of electricity. Research at Carnegie Mellon has focused on allocating power to homogeneous servers. This has yielded that "it is not always optimal to run servers at their maximum power levels," and has provided a model for power allocation. These results are extended to heterogeneous server farms by adapting a developed queueing theoretic model and verifying through experimentation.

QUANTITATIVE ANALYSIS AND GRAPHICAL REPRESENTATION OF CELL BEHAVIORS

S KANG · COMPUTER SCIENCE
Advisor(s): Mei Chen · Unknown
Tim Hoffman · Computer Science
Rangos Hallway, 2nd Floor / 3-5pm

Automated tracking of individual cells in populations provide fine-grained measurements of cell behaviors. These include migration (translocation), mitosis (division), apoptosis (death), and shape deformation of individual cells, as well as interaction and lineage (mother-daughter relations) between cells. Automated cell tracking programs generate low-level raw data that are unintuitive for human interpretation. In this project, we will develop automated methods to extract statistical data regarding cell behaviors from machine generated low-level data, and present them in a human-readable format with intuitive visual representation. We will implement our methods using MATLAB and, with graphs, outline the statistical association between time and several important properties of stem cell populations, including the number of cells, confluence, migration speed, and mitotic fraction.

ROBORCHESTRA IV

LAURA ABBOTT · COMPUTER SCIENCE
ROHAN ALETTY · ELECTRICAL & COMPUTER ENGINEERI
ANDREW BURKS · MECHANICAL ENGINEERING
KATHERINE COSTE · MATERIALS SCIENCE ENGINEERING

MATTHEW FIORILLO · PHYSICS
JAYWOO KIM · MECHANICAL ENGINEERING
LESLEY LINNE · COMPUTER SCIENCE
RICHARD PANTALEO · MECHANICAL ENGINEERING
ERICA SANDBOTHE · COMPUTER SCIENCE
MICHAEL SANDBOTHE · COMPUTER SCIENCE
JUSTIN SCHEINER · ELECTRICAL & COMPUTER ENGINEERING
DANIEL SHOPE · MECHANICAL ENGINEERING
STEFAN SULLIVAN · MUSIC
GREGORY WILLIAMS · COMPUTER SCIENCE
Advisor(s): Roger Dannenberg · Computer Science
Hoch Commons-2nd Floor, Rangos side / 3-5pm

The RobOrchestra project is dedicated to the creation of music using technology coupled with art. Now in its fourth year, RobOrchestra has created a number of robots with specific musical functions and generated meaningful ways for them to play together cooperatively. This year, RobOrchestra hopes to expand its technological outreach to other instruments as well as creating methods for humans to interact with the robots' performance. In this manner we will expose the connection between science and art by showing the mathematical complexity of music and the artistic possibilities of robotics.

ROBUST LOCALIZATION IN CLUTTERED INDOOR ENVIRONMENTS
TUDOR ACHIM · COMPUTER SCIENCE
Advisor(s): Siddhartha Srinivasa · Robotics Institute
Peter/Wright / 12-2:30

Compared to localization techniques that use no a priori knowledge of the environment a robot navigates in, landmark based localization guarantees accurate estimates, so long as the triangulation algorithm is provided with good data about the landmarks a robot sees. This project explores the use of known reflectors in a scene to calculate the robot's position, and attempts to overcome its sensing limitations by constantly updating and querying a map of predicted reflector locations.

SALON: ONLINE DOCUMENT ANNOTATION
AARON TAN · COMPUTER SCIENCE
Advisor(s): Ananda Gunawardena · Computer Science
Peter/Wright / 12-2:30

How do we effectively facilitate discussion in groups on a single document online? Salon is the answer. Salon is an online document annotation system meant for identifying hotspots in a document and encouraging collaboration amongst people reading the same document. The main purpose of this independent study would be to perfect the existing Salon annotation

system and study its effectiveness. There are two fronts in the study of the effectiveness of this system; (1) the usability of the salon program for the purpose of annotating an online document and (2) the presentation of the visual aggregation of information in a visually valuable format.

SWAP CONFLICT RESOLUTION IN THE NACL AUTOMATON

NICHOLAS BUROOJY · COMPUTER SCIENCE
Advisor(s): Edward Fredkin · Robotics Institute
Kirr Commons-1st Floor, Window side / 3-5pm

NaCl is a reversible, three dimensional cellular automaton. Current computer simulations of NaCl are unnecessarily slow, use an excess of computer memory, and ignore swap conflicts. We use a octree index to eliminate most of the computation on sparse grids and thus speed up the simulation by an order of magnitude. To significantly reduce the memory usage of large sparse grids, we use a hash table to store only the interestingregions. Finally, NaCl mimics physical particles in many important ways (i.e. cpt-reversibility, conservation of motion mass and charge) but ignoring conflicting swaps does not resemble physics. Instead, we propose to make an automaton that is very similar to NaCl, but we redefine the shape of the area that can influence a swap and we become much more strict with the definitions and combinations of rules.

TASHI

MICHAEL WANG · COMPUTER SCIENCE
Advisor(s): Michael Ryan
Rangos Hallway, 2nd Floor / 3-5pm

Tashi explores the subject of cloud computing, offering open-source software to serve as a basis for developers and researchers with cloud computing needs. Cloud computing is a form of distributing computing that provides location-independent computing power and resources for users. Tashi is significant because there are currently few open cloud computing platforms that the general public is able to use. In my project, I aim to replace the existing RPC (Remote Procedure Call) protocol, Thrift, with a suitable alternative.

TECHBRIDGEWORLD - CHINESE BRAILLE TUTOR

PENGFEI LI · COMPUTER SCIENCE
Advisor(s): Mary Bernardine Dias · Robotics Institute
Rangos Hallway, 2nd Floor / 3-5pm

Researching an efficient implementation of Chinese Braille using the current Braille Tutor API and designing educational games for learning Chinese Braille

THE EFFECT OF CORRELATED SERVICE REQUIREMENTS ON RESPONSE TIME

MICHELLE BURROUGHS · COMPUTER SCIENCE
Advisor(s): Mor Harchol-Balter · Computer Science
Peter/Wright / 12-2:30

Queueing theory is commonly used to analyze expected response time in computer systems, but current results rely on the unrealistic assumption that successive service times are independent and identically distributed. In reality, jobs sizes often exhibit some temporal correlation, and we seek to understand the effect that this correlation has on expected response time. Specifically, we consider the case of an open system where successive Poisson arrivals have similar service requirements with some probability and otherwise have an independent service requirement. We study the effects of this correlation under various scheduling policies through both simulation and analytical techniques and find that correlation can cause expected response time to greatly increase. Finally, we aim to suggest good policies for reducing the effect of correlation on mean response time.

THE TENTACLE ARM: CONTROL OF A HIGH-DOF PLANAR MANIPULATOR

JONATHAN COENS · COMPUTER SCIENCE
Advisor(s): David Touretzky · Computer Science
McKenna / Oral 5 1:20pm

Effective control of a high degree-of-freedom [DOF] manipulator increases in computational complexity with the number of joints. A controller for a many-joint arm must include algorithms for an inverse kinematics solver, a path planner, and object manipulation strategies. These algorithms have been developed for a planar "tentacle" arm composed of eight Robotis Dynamixel AX-12 servos in series. The goal is to be able to manipulate objects in real time. With the algorithms in place, a variety of operations are demonstrated on objects of different sizes using an actual tentacle arm. The work will be incorporated into the Tekkotsu robot programming framework.

TOOLS FOR DESIGNING DYNAMIC BEHAVIORS

ELLIOT CUZZILLO · COMPUTER SCIENCE
Advisor(s): Chris Atkeson · Robotics Institute
Peter/Wright / 12-2:30

In robotics generally, designing new behaviors often involves a human acquiring domain knowledge about a particular robotic system, and then applying that knowledge to generate new behaviors. This presentation will most likely explore software tools for easing this process.

TOWARDS A CERTIFYING AND SAFE C COMPILER

PHILIP GIANFORTONI · COMPUTER SCIENCE
Advisor(s): Karl Crary · Computer Science
McKenna / Oral 6, 1:40pm

Although the C language is widely used in computer applications, programs written in C tend to be unsafe since they allow nearly direct memory access via pointers. This project aims to eliminate the lack of memory safety in C by inserting bounds checks when accessing objects in memory, and abstracting pointers so they may only be modified by operations that perform valid pointer arithmetic. We attempt to accomplish this goal by writing a compiler for unmodified C code that provides these safety guarantees automatically.

USING MACHINE LEARNING TO PREDICT HUMAN BRAIN ACTIVITY

MAHTIYAR BONAKDARPOUR · COMPUTER SCIENCE
Advisor(s):Tom Mitchell · Computer Science
McKenna / Oral 7, 2:00pm

Brain imaging studies are geared towards decoding the way the human brain represents conceptual knowledge. It has been shown that different spatial patterns of neural activation correspond to thinking about different semantic categories of pictures and words. This research is aimed at developing a computational model that predicts functional magnetic resonance imaging (fMRI) neural activation associated with words. The current model has been trained with a combination of data from a text corpus and fMRI data associated with viewing several dozen concrete nouns. Once trained, the model predicts fMRI activation for other nouns in the text corpus with significant accuracy (for individual subjects).

In this thesis, we aim to develop a model which can accurately predict fMRI activation across subjects and studies. Through the failure of a naive solution to this problem, we explore both the differences in brain activation from study to study (in the same subject), and the accuracy of mapping brain coordinates to a common space. We also develop new methods of searching for informative and stable voxels. We compare models for the same subject across multiple studies, and multiple subjects in the same study thereby allowing us to understand the variability in brain activation from subject to subject, and study to study.

WII WANT TO WRITE: AN ACCELEROMETER BASED GESTURE RECOGNITION SYSTEM

JEFFREY LAI · ELECTRICAL & COMPUTER ENGINEERING
TIAN SENG LEONG · ELECTRICAL & COMPUTER ENGINEERING
JEFFREY PANZA · ELECTRICAL & COMPUTER ENGINEERING
PETER PONG · COMPUTER SCIENCE
Advisor(s): Jason Hong · Human Computer Interaction Inst.
Rangos 2 & 3 / Sigma Xi Group 4, 11:00am

The popular adoption of accelerometers in entertainment and mobile communication devices allows the use of physical gestures as an additional source of input. In particular, the successful adoption of accelerometer technology in the iPhone and the Wiimote (a controller for the Nintendo Wii gaming console) reveals the untapped potential of physical gestures as an intuitive form of user input. As a result, the necessity to accurately recognize acceleration data is becoming increasingly relevant. In this paper, we present a gesture recognition algorithm that recognizes user's gestures based on input signals from a 3-axis Analog Device ADXL330 accelerometer in the Wiimote. We explored the use of Dynamic Time Warping (DTW) as a means to classify accelerometer data. In a study comparing our DTW classifier with the Hidden Markov Model (HMM) and the feature based classifier on recorded gestures, we found that our classifier obtains 94% accuracy using only one training example and over 97% accuracy using 3 or more examples. In addition, our classifier is able to obtain satisfactory recognition accuracy using training data from one user and validation data from another user. Results have also shown that the algorithm is generally unaffected by varying size and speed of the gestures. Code and data presented in this paper are available online at *http://www.wiiwant2write.com*.

WIKIPEDIA ADMINISTRATOR ANALYSIS PROJECT

DAVID BUNKER · COMPUTER SCIENCE
Advisor(s): Robert Kraut · Human Computer Interaction Inst.
Peter/Wright / 12-2:30

he purpose of this project was to use machine learning algorithms and data analysis tools to accurately predict which Wikipedia-administrator nominees will become administrators and determine what special traits these nominees have. The initial 26 million nominee revisions were stored on a Hadoop cluster as a relational database and manipulated using the programming language Pig for fast parallel data manipulation. Non-negative matrix factorization and hierarchical clustering were used to cluster pages and nominees. Analysis based on this clustered information is useful to Wikipedia nominees and administrators as an evaluation metric.

SCIENCE & HUMANITIES

SCIENCE AND HUMANITIES SCHOLARS

SCIENCE AND HUMANITIES SCHOLARS

CONFLICT MONITORING VERSUS UNCERTAINTY REDUCTION IN THE MEDIAL FRONTAL CORTEX

JUDITH SAVITSKAYA · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Dr. Jack Grinband
Rangos 2 & 3 / Sigma Xi Group 5, 10:00am

The dorsal medial frontal cortex (MFC), including the anterior cingulate cortex (ACC), is central to behavioral models of decision making4. Because a broad range of perceptual and emotional processing results in the conscious selection of actions, the MFC is central to most theories of cognitive function. Two theoretical frameworks have been proposed to explain the functional role of MFC activity in choice: detection of internal response conflict1-3 or accumulation of evidence to reduce decision uncertainty5-7. The former assumes the existence of a neural monitoring system specialized for response conflict which updates other brain regions involved in regulating control processes. The latter assumes a domain-general mechanism, which accumulates sensory evidence until a response threshold is reached. These models make mutually incompatible predictions about the effect of conflict and error-likelihood on neural activity. Specifically, the conflict monitoring model predicts a positive relationship between MFC activity and error-likelihood, whereas the uncertainty reduction model assumes these variables are independent. Previous studies1-3 have been unable to resolve these models due to the confounding effects of response time (RT) on neural activity. We show that by controlling RT, the correlation between MFC activity and error-likelihood falls to zero, contrary to the conflict monitoring model. In contrast, the MFC showed a monotonically increasing relationship with RT, consistent with the time-dependent accumulation of sensory evidence within the MFC.

DISCOVERING PARTIALLY ORDERED KNOWLEDGE STRUCTURES FROM STUDENT TEST DATA

EILEEN TUCKER · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Brian Junker · Statistics
Hoch Commons-2nd Floor, Window side / 12-2:30

Test questions and other cognitive tasks can be arranged in a partial ordering according to prerequisites. These relationships can be discovered from student test data using methods similar to cluster analysis. This project evaluates an algorithm to construct partially ordered knowledge structures using student test data simulated from two cognitive assessment models: DINA and NIDA. The success of each model in creating a partially ordered knowledge structure is examined at various parameter values. These partially ordered knowledge structures can be used to assign skills to test items.

EXAMINING PERSEVERATION IN THREE-YEAR-OLDS USING THE GO/NO-GO TASK

LAUREN BURAKOWSKI · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Anna Fisher · Psychology
Dowd / Oral 4, 1:00pm

Perseveration, or responding in a previously relevant way that is no longer appropriate, has been traditionally studied in the context of the Dimensional Change Card Sort task (Zelazo, 2006). This study uses a modified version of the go/no-go task to examine perseveration. The task controls for spatial location of the test cards and perceptual conflict of the display. Two versions of the task were created: one required dimensional switching and the other required response switching. Children were found to perseverate in the dimensional switch condition but not in the response switch condition. These findings are discussed with respect to existing theories of perseveration.

FILLING IN THE GAPS: CREATING AN ONLINE TUTOR FOR FRACTIONS

NICOLE HALLINEN · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Robert Siegler · Psychology
Hoch Commons-2nd Floor, Rangos side / 3-5pm

An online tutor was developed to help children better understand fractions. Magnitude representations, specifically numberline estimation practice questions, were highlighted in this tutor to emphasize the relationships between fractions and whole numbers. A study in which the type of fractions presented and practiced is manipulated between subjects is proposed to explore the relationship between fraction instruction and transfer to other fraction estimation contexts. It is hypothesized that presenting mixed numbers (fractions greater than one) will elicit better transfer to other types of fractions than presenting proper fractions (fractions less than one).

I 'WAS PLAYING' WHEN I 'LEARNED': DEVELOPING AND EVALUATING A NARRATIVE GAME FOR LEARNING FRENCH ASPECTUAL DISTINCTIONS

NICOLE HALLINEN · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Christopher Jones · Modern Languages
Rangos 2 & 3 / Sigma Xi Group 6, 11:15am
Dowd / Oral 9, 3:20pm

Two online learning environments were developed to instruct French learners about the distinctions between the pass compos and imparfait past tenses: a narrative game in which players edit articles at a virtual journalism office and an exercise-based tutor. Elementary and Intermediate French learners participated in a study in which learning gains and motivational responses to each instructional environment were assessed to explore the possibility of effectively using narrative games in language education. This poster and oral presentation will describe the creation and evaluation of these online learning programs.

IMPROVEMENT OF PNA-DNA HYBRIDIZATION UNDER PHYSIOLOGICAL CONDITIONS

ASHLEY KILP · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Danith Ly · Chemistry
Hoch Commons-2nd Floor, Rangos side / 12-2:30

Peptide nucleic acid (PNA) is a synthetic mimic of natural nucleic acids, i.e. DNA and RNA. It has promising functionality as an agent in various medical applications, including treatment of genetic diseases. It is particularly suited for "antisense" applications, in which genetic expression is modified by the binding of molecules to DNA or RNA. While PNA's sequence-specific binding, longevity in cells, and relatively fast and inexpensive synthesis make it a good choice, it still has difficulty in binding to mixed-sequence B-DNA in a sequence specific manner at physiologically relevant salt concentrations. My research will work to overcome those limitations, so that PNA technology may then be used to develop treatments that can be effectively used in the human body, and fight those genetic diseases for which current medicine can do little.

ISOLATION AND PURIFICATION OF MG1.5 SINGLE CHAIN VARIABLE FRAGMENT FOR STRUCTURAL DETERMINATION BY NUCLEAR MAGNETIC RESONANCE (NMR) SPECTROSCOPY

SAMUEL KIM · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Peter Berget · Biological Sciences
Gordon Rule · Biological Sciences
Hoch Commons-2nd Floor, Rangos side / 12-2:30

The MG1.5 single chain variable fragment (scFv) is a biosensor platform called a Fluorogen Activating Protein (FAP). This protein binds to the fluorogenic dye, malachite green causing it

to fluoresce. By determining the protein-dye structural interactions, we can modify the platform with new amino acid substitutions for increased specificity, sensitivity, and detection capabilities.

To determine the structure using NMR spectroscopy, we need to generate a large amount of protein under conditions compatible with heavy isotope labeling. I have been using an E.coli expression system to secrete MG1.5 directly into the periplasm space. The MG1.5 is secreted with a His6-tag, allowing for purification by a Ni+2-NTA column. I generated enough 15N-labeled MG1.5 in minimal media for preliminary NMR structural data this summer; the spectrum indicated the protein is a beta sheet protein that can bind malachite green dye. The protein may also exist as a dimer, in which the two separate units of proteins are interacting with each other. My ultimate goal is to label the protein with 13Carbon in addition to 15Nitrogen because carbon labeling provides more definitive structural information. The NMR analysis can be combined with future x-ray crystallography data for a comprehensive structural determination of MG1.5 and any derivatives made using this platform.

PHASE FIELD MODEL OF TRIPLE POINT JUNCTIONS IN FLUID-FLUID INTERFACES

CHRISTOPHER ELDRED · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Robert Sekerka · Physics
Rangos 2 & 3 / Sigma Xi Group 5, 10:45am

Triple point junctions in fluid-fluid interfaces are analyzed using both analytic and numerical techniques. A phase field model is developed and compared to the classical solution of the triple point junctions using a vector force balance. Comparison is made to the binary-phase interface that can be computed analytically. Numerical methods are used to investigate specific behavior near the triple point.

REAL-WORLD PROCESSING OF WORD-REFERENT PAIRS IN ADULTS

LAURA CACCIAMANI · SCIENCE AND HUMANITIES SCHOLARS
Erik Thiessen · Psychology
Kirr Commons-1st Floor, Window side / 3-5pm

The process of pairing words with their referents in the real world is often ambiguous; the same word may refer to different objects, the same object may be referred to by different words, and there may just be insufficient environmental cues to assist us in the process. Thus, how is it that adults are able to go about this, particularly when the word-referent pairings are not constant? Three different experiments were completed which tested the ability of adults to pair up novel words and shapes after being exposed to a learning phase where the words referred to the correct object either 50% or 75% of the time, in order to simulate the ambiguity of real-world referents and determine to what extent that ambiguity impairs their ability to correctly match them. The results showed that although all adults were able to determine word boundaries within the stream of speech, the difference in ability between the two conditions on pairing the words with their referents was not significantly different.

STATISTICAL MODELS FOR CORRECTING CCD NOISE

ROBERT CHEANEY · MATHEMATICS
DONGMIN LEE · SCIENCE AND HUMANITIES SCHOLARS
SAMANTHA MARINO · MATHEMATICS
KATHRINE SAPEGA · ECONOMICS AND STATISTICS
Advisor(s): William Eddy · Statistics
David Friedenberg · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

A charge-coupled device (CCD) is a main component of a digital camera that creates a digital image by converting light into an electrical charge. The CCD consists of a silicon dioxide layer and an array of electron potential wells. When a photon hits the silicon dioxide layer, just above an electron well, the released electrons are trapped inside the well. Each electron well is then sequentially converted and stored digitally as a pixel in the image. During this process, various effects such as dark current, inaccurate pixel values, photon noise, and sensitivities due to manufacturing processes commonly occur. These effects tend to alter the individual pixel values in the image, thus creating excess image noise. Several images of the inside of a lens cap were taken to explicitly show the current effects of an individual camera. The primary objective of this study was to estimate these effects by producing a function that can be used to correct CCD related noise in other images taken by this camera.

SUBSTITUTED POLYFLUORENES FOR APPLICATION IN POLYMER LIGHT-EMITTING DIODES

SWATI VARSHNEY · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Richard McCullough · Chemistry
Hoch Commons-2nd Floor, Rangos side / 3-5pm

Polyfluorenes have been identified as viable light-emitting polymers for use in polymer light-emitting diodes (PLED) and ultimately printed, flexible flat-panel displays. As yet, a polymer with stable, long-lasting, and efficient white luminescence has not been found. This experiment attempts to generate such a polymer by exploring the quasi-"living" nature of a novel polymerization method developed previously by the McCullough Group (Universal Grignard Metathesis). The main goals of the experiment are to generate "living" conditions for fluorene homopolymerization, end-cap the "living" polymers with functionalized end-groups, and create block copolymers of dioctyland diethylhexyl-substituted fluorenes by chain extension.

THE EFFECT OF ACTION ON CAUSAL PERCEPTION IN 3- AND 4 1/2-MONTH-OLD INFANTS

LAUREN KROGH · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): David Rakison · Psychology
Dowd / Oral 10, 3:40pm

Research has shown that infants understand the concept of causality beginning at the age of 6 months. However, recent studies have demonstrated that giving 4.5-month-old infants the ability to perform causal actions gives them the ability to perceive causality at this younger age. In these studies, infants performed previously impossible causal interactions by wearing red mittens covered in Velcro that attached to Velcro on green toy balls. Researchers then examined infants' ability to distinguish between causal and non-causal events involving red and green balls. I modified the experimental design by altering the color of the mittens and the color and shape of the toys infants interacted with. If infants learn about the abstract concept of causality from their action experience, the particular objects used in the action task should not constrain infants' perception of causality in the test events. I also conducted the original experiment with 3-month-olds to determine if these younger infants were also capable of understanding causality through action experience.

THE EFFECT OF CARDIOVASCULAR REACTIVITY TO AND RECOVERY FROM STRESS ON IMMUNE RESPONSE

KATHERINE FARNER · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Sheldon Cohen · Psychology
Rangos 2 & 3 / Sigma Xi Group 1, 12:00pm

From folklore and mass media to empirical research, stress has long been seen to weaken an individual's immune system, rendering them vulnerable to disease. This study asks, "How do individuals' reactions to and recovery from stressful events affect their susceptibility to disease?" It was hypothesized that individuals who display greater reactivity to a laboratory stress task and slower recovery would have poor immune function. As part of the Pittsburgh Cold Study, I have been given access to data for 153 participants measuring their cardiovascular stress reactivity and recovery and their susceptibility to disease. Stress reactivity and recovery were measured as changes in heart rate and blood pressure in response to a laboratory stress task simulating public speaking. Susceptibility to disease was examined by measuring an individual's antibody proliferation in response to the standard Hepatitis B vaccine series. The cardiovascular markers were shown to react to the laboratory stressor by increasing in a means consistent across sessions. Neither stress reactivity nor recovery was found to significantly predict antibody response to the Hepatitis B vaccine. The effect of diastolic blood pressure on second antibody response and cardiovascular recovery on third antibody response approached significance. These findings conflict with previous research thus demonstrating the complexity of the interaction between stress and disease and the difficulty in measuring and operationalizing these variables.

TRACKING MORPHOLOGY CHANGES IN THE DEVELOPING MAMMALIAN ACCESSORY OLFACTORY BULB

ROHIT RAMNATH · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Nathan Urban · Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 2, 11:15am

The Mammalian Accessory Olfactory System is involved in the detection of pheromonal odors. The pattern of connectivity in this system has important implications for how this information is processed in the brain and translated into a behavior. My project involves defining a timeline for the development of this system, and utilizing immunohistochemistry and computational modeling to understand changes occuring to individual cells and to the system as a whole.

UNDERSTANDING THE BEHAVIORAL RESPONSES CORRESPONDING WITH THE EMOTIONS OF GUILT AND SHAME

JACQUELINE STEINER · SCIENCE AND HUMANITIES SCHOLARS
Advisor(s): Carey Morewedge · Social & Decision Sciences
Hoch Commons-2nd Floor, Window side / 12-2:30

This research compares the emotions guilt and shame and determines the different behavioral responses that come from inducing these similar emotions. This research question is an interesting and important question on several levels. To begin with, shame and guilt are basic emotions felt by ordinary people; however few people can actually determine when they are experiencing either shame or guilt. Despite the fact that these emotions appear to be very similar, research has shown that guilt produces a negative feeling about an external focus, such as an action, while shame produces negative internal feelings of the self. Understanding more clearly under what circumstances one is likely to feel shame versus guilt is important when trying to determine the underlying cause for a particular behavioral pattern.

UNITED STATES CENSUS: DIRECT VERSUS SYNTHETIC DUAL SYSTEMS ESTIMATION FOR THE POST-ENUMERATION SURVEY

STEPHANIE BECHT · SCIENCE AND HUMANITIES SCHOLARS
EDDY CHIANG · ECONOMICS AND STATISTICS
DANIEL FRANK · STATISTICS
KANY KANG · ECONOMICS AND STATISTICS
CASSANDRA STUDER · STATISTICS
Advisor(s): William Eddy · Statistics
Wean Commons-1st Floor, Connan side / 3-5pm

This project is concerned with the United States census. The Census is vital because its results are used for re-appropriating seats in the House of Representatives as well as determining the amount of funding that states receive. Thus it is clear that ensuring the numbers accurately reflect those of people living in the United States is of paramount importance. Inevitably, some people will be missed in the counts. To correct this, we can utilize capture-recapture methods to improve the estimates delivered by the census. The question then becomes whether all individuals are missed equally, or whether racial, socioeconomic, and other conditions make some people more likely to be left out of the

count than others. We therefore compare two methods of estimation that differ in that one assumes all people are missed equally, and the other assumes certain types of individuals with various characteristics are more or less likely to be missed than others.

TSB

TEPPER SCHOOL OF BUSINESS

BUSINESS ADMINISTRATION

CHINESE CURRENCY POLICY AND ITS CORRELATION WITH US-TRADE DEVELOPMENT

TANG TANG WONG · BUSINESS ADMINISTRATION
Advisor(s): Evelyn Pierce · GSIA
Dowd / Oral 1, 12:00pm

During his Senate confirmation hearing on January 21st, Secretary of Treasury nominee Tim F. Geithner took a hardline on the Chinese Yuan undervaluation issue and accused the Chinese government as a "currency manipulator". When answering the Senate Finance Committee's question about possible relation between low Yuan exchange rate and mounting US current account deficit, Mr. Geithner provided a confirming response and promised that the new administration would take a stronger stance in its interactions with the Chinese government. With the global economy stepping into recession, Geithner's statement was widely seen as a dangerous move made by the Obama administration. During the recent annual meeting of World Economic Forum in Davos, Chinese Premier Wen Jiabiao bluntly criticized the U.S. for causing the financial meltdown, and he re-emphasized the Chinese policy of maintaining a "stable economic environment in the region". This study suggests that the development and transformation of the US economy has caused heavy US dependence on foreign imports, while the "artificially low" Yuan exchange rate has provided a cheaper option for the US purchases. The study's main concern is to examine the association between US-Sino trade deficit and three major factors: foreign exchange rate, economic growth, and structural change of the US economy. The foreign exchange factor is measured by the real exchange rates suggested by the theory of Purchase Power Parity. As for economic growth, US retail sales numbers are observed as a proxy indicator. Also, national employment data of major U.S. industries are used to measure the distributional change in American economy.

EARLY PANCREATIC CANCER DETECTION

JASON BLAHOVEC · MATHEMATICS
MAURA FITZGERALD · STATISTICS
MANISHA JOHARY · BUSINESS ADMINISTRATION
KEVIN KWAN · BUSINESS ADMINISTRATION
CASSANDRA STUDER · STATISTICS

Advisor(s): William Eddy · Statistics
Hoch Commons-2nd Floor, Rangos side / 3-5pm

Pancreatic cancer is a disease where abnormal cells grow in the pancreas and disrupt the growth of healthy tissue. Early detection of pancreatic cancer is extremely important as the cancer develops rapidly, spreading from the pancreas to surrounding organs and lymph nodes. This disease has the lowest survival rate of all major cancer types. Pancreatic cancer can be diagnosed by measuring the level of Cancer-Antigen 19 (CA19-9) in a patient's blood. This approach, however, is not very efficient for early detection, as CA19-9 levels are consistently detected only once the cancer has advanced to a late stage. Current research aims at analyzing several chemical levels (biomarkers) in patient blood to find a combination that gives useful information on the presence of the disease in early stages. Through our statistical analysis, we strive to develop an accurate, concise classification model that identifies specific biomarkers most useful in detecting signs of pancreatic cancer early. This test may then be added into a routine medical examination with minimal extra cost.

FRONT OFFICE EFFICIENCY IN AMERICA'S PASTIME

JUSTIN MOHNEY · BUSINESS ADMINISTRATION
Advisor(s): Evelyn Pierce · GSIA
Dowd / Oral 5 1:20pm

In the world of professional sports, front offices are occassionally applauded for building championship dynasties. More often, they are vilified for their inability to put a winning team on the field. This is especially true in Major League Baseball where small market teams operate with team salaries that are only a fraction of those of the large market teams. It has been shown by the Blue Ribbon Commission that higher payroll teams operate with a competitive advantage over teams with lesser payrolls. There is also a movement in MLB, born out of Michael Lewis' Moneyball, that proposes efficient contracts as a method for small market teams to compete. I aim to create a market based valuation model to determine the efficiency with which teams handle player contracts. This model will then be used to determine if efficient front office's yield more successful teams than less efficient front offices.

GRAPH AFRICA: A COLLABORATIVE ATTEMPT AT CREATING A HIGH-QUALITY VISUAL KNOWLEDGE REPOSITORY ABOUT AFRICA.

SUSAN LIN · SELF-DEFINED
EDWIN SHAO · BUSINESS ADMINISTRATION
Advisor(s): Edda Fields · History
Rahul Tongia · Engineering and Public Policy
Pake / Oral 7, 2:00pm

Contemporary Africa has been blessed with an incredible diversity of people interested in its past, welfare, and future. Academics, NGOs, and entrepreneurs flock to the continent because

of its rich history, intractable challenges, and most importantly, innumerable opportunities. This diversity has resulted in a large potential for collaboration and interdisciplinary work. But it has also created a set of unique communication and informational challenges that grow more complex daily, as additional people enter Africa with their own knowledge and goals. Graph Africa aims to explore how people most effectively learn about Africa, with the aim of becoming a prominent learning tool for Africanists of all backgrounds.

PROFITING FROM GREEN BUSINESS IN THE BUILT ENVIRONMENT

WALTER KING · BUSINESS ADMINISTRATION

Advisor(s): Evelyn Pierce · GSIA

Pake / Oral 9, 3:20pm

This thesis examines how businesses are or are not able to implement financially feasible energy efficiency projects. The first part of this thesis includes a general overview of how environmental issues are shaping business decisions. The second part includes a deeper analysis of energy efficiency projects and argues that they are the most beneficial way for businesses to reduce both costs and CO2 emissions. Special focus is given to the "built" environment, as the biggest reductions in CO2 can be realized in this arena.

ECONOMICS

A MODEL FOR THE CONTINUOUS-TIME VALUATION OF ALTERNATIVE ENERGY PROPOSALS IN STOCHASTIC MARKETS

JEROME COMBES-KNOKE · ECONOMICS

Advisor(s): Benoit Morel · Engineering and Public Policy

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

Energy markets are notoriously volatile and to a large extent dependent on non renewable fuels. There are numerous proposals for alternative energy and supply diversification that may help hedge against energy price volatility and increase energy supply. This paper seeks to provide a general methodology for modeling energy prices and determining the expected net present value of these proposals. In this model, markets are assumed to be efficient and arbitrage free; future energy price movements are expressed as continuous-time stochastic processes. The model developed is designed such that it can applied as a tool to help make investment decisions, guide government energy policies, and ultimately answer the question of how society will manage in a given set of parameters.

AN ECONOMETRIC ANALYSIS ON FACTORS THAT AFFECT TEENAGE PREGNANCY BASED ON 1979 NATIONAL LONGITUDINAL SURVEY OF YOUTH

ATHIP TANTIVORAWONG · ECONOMICS
Advisor(s): Stephen Spear · Economics
Pake / Oral 2, 12:20pm

Teenage pregnancy in the United States presents complex problems that affect the lives of the teenage parents themselves, their children, as well as the government. The problem such as low education attainment rate for adolescent parents is an important example. Without gaining sufficient education, the adolescent parents end up working in less prestigious jobs and earning lower salary then their peers. Moreover, this problem incurs cost to the government and society as well since these adolescent teens usually turn to the government for support through social welfare benefits. This is an important issue as well since the government has to spend billions of dollars per year on these adolescents instead of using that amount of money to spend on goals such as improving the education or health care system. In order for the policymakers to effectively solve the problem of teenage pregnancy, the factors that affect this problem must be determined first. Once they are identified, the policymakers can come up with appropriate policies that would specifically influence these factors in a way that reduces the rate of teenage pregnancy.

CONSIDERATIONS FOR AN NFL ROOKIE PAY SCALE

DAVID MIRSKY · ECONOMICS
Advisor(s): George-Levi Gayle · Economics
Hoch Commons-2nd Floor, Rangos side / 12-2:30

As it stands now, high first-round draft picks receive (what some consider) unjustifiably high compensation considering they've never actually played a game in the NFL. The teams that have those high draft picks are supposed to be able to build for the future. However, the cost of choosing a player that high is so astronomical (the guaranteed money is such that, even if the player never actually plays, he is set for life) if a team makes a subpar pick, they can ruin their salary cap situation for years to come. Further, the tightened salary cap makes it harder to sign veteran free agents, which, in turn, makes it harder to stay competitive in the league. The fewer competitive teams in the league, the less entertaining the games become. Lagging entertainment value leads to decreased demand, which leads to decreased revenue.

My goal is to use the aforementioned areas of economics to design a "pay scale" that would set a new standard for signing high first round draft picks. Thus, the risk associated with the pick would be mitigated, and balance would be restored to the system. This is a very pressing issue because the current Collective Bargaining Agreement between Players and Owners is set to expire after the 2009 season, setting up an uncapped year in 2010 (in which both teams and contracts would be wildly unpredictable), and a potential work-stoppage in 2011. A fair, effective rookie pay scale would do much to address the problems with the current CBA, and

bring both the Players and Owners one step closer to successfully negotiating a new CBA so a work-stoppage can be avoided.

DO SPECIAL AND CHARTER SCHOOLS HELP ACHIEVEMENT IN REGULAR PUBLIC SCHOOLS?

ANDRE TARTAR · ECONOMICS
Advisor(s): Maria Ferreyra · Economics
Class of '87 / Oral 2, 12:20pm

Looking at the 250 largest school districts in the county, this Senior Economics Honors Thesis project will study the effects of special schools, such as charter schools and special education schools, on achievement in regular public schools. One theory of education claims that schools need to be more targeted to students' needs. Therefore, minority and low-income students, students already facing a cognitive and achievement gap early in their education, will require targeted and more rigorous schools than other students. Students who fall under the Disabilities Education Act need tailored attention, in special education schools for example. By studying the relationship between the opening and operation of these kinds of schools with achievement in regular public schools and more generally, this project will put that theory to the test. Additionally, given the richness of the data being mined, compiled from the National Center for Education Statistics' Common Core of Data, secondary findings may emerge that will warrant discussion in this presentation.

CLASSES & SPECIAL GROUPS

PROJECT DEMONSTRATIONS FOR PROTOTYPING

Instructor: Susan Finger
Connan
12:30-3:30 p.m.

The teams of students in Rapid Prototype Design (39-245) have designed, prototyped and tested activities to engage middle school girls in learning about engineering. The project focus on understanding how energy is transformed from one form to another. Some of the activities created by the students will be used during the Summer Engineering Experience for girls (SEE) sponsored by Institute for Complex Engineered Systems at CMU.

BALLOON POWERED CARS

TANVI BUBNA • MECHANICAL ENGINEERING
KYLE GEE • MECHANICAL ENGINEERING
JONATHAN HERNANDEZ • CIVIL AND ENVIRONMENTAL ENGINEERING
SARAH PFEFFER • MATERIALS SCIENCE ENGINEERING
KONSTANTIN VIDENSKY • MECHANICAL ENGINEERING

In our activity, children will build a balloon powered car and learn that energy that is stored can be transformed into kinetic energy. We will demonstrate a pre-made balloon powered car and encourage the children to hypothesize why the car moves. After the children observe that it is the air moving out of the straw that causes the car to move, we will explain the concepts of conservation of energy, Newton's third law (equal and opposite forces), and conservation of momentum to help the children understand the physical principles behind the motion of the car. We will then show the children how the cars are made, and assist them in the construction of their own cars. When each child has built a car, he or she will test Newton's third Law by varying the amount they inflate their balloon, causing the car to travel varying distances.

BOTTLE ROCKETS
RAY BARSA · MECHANICAL ENGINEERING
JOSEPH SEYMOUR · MECHANICAL ENGINEERING
SAMANTHA SHROPSHIRE · MECHANICAL ENGINEERING

Children will learn about concepts of exit pressures with respect to nozzle diameters in our rocket activity. The children will place Mentos into bottles of soda, which will react to make the gases that power the rockets. The experiment will be repeated with holes of different diameters in the bottle caps, so that they can see the effect that the nozzle diameter has on the velocity of the stream exiting the bottle. We will also have an interactive demonstration to explain the physical reasons behind the soda and Mentos eruption.

CRANK THAT
JACOB BEATTY · ICES
MANA HESHMATI · ICES
FEDERICO RIOS · DESIGN

Through the application of a mechanism that demonstrates the process of transforming rotational energy into linear energy, young students will learn about mechanical advantage. This mechanism includes a crank and gear system. When the crank is turned, the gear will lift a rack which holds a weight. The weight is too heavy to be lifted by hand, but when using the mechanism, students will realize that it is easy to overcome the forces of gravity. This project teaches the importance of mechanical advantage, and how through turning a set of gears that are attached to a rack, rotational energy can be transferred into linear motion.

ELECTROLYTE CARS
GWENDOLYN BARR · MECHANICAL ENGINEERING
BENJAMIN MATZKE · MECHANICAL ENGINEERING
FRANCISCO SANTIAGO · MECHANICAL ENGINEERING

In this activity, the children will learn how varying fluids allow electricity to flow through interaction with mini-electrolyte cars. The wires that provide power to the car will be routed through a small container of liquid. This liquid completes the circuit and, based on its electric conductivity, the car will move faster or slower. This fun and engaging activity will illustrate transformation of energy from elastic to kinetic states and at the same time help children understand how electricity flows through fluids.

EXPERIMENTING WITH HEAT CONDUCTION
MICHAEL FOX · MECHANICAL ENGINEERING
DANIEL SAWL · SOCIAL & DECISION SCIENCES

JACOB SIBILSKI · MECHANICAL ENGINEERING
GAURAV VERMA · MECHANICAL ENGINEERING

The purpose of our project is to engage students in learning about the transfer of thermal energy. Children will be able to perform experiments on how different materials conduct heat. The children will learn why certain materials are used to conduct heat and why others are used as insulators. They will achieve this by designing walls made of different materials, with one side touching a heat source and the other touching a thermometer. The students will observe how various materials enhance or inhibit heat conduction by observing the differences in temperature. The children will be able to see how heat, like electricity, can flow through objects, and how material affects heat flow.

HUMAN POWERED GENERATORS

ADAM KNOWLTON · ICES
JUSTIN PRATT · ICES
JUSTIN WHALEY • MECHANICAL ENGINEERING

Our project will show children the transformation form mechanical to electrical energy. Area students will use simple DC generators powered by hand and drills to create enough current to power a small LED. By connecting the wires to an ammeter, the children can see how mechanical input work relates to electrical energy output as well as the importance of efficient generators. Finally children will have the opportunity to power energy efficient and energy inefficient lights in order to learn the importance of energy efficiency.

INTERACTIVE EXPLORATION OF COMPRESSED AIR

MICHAEL LIN · MECHANICAL ENGINEERING
JOSEPH MEYER · MECHANICAL ENGINEERING
KESHAV RAGHAVAN · ICES
JOHN SMARTO · MECHANICAL ENGINEERING

The Interactive Exploration of Compressed Air activity teaches middle school children about the storage of energy in compressed air and also the transformation of that stored energy to kinetic energy. To achieve this, the activity is centered around experimenting with a bicycle-pump-powered air cannon. By varying pressures, launch angle, projectile shape, and other variables, the children will leave with hands-on experience with energy transformation using compressed air.

INTERACTIVE SAILCARS

BENJAMIN ALLEN • ICES
CHRISTIAN CHEN • CIVIL AND ENVIRONMENTAL ENGINEERING

MICHAEL CUSHMAN · MECHANICAL ENGINEERING
SANTIA VALERIO · MECHANICAL ENGINEERING

The intent of this project is to teach children about wind power. The children will learn by creating a sail-powered car. While a fan is set to low power the wind created by the fan directs the sail-powered cars down a path. They will learn through trial-and-error which sail types will work best in utilizing the wind power to drive their car. Chopsticks and newspaper are provided to allow the children to experiment with different shapes and sizes of sails and these sails attach to the vertical supports. Children attach their sails to various attachment points on the provided car bases. During the project we will explain to the children how electrical energy is converted into mechanical energy, then converted to wind energy and back again into mechanical energy. We will also explain why certain sail types work better than others based on their shape and size.

LEVERS, PULLEYS, AND MECHANICAL ADVANTAGE

CLAYTON CRITES · MECHANICAL ENGINEERING
ROSEMARY LUO · ICES
REBECCA MCAUSLAND · DRAMA
COLIN O'SHEA · MECHANICAL ENGINEERING

To better familiarize children with the concept of mechanical advantage, we've devised an activity which will allow for hands on engagement with a pulley-driven see-saw apparatus. During the session the children will interact with the apparatus by pulling a rope attached to pulleys which will raise the weighted end of the see-saw. Children can be seated on both ends of the apparatus, essentially acting as counterweights to change the mechanical advantage. By moving the fulcrum of the see-saw and changing the number of pulleys used to raise a given weight, the children will be able to experience physically the mechanical advantage provided by each setup. This activity will help solidify the basic statics concepts behind both the classic lever and pulley mechanisms.

MECHANICAL ADVANTAGE LIFTING DEMONSTRATION (GOLDILOCKS AND THE FIVE MECHANICAL ADVANTAGE SYSTEMS)

MAXWELL GUSTAFSON · MECHANICAL ENGINEERING
ALEXANDER MAY · MECHANICAL ENGINEERING
ALEXANDER SCHLICHTING · MECHANICAL ENGINEERING

The goal of this interactive demonstration is to teach young students the benefits of mechanical advantage machines. This will be achieved by engaging the children in five methods of mechanical lifting: an Archimedes screw, three pulley systems, and a waterwheel. The children will be led through a story outlining exercises in which they lift a proscribed amount of small, dense objects to a predetermined height; thus teaching the participants

about the costs and benefits of mechanical advantage. These costs and benefits include the exchange between: complexity of mechanism and semi-continuous flow, distance of travel and force, and the simplicity of motion versus the ability to rest or stop.

POTENTIAL TO KINETIC ENERGY ROLLER COASTER

JENAE PENNIE · CIVIL AND ENVIRONMENTAL ENGINEERING
BRANDON VAN TASSEL · MECHANICAL ENGINEERING
ROSE WEISBURGH · MECHANICAL ENGINEERING

The goal of our project is to show the relationship between potential and kinetic energy, through experimentation. In order to teach this lesson, each child will design a roller coaster. The roller coaster will have several requirements including at least one loop and hill. The roller coaster will only work if the heights of at the initial drop, the hill, and the loop are within a specific set of proportions.

POWERING YOUR OWN CART: EXPLORING SPEED AND POWER THROUGH TRANSMISSIONS

JEFFREY BIZZAK · ICES
YIXIN LIU · ELECTRICAL & COMPUTER ENGINEERING
ELIZABETH SCHWARTZ · ICES

In this project, students will learn about mechanical advantage through different gear ratios. They can explore the trade-off between speed and power. By manipulating a system of color-coded gears mounted on a pegboard, the children will learn that the distance of rotation (input) due to different gear ratios affects the displacement (output) and power (output) of the system. In addition, the students will have a chance to use a gear system to propel themselves on a platform cart. The children will use a crank that is connected to the front axel of the cart to learn about the transfer of power from the hand crank to the cart wheels.

SEE ACTIVITY: HOW SPEAKERS WORK

SHREY AGGARWAL · MECHANICAL ENGINEERING
JONATHAN · MATUSKY MATERIALS SCIENCE ENGINEERING
DAVID O'CONNOR · MECHANICAL ENGINEERING
JUSTIN YI · MECHANICAL ENGINEERING

In this activity, students will learn how electromagnetism and vibrations can be used to produce sound. The students will learn that current, when run through a coil, can produce a magnetic field. Students will also learn how vibrations can be used to produce sound, and how volume and pitch can be altered. Students will build their own speaker by making electromagnetic coils and amplification chambers. They will make the speakers by using

different numbers of magnets and coils to vary the volume. They will construct amplification chambers out of cardboard and experiment with different sizes and shapes. In this way, students will learn how the physical properties of a speaker change the volume of the sound.

VEHICLE PROPULSION DYNAMICS

JONATHAN BATES · SELF-DEFINED
ALEXANDER HANSON · ICES
AANCHAL RAJ · ELECTRICAL & COMPUTER ENGINEERING

Using a simple mousetrap powered vehicle, children will be challenged to find propulsion configurations that meet distance and power objectives. This is accomplished by a modular car design with multiple gears mounted to the rear axle and variable length lever arms. Children will be asked to collaborate in pairs to achieve greatest distance on flat ground, up a ramp, and to win in a race. The exhibit will reinforce basic propulsion, energy conservation, and mechanical advantage concepts. It will also provide a template for iterative design. The ability to rapidly change configurations will allow for multiple attempts at the same objective. The concepts behind engineering design are further developed by the optimization process.

'thought' undergraduate research journal

Staff:
Jillian Bateman (MA in Professional Writing)

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Molly Nix (Communication Design and Human-Computer Interaction)
Tony Lee, Jr. (Communication Design)
Rachel Inman (Communication Design)

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Scott Rosenfeld (Professional Writing and Psychology)
Kate Smith (Decision Science & Public Policy and Management)
James Berndt (Creative Writing and Ethics, History, and Public Policy)
Faith SumTsit Lam (Philosophy)

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Stephanie Chen (Business Administration)

IT

Graham Pugh (H&SS Interdisciplinary)

Advisors

Stephanie Wallach (URO)
Jen Weidenhof (URO)

Common Area 12-2:30 p.m.

'Thought', the Carnegie Mellon Undergraduate Research Journal, presents its third issue along with two monetary prizes for the best research submissions. Authors must both submit their articles to Thought and participate in the Meeting of the Minds to be eligible to receive the prize. We continue our mission of seeking out and publishing compelling undergraduate research.

SPECIAL COMPETITIONS JUDGES & SPONSORS

AWARD FOR ARTISTIC EXCELLENCE

The Award for Artistic Excellence is sponsored by engineers in support of the arts. Awards will be given to outstanding visual and performing arts presentations.

Cara Costello, Language Development Specialist, ICC
Tim Haggerty, Director, Humanities Scholars Program
Yona Harvey, Visiting Lecturer, English
John Mackey, Assistant Department Head, Mathematical Sciences
Joe Mannino, Professor of Art
Therese Tardio, Lecturer, Spanish

CIT HONORS POSTER COMPETITION

All students conducting research through the Carnegie Institute of Technology Honors Program participate in the CIT Poster Competition. The judges for the CIT Poster Session will be:

Faculty:
Shelly Anna, Mechanical Engineering
Kris Dahl, Material Science and Engineering
Warren Garrison, Material Science and Engineering
Chris Hendrickson, Civil and Environmental Engineering
James Hoe, Electrical and Computer Engineering
Mohammad Islam, Material Science and Engineering
John Kitchin, Chemical Engineering
Irving Oppenheim, Civil and Environmental Engineering
Yoed Rabin, Mechanical Engineering
Nikolaos Sahinidis, Chemical Engineering
Tom Sullivan, Electrical and Computer Engineering
Newell Washburn, Biomedical Engineering
John Wesner, Institute for Complex Engineered Systems/ME

Alumni Judges:
Jayshree Ranka
Bob Unetich

FORD MOTOR COMPANY UNDERGRADUATE RESEARCH AWARDS

Ford Motor Company is proud to encourage environmental and automotive research through their sponsorship of the Ford Undergraduate Research Awards. Prizes will be awarded to the top three presentations.

Peter J. Castelli (Mechanical Engineering '04), Vehicle Development Engineer, Vehicle Dynamics CAE
Mark Rockwell (Mechanical Engineering '07), Large V6 Engine Calibration Engineer

IBM UNDERGRADUATE "INNOVATION THAT MATTERS" AWARD

IBM, in association with the CMU ACM Student Chapter, is proud to sponsor the Undergraduate "Innovation That Matters" Award. One of IBM's bedrock principles is to create "Innovation that Matters." This award is rooted in the belief that the very nature of innovation has changed in the early days of the 21st century. It is increasingly open, collaborative, multi-disciplinary and global. This shift means that the truly revolutionary innovations of our time -- the ones that will create new markets, redefine old ones, and maybe even change the world for the better – require the participation and knowledge across multiple disciplines with a diversity of approaches/thought patterns. This award is designed to challenges some of the brightest minds on the planet -- CMU Undergraduates -- no matter what their field of study – to collaboratively advance the state of society through interdisciplinary research.

Robert Bry, Manager, IBM Academic Initiative
Kevin Faughnan, Director, IBM Academic Initiative
Herm Anand
Jiwu Tao
Tom McManus
Mark Sherman
Janet Mostow

INTEL IFYRE COMPETITION

This competition, sponsored by Intel, seeks to recognize significant and creative work supported by the IFYRE (Intel First Year Research Experience) 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.

Jason Campbell
Dave O'Hallaron
Padmanabhan "Babu" Pillai
Dean Pomerleau

JOHNSON & JOHNSON UNDERGRADUATE RESEARCH AWARD

Johnson & Johnson is proud to support innovative projects from all disciplines involving technology, business, and/or healthcare. Two prizes will be awarded.

Eduardo Frias, Vice President, Information Technology
Matthew Sware, Analyst, Information Technology
Rob Wilson, Director, Information Technology

THE NINTH ANNUAL LOCKHEED MARTIN ECE UNDERGRADUATE PROJECT AWARDS SPONSORED BY LOCKHEED MARTIN, ORGANIZED BY ETA KAPPA NU, SIGMA, PA

The Sigma Chapter of Eta Kappa Nu at Carnegie Mellon is proud to present the Ninth Annual Electrical and Computer Engineering (ECE) Project Awards sponsored by Lockheed Martin. This competition is designed to encourage undergraduate ECE students to present their projects, and motivate them to learn from others' work. Eta Kappa Nu (HKN) Sigma Chapter is the Carnegie Mellon chapter of the National Honor Society of Electrical and Computer Engineering. Our goals are to enhance interactions between ECE students, improve student-faculty communication, and develop contacts with industry leaders.

David Casasent, Professor, ECE
Judith Klein, Information Systems and Global Services, Lockheed Martin
Bradley Miller, Senior ECE, Eta Kappa Nu (HKN) Officer

THE ALLEN NEWELL AWARD FOR EXCELLENCE IN UNDERGRADUATE RESEARCH

The Allen Newell Award for Excellence in Undergraduate Research, established in 1992, is the penultimate undergraduate award in the School of Computer Science. It recognizes outstanding undergraduate research in Allen's 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. Allen Newell had a long and profound scientific career that contributed to multiple subdisciplines in computer science. 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..

PHI KAPPA PHI COMPETITION

The Carnegie Mellon chapter of the Phi Kappa Phi honor society will award prizes to student member(s) in recognition of outstanding research. Judges include faculty and staff members of

the society, including executive committee members:

Melissa Cicozi, Assistant Head, Design
Nancy Klancher, Director, Graduate Programs Office
James Roberts, Teaching Professor, Computer Science
Karen Stump, Teaching Professor, Chemistry

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. A panel of judges will evaluate each project.

Brooke Feeney, Associate Professor, Psychology
Vicki Helgeson, Professor, Psychology
Charles Kemp, Assistant Professor, Psychology
Ken Kotovsky, Professor, Psychology
David Rakison, Associate Professor, Psychology
Erik Thiessen, Assistant Professor, 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.

Antonio-Javier Lopez (Biology)
Clark Glymour (Philosophy)
Shannon Young (Civil Engineering)
Emily McCall (English)
Joseph Devine (H&SS)

SCS ALUMNI AWARD FOR UNDERGRADUATE EXCELLENCE

The SCS Alumni Award for Undergraduate Excellence, 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.

Grace A. Lewis, MSE 2001 (Chairperson)
Bruce Horn, M.S. 1991, Ph.D. 1993
James Ivers, MSE 1996
Raúl Medina-Mora, M.S. 1979, Ph.D. 1982
David I. Murray, B.S. 2006, B.F.A. 2006
Erik W. Selberg, Ph.D., B.S. 1993
Boris Sofman, B.S. 2005 (ECE and CS), M.S. 2007 (Robotics)
David M. Steier, M.S.1986, Ph.D.1989

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.

V. Emily Stark, Director of Department Operations, Biological Sciences
Christopher Borysenko, Interdisciplinary Lab Director, MCS
Maggie Braun, Assistant Department Head, Biological Sciences
Roy Briere, Associate Professor, Physics
Elane Fishilevich, Postdoctoral Research Assistant, Biological Sciences
Robert Heard, Associate Teaching Professor, MSE
Veronica Hinman, Assistant Professor, Biological Sciences
Tim Hoffman, Assistant Teaching Professor, Computer Science
Aharon Inspektor, Kennemetal
Annette Jacobson, Teaching Professor, Chemical Engineering
Tina Lee, Assistant Professor, Biological Sciences
Greg Lowry, Assistant Professor, Chemical Engineering
Radu Moldovan, Research Associate, Physics
Linda Peteanu, Associate Professor, Chemistry
Lisa Porter, Professor, MSE
Russell Schwartz, Associate Professor, Biological Sciences
David Squarer, Independent Consultant
Joel Stiles, Associate Professor, Biological Sciences
Shoba Subramanian, Postdoctoral Research Associate, Biological Sciences

STATISTICS COMPETITION

The purpose of this competition is to encourage undergraduate projects and research in statistics and its applications, to inform faculty and students about these projects, and to

encourage cross-departmental interaction. The competition is open to any student or team of students who have completed a project under supervision of faculty in the Statistics Department.

Bill Eddy, Visiting Assistant Professor
Oded Meyer, Assistant Teaching Professor
Yuval Nardi, Visiting Assistant Professor
Rebecca Nugent, Visiting Professor
Alessandro Rinaldo, Assistant Professor

STUDIO FOR CREATIVE INQUIRY AWARD

This competition rewards a creative project that exemplifies or explores the zone between art and science and impacts the local or global community. The recipient(s) will be selected by research fellows and staff of the STUDIO for Creative Inquiry.

Golan Levin, Director of STUDIO

THOUGHT PRIZE FOR EXCELLENCE IN RESEARCH PRESENTATION

Thought, Carnegie Mellon's Undergraduate Research Journal, is proud to sponsor its second annual competition for the best article in its current issue. A panel of editors will choose the winning article based on its originality, contribution to the field, quality of research, and quality of writing.

Jillian Bateman (Professional Writing)
Shannon Stephens (Creative Writing and Studio Art)

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.

David Gerard, Executive Director of the Center for Study and Improvement of Regulation
Michael Griffin, Executive Director of the Green Design Institute
Cliff Davidson, Director of the Center for Sustainable Engineering

YAHOO! UNDERGRADUATE RESEARCH AWARDS

Yahoo! will be looking for interesting and creative projects that lie in the intersection areas between computer and information sciences and the business or social science domains.

Don McGillen, Ph.D., Senior Manager, Campus Relations

SURG/SURF SELECTION COMMITTEE

Shelly Anna, Assistant Professor, Mechanical Engineering

Patricia Bellan-Gillan, Professor & Associate Head, School of Art

Annette Jacobson, Director of CPS & Professor, Chemical Engineering

Linda R. Kauffman, Teaching Professor, Biological Sciences

Thomas M. Keating, Associate Teaching Professor, CSD Education

Kenneth Kotovsky, Professor, Psychology

Evelyn Pierce, Associate Teaching Professor, Management Communications

Jessie B. Ramey, Founding Director and Special Consultant, URO

Karen Schnakenberg, Teaching Professor, English

Mark Stehlik, Assistant Dean, CSD Education

Gloriana St. Clair, Dean of University Libraries

Heidi Tracy, Assistant Vice President of Individual Giving

Stephanie Wallach, Director, URO

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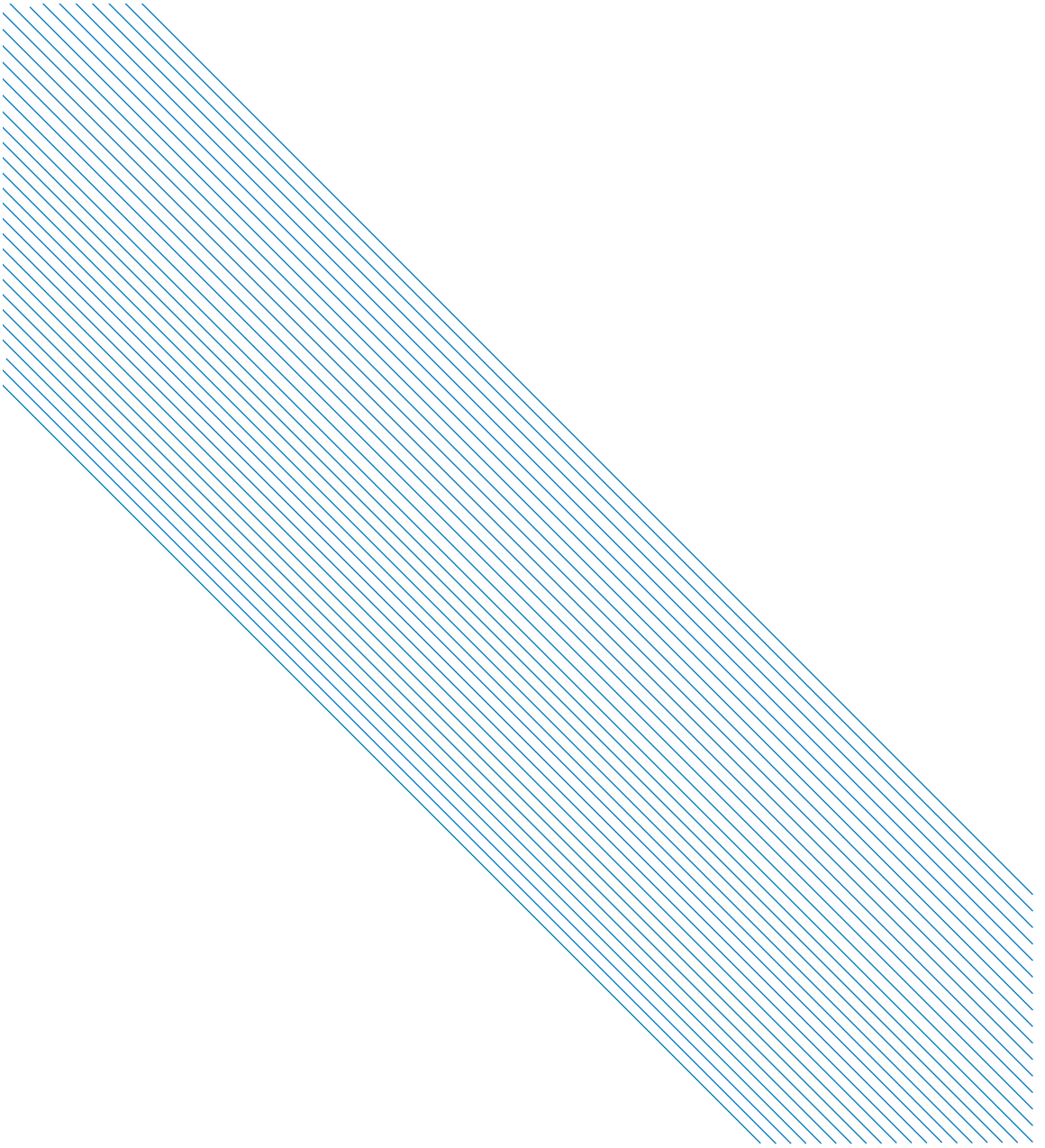

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