STAR Scholars
Summer Showcase 2011

Wednesday, August 24, 2011

STAR Scholars 2011

Edmund T. Bossone

Engineering Center

10:00am—2:00pm

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MANTUA: A STUDY IN URBAN DEVELOPMENT

Mantua is a historical neighborhood in West Philadelphia, bordered by Spring Garden Street to the south, Mantua Avenue to the northeast, and N. 40th Street, to the west. Through their research, students sought to understand the physical qualities of the neighborhood through quantitative and qualitative analysis. Research areas included architectural styles, historical development, two-dimensional graphical analysis, and the development of a detailed three-dimensional digital model available for general use. Furthermore, the students' research has laid the groundwork for future inquiry into the neighborhood.

Patrick Barendt
Architecture

Samantha Holmes
Architecture

Philip June
Architecture

Jeffrey Pond
Architecture

Zoe Spencer
Architecture

Dr. Frank de Santis
Architecture
& Interior Design

THE PEALE MUSEUM: NEXUS OF SCIENCE, ART, AND TECHNOLOGY

Matt Haas

Digital Media

Hannah R. Winograd

Digital Media

Dr. Glen Muschio

Cinema & Television

Charles Willson Peale, an American painter and scientist of the Enlightenment, developed his "Philadelphia Museum," housed on the second floor of Independence Hall 1811-1827. The museum was arranged to depict man as the pinnacle of all life on earth. Among scholars, Peale's innovative use of science, art and technology to raise public awareness about the "scientific" ordering of the world is well known, yet his contribution is all but unknown to the estimated 4 million people a year who visit Independence Hall, a UNESCO World Heritage site dedicated to the signing of the Declaration of Independence. The goal of this project is to create an interactive 3D virtual model of Peale's museum. The model will be used to help raise awareness about the importance of the Enlightenment in understanding the American Revolution. Our 3D digital model is based on a published guide to the museum's collection written by Peale himself, two paintings by Titian Peale and Charles Peale, and published historical accounts. The results include an interactive 3D rendering of the model containing ninety of Peale's portraits, display cabinets and cases depicted in the paintings. The interactive model will be used in smart phone tours of Independence Hall and for other educational uses.

PECO Crown Lights Public Service Announcements

Matt Haas
Digital Media

Hannah R. Winograd
Digital Media

Dr. Glen Muschio
Cinema & Television

The objective of this project is to make use of scientific data produced in the National Science Foundation, Award Number 0803670, "The 3D Colonial Philadelphia Project --Digital Restoration of Thin-Shell Objects for Historical Archeological Research and Interpretation," to inform the general public about two archaeological events, Pennsylvania Archaeological Month and Philadelphia Archaeological Day. To reach our intended audience, we will use the Crown Lights on top of the PECO building. This electronic display board is an important device in communicating in formation to a large portion of the city inhabitants. The team used design principles, new media technologies, and a 3D model of a ceramic artifact to produce the animated public service announcement (PSA). This interdisciplinary and collaborative project brings together science, art, and technology. Working with a computer science graduate student, we converted scientific file formats to be compatible with design software. We worked with Philadelphia Archaeological Forum (PAF) to produce the text for the public service announcement which refers people to the PAF website. The PSAs will run from September 29th till October 31st.

The Use of Media by Performing Arts Organizations

Simone Dallaire

Entertainment & Arts Management

Dr. Larry Epstein

Arts & Entertainment Enterprise

A recent trend in the performing arts industry is the use of various digital media outlets as distribution platforms for creative works. In depth analysis of the development of this trend and the business structure behind led to the conclusion that there are several intersecting developments fueling this trend, including the conversion to digital cinema in movie theaters, a decline In overall movie theater attendance, and performing arts organization's interests in expanding the audience for the fine arts. The most frequent occurrences of this trend occur through broadcast networks (i.e. PBS's *Live From The Lincoln Center* program) and movie theaters (i.e. *The Met: Live in HD*). The use of movie theaters as a means to showcase fine arts is a recent advance and, unlike the use of broadcast networks, creates a simplified business model that could create new revenue streams for performing arts organizations. While these types of "alternative content" events shown in movie theaters around the world make up a very small percentage of overall box office growth, it is an expanding market that has seen recent growth. Currently, profits from these events have been slim, but continued growth, which seems likely, could eventually lead to creating alternative income for performing arts organizations.

Fashionable Technology for the Medical Industry

Sarah Mackenzie

Fashion Design

Dr. Genevieve Dion

Fashion Design
Design & Merchandising

Smart garments can make an enormous contribution to health care. Designed and fabricated properly they can increase patient safety and comfort and replace bulky medical instrumentation. Through our research, we seek to prove that it is possible to create comfortable, fully manufacture-able systems of knitted sensors. We researched do-it-yourself wearable technology websites and used conductive threads, yarns and fabrics to create rough semi-flexible prototypes to test the technology. We then used these prototypes to design and knit samples on a Shima Seiki computer aided 3D knitting system on which formfitting seamless garments can be constructed with specialized yarns to perform specific functions. This mode of fabrication offers a future of many opportunities for smart garments and holds remarkable potential in medical apparel. The time patients are required to stay in the hospital could be significantly reduced if they are able to wear comfortable and reliable monitoring equipment without hindrance to everyday activities.

THE POLISH POSTER PROJECT

Jasmine Corrie

Graphic Design

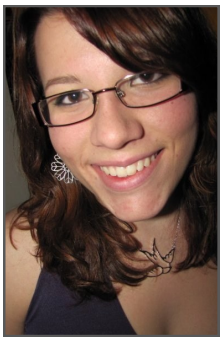
Dr. Jody Graff

Program Director,

Graphic Design

The Polish Poster Project involves the archiving of the Antoinette Westphal College of Media Arts & Design Polish Poster Collection. The project consists of the research, organization, and exhibition of over 2000 Polish Posters. When the posters were acquired (The Frank Fox Collection) and donated (the Lewalski Collection), they were received with minimal additional information. Through the research of many books, websites, translators, and personal accounts of Frank Fox, who knew many of these artists personally, we were able to gather background information about many of the posters and their artists. As the main focus of the project shifts from research to exhibition, we are beginning to develop a website to exhibit the posters for individuals interested in Polish Poster design and to be utilized as a searchable databank for student research and projects. As a graphic designer, the design and development of the website is an added bonus to this project. When the website is complete, we hope to be able to better collaborate with museums and universities around the world in order to gain a better understanding of the history and significance of the Polish Poster art.

Graphic Design and Silkscreening



Elanor Williams

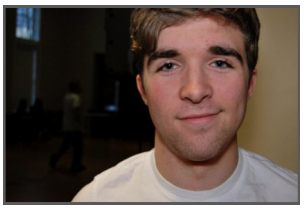
Graphic Design

Ms. Anne Schaefer

Graphic Design

As a student of the College of Media Arts and Design, I chose a mentor that would give me the opportunity to work creatively. My mentor, Anne Schaefer, is a working artist, a small business owner, and a professor at both Drexel and the University of the Arts. In just ten weeks I have seen an installation go from an idea to the walls of a gallery; I have learned about the infrastructure of a small business; I have edited photographs and taught myself how to build a website on which to show them; and I have learned new silkscreen techniques and how to apply my skills to printing on fabric. Early on in the summer, my mentor and I discussed my personal project and I decided that I would like to take on the challenge of designing my own textile to be silkscreened onto a duvet cover. While this project was difficult for me, it gave me the opportunity to learn new techniques from my mentor and grow in the process. I am proud of what I have created and learned in the past weeks and will forever be changed by this experience.

The Growing Brazilian Economy, Its Effect on Music Piracy, and the Implications for the Devaluation of Music



Michael Rodino

Music Industry

Mr. Darren Walters

Music Industry

Music piracy has consistently been viewed as a product of today's technological advances and has helped cause the recent devaluation of music. The Internet and advancement of storage space on personal devices and computers has made it easier for consumers to transfer and share music without purchase. However, while the United States has witnessed, and utilized, the development of music piracy and the evolution of technology, countries like Brazil did not have the access to the same technology that defined piracy in the United States and other economically sufficient countries in the early 2000's. By using accounts from Professor Walters' experience in Brazil's music industry, as well as my own comparative analysis, I will show how piracy has still developed even without adequate access to technology and prove that consumers have decreased the value of music, not only in the United States, but in Brazil, as well.

ALZHEIMER'S DAY LIGHTING STUDY

Megan Peaslee

Product Design

The objective of this project is to determine the influence that daylight and man-made lighting systems have on the circadian rhythm of Alzheimer's patients. Research has shown that Alzheimer's patients suffer sleep cycle disruption due to a degradation of their natural circadian rhythms. This disruption of sleep expresses itself in an increased restlessness and agitation in the Alzheimer patient. Researchers are still far away from finding a cure for Alzheimer's; however, this research hopes to improve the quality of life for patients. This project builds on the work of Dr. Daniel Marenda (*Biology*) using drosophila flies that exhibit Alzheimer's disease.

Data is being collected using 16 normal and 16 Alzheimer drosophila melanogaster. The experiment follows the protocol of 5 days of 12 hours of light/12 hours of dark in a controlled environment. This cycle is then followed by 7 days of complete darkness. Data collected will directly impact funded research being conducted by Dr. Gena Ellis. One of three possible outcomes is predicted: 1) no correlation with lighting and the sleep cycle, 2) a positive correlation with lighting and the sleep cycle, or 3) inconclusive data. Ultimately, the results of this experiment will influence experiments of human trials involving the design of lighting fixtures that mimic a full 24-hour cycle of daylight and darkness. These fixtures are used as a means of determining an effective treatment of sleep disorders caused by a disruption in circadian rhythm.

Dr. Michael Glaser

Fashion Design
Product Design
Design & Merchandising

Adapting Nonfiction for the Screen

Justine Higgins

Screenwriting & Playwriting

Mr. Jason Wilson

Pennoni Honors College

Transcribing a story from one medium into another is much more difficult than most people realize, especially when converting a work of nonfiction into fiction. Oftentimes, major elements must be altered so that the story can be told in a more narrative and dramatic form so as to reach a wider audience. In this project, I adapted the nonfiction novel *Boozehound*, by Jason Wilson, into a film script. *Boozehound* is a collection of small vignettes about a number of very rare or expensive spirits. The process began with reading the book several times in order to gain a thorough understanding of the basic story elements. Then I brainstormed and outlined several ideas, choosing the best three to draft treatments for. A treatment is where the film is broken down scene by scene and described in great detail, exposing all of the problems that a proposal may have. It was at this stage I discovered that the easiest way to make the novel work as a film was to compress time and change the location. After settling on an idea, I was finally able to begin writing the script.

My proposed script features David Cartwell, a semi-famous spirits writer, who attends the Tales of the Cocktail spirits conference in New Orleans, and who, after a series of strange occurrences and with the help of a failed love affair, realizes he is living in a bubble of booze, parties, and exotic places and needs to get back to the real world.

WALKABILITY'S IMPACT ON SENIOR HEALTH (WISH)

Brittany Handler

Anthropology

Objectives: WISH is an exploratory study that is funded by the National Institute of Nursing Research of the NIH and involves the Philadelphia Corporation for Aging and the Asociación de Puertorriqueños en Marcha. The WISH project is meant to determine how to design healthier urban neighborhoods, especially in relation to people over age 60. Ultimately, the project will recruit seniors to identify assets and limitations of the area. My objectives for the summer were to qualitatively and quantitatively describe the demographics, walkability, and activity of one neighborhood in eastern North Philadelphia. **Research Methods:** Field observations and structured systematic observations were conducted in the target neighborhood. First, I conducted field observations to identify specific segments, or blocks, in the neighborhood for focus in the coming phases of the project. Next, I collected quantitative data using two validated structured observational instruments to assess the walkability and physical activity of residents within the selected segments. **Implications:** After this process, community members will be recruited to conduct similar observations. These data will then be compared to the data I collected. My findings from the initial phase of the project were compiled into a report, which will be used as a reference throughout the project. The findings from WISH will impact the design of urban neighborhoods so moderate forms of physical activity, such as walking and bicycling, are encouraged. As an increase in these activities benefits public health, city planners consult projects such as WISH to know what conditions to improve in an urban neighborhood.

Dr. Yvonne Michael

School of Public Health

Epidemiology & Biostatistics

Elucidating Microbial Gut Symbionts of *Cephalotes varians*

Riddhi J. Amin

Biological Sciences

Symbiotic relationships have been documented across numerous animal species, and these intimate links affect the reproduction, diet, and the evolution of many organisms. Studies of bacteria inhabiting the guts of the ant, *Cephalotes varians* have revealed multi-species communities with potential roles in host nutrition. This particular research sought to cultivate the bacterial species that are known to inhabit *C. varians* guts and while screening for archaeal and fungal microbes. Cultivation of the bacteria will allow for further investigation into their exact function in the symbiotic relationship, while screening for Fungi and Archaea provides the first attempts to survey for microbes outside of the Eubacteria. Sequences from eight different cultured bacteria suggest that the gut contains rare and previously undiscovered bacterial species, such as the Chryseobacterium, a type of Flavobacteria. However, further research is required to successfully grow the dominant symbiotic microbes identified by culture-independent means. In addition to these Eubacteria, PCR screening implies the presence of Archaea in *C. varians* guts. Future research will utilize several types of growth media geared towards providing the symbionts with the nutrition needed to be cultured. Also, the presence of archaeal and fungal species will verified by further screening and sequencing in order to establish species' identity. In conclusion, this study has provided insights into microbial communities that colonize the digestive systems of *C. varians*, revealing a greater diversity than originally appreciated.

Dr. Jacob Russell

Biology

The Role of Calcineurin in a Drosophila Model of Alzheimer's Disease

Neha Arjunji

Biological Sciences

Our lab has developed a transgenic model of Alzheimer's Disease (AD) by expressing the wild type human forms of both APP and BACE within the CNS of Drosophila melanogaster. These transgenes, combined with Drosophila's endogenous functional homolog of the gamma-secretase complex, recapitulates the amyloidogenic proteolytic processing that occurs in AD brains. Calcineurin has been implicated in the pathology and progression of neurodegeneration in AD brains. We have used our transgenic APP:BACE Drosophila to test the role of calcineurin in AD using both RNAi knockdown and pharmacological techniques. Drosophila exhibit negative geotaxis by climbing upwards when tapped to the bottom of a vial, and disruption of this stereotyped response is indicative of nervous system dysfunction. Calcineurin inhibitors administered via feeding improve the impaired motor reflex behavior observed in the APP:BACE flies. RNAi-mediated knockdown of calcineurin in the APP:BACE Drosophila model also partially suppresses the defective climbing behavior. These studies emphasize the utility of this model for dissecting the molecular mechanism of neurodegeneration, as well as testing possible pharmacological interventions in an in vivo system.

Dr. Aleister Saunders

Biology

Bring Old Collections into New Focus

Aja Carter

Biological Sciences

Dr. Kenneth Lacovara

Biology

During the early days of paleontological research and fieldwork fossils where often collected from pits dug in local farms for soils or minerals. These fossils were collected by museum workers or farm workers and sent to the museum (the Academy of Natural Sciences). Each received lot was prepared, given a museum collection number, and studied then shelved. Each time a worker collected at a given pit the newly collected specimens would be given a new number. Synonymizing numbers and lots of specimens can help to illuminate loss of bone due to collecting habits and weathering/ rate of fossil becoming unearthed.

Recently we found cause to synonymize three lots and their numbers into one. This has led us to ask the question of how often the same individual skeleton might have been collected in separate lots and now sit under several separate collections numbers. We propose to set up a dichotomous key to quantify the possibility of any given lots being synonymizable. The key will look at genus/ species, date of collection, place of collection, and overlap of identifiable skeletal elements and morphology of bone break surfaces.
We will begin with the date of collection of the recently synonymized crocodilian skull and extend our time brackets out from that date to two years before and after it is collecting. Our outcome will be the dichotomous key and synonymized specimens, as well as a recommendation for usefulness of the key in other institutions and in our own vertebrate paleontological collections.

Effect of ErbB2 on Glutaminase Expression in Breast Cancer Cells

Clarissa Chu
Biological Sciences

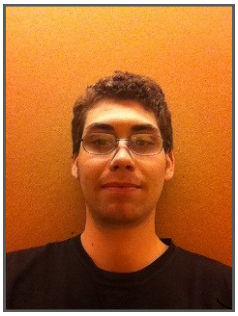
Dr. Nianli Sang
Biology

Shuo Qie
Graduate Student Mentor

ErbB2 is an oncogene that is overexpressed in certain tumors, most frequently in breast cancers. It can activate the PI3K/AKT and MAPK signaling pathways to enhance tumor growth and metastasis. Glutaminase is an enzyme that breaks down glutamine to provide energy, biosynthetic precursors, and reducing agents for actively dividing tumor cells. Our preliminary data shows that ErbB2 increases glutaminase expression. However, the exact mechanism by which ErbB2 upregulates glutaminase expression is not yet clear. My research goal is to determine the role of the PI3K/AKT and MAPK/ERK pathways in ErbB2-mediated upregulation of glutaminase.

To achieve this goal, I utilized MCF-10a cells (normal human mammary cells) and NeuT cells (MCF-10a cells with constitutively active rat ErbB2). I used MCF-10a cells transiently transfected for 24 hours with a control plasmid, a plasmid overexpressing Akt-Myr, and a plasmid overexpressing pCMV-MEK, respectively. I also included MCF-10a and NeuT cells as controls. I collected the whole cell lysate for Western blot analysis to determine the expression of ErbB2, glutaminase, pAKT, total AKT, pERK, total ERK, and α-tubulin (a loading control). The results showed that the overactivation of PI3K/AKT and MAPK/ERK cannot sufficiently induce glutaminase upregulation in MCF-10a cells. Therefore, ErbB2 may increase glutaminase expression through other pathways. In future studies, I will test other signaling pathways that may enhance glutaminase expression in the ErbB2-positive breast cancer cells.

Do Frequencies of Bacterial Symbionts in Pea Aphids Vary with Parasitism Rates?



Steven G. Doll

Biological Sciences

Dr. Jacob Russell

Biology

Andrew Smith

Graduate student mentor

The pea aphid, *Acyrthosiphon pisum*, harbors several facultative bacterial endosymbionts. One of these endosymbionts, *Hamiltonella defensa*, is of particular interest due to its capacity to defend pea aphids against the parasitoid wasp *Aphidius ervi*. This study seeks to determine the relationship amongst symbiont frequency and the prevalence of parasites. We sampled several alfalfa and clover fields in southeastern Pennsylvania and central New York for *A. pisum* and its natural enemies once every three weeks beginning in May, 2011. Aphids collected in the field were either immediately stored in ethanol and screened for the presence of endosymbionts in the laboratory or brought back to the laboratory to determine rates of successful *A. ervi* parasitism. We predict that *H. defensa* frequencies should vary according to wasp densities. There is an apparent cost of infection in the absence of parasitism, and so we predict that *H. defensa* frequencies should vary in relation to wasp density. Our current findings indicate a low frequency of *H. defensa* within pea aphids collected from alfalfa in New York on the first sampling date in early May. Pea aphids collected from alfalfa in Pennsylvania on the same sampling date had a higher frequency of *H. defensa* and a substantial parasitism rate. Temperature may be an important factor in determining aphid resistance to parasitism. As such, future analyses will examine the relationship between temperatures recorded in the sample fields and any seasonal changes in symbiont frequency, helping to further elucidate the relationships amongst *A. pisum*, its natural enemies, and *H. defensa*.

Ideal Concentration of Matrigel and Collagen to Simulate In Vivo Breast Cancer Invasion in the Extracellular Mix

Melissa Duong

Biological Sciences

Background: The extracellular matrix (ECM) surrounding cells is an elaborate network of structural proteins, primarily collagen. Invasion assays are utilized in experiments to simulate cancer cell migration and invasion through the ECM of surrounding tissue. These assays usually rely on one type of collagen fiber; however, the mammary environment is more complex. Rat-tail collagen is made of short fibers and bovine collagen of long fibers. We used a 3D innovative invasion assay utilizing both types of collagen at varying concentrations. The purpose of this study is to observe the effects of differing concentrations of ECM components on breast cell invasion as it would be useful to study tumors. It is hypothesized that a combination of rat-tail and bovine collagen will be most similar to the mammary ECM environment. **Methods**: NeuN cells, engineered to mimic pre-invasive breast cancer cells, are combined with a gel mixture that contains matrigel, and varied concentrations (0.8 to 2.3 mg/ml) and sources (rat tail and bovine) of collagen for an incubation and invasion period of 24 hrs. **Results**: Keeping matrigel concentration constant at 1.0 mg/ml, the maximum percent invasion of 28.37% was observed with 0.8 mg/ml of rat-tail collagen. At a consistent matrigel concentration of 1.16 mg/ml, the maximum percent invasion is 9.87% at 1.3 mg/ml bovine collagen. **Conclusion**: By determining the ideal concentrations of matrigel and collagen in the invasion assay, in vivo invasion of breast cancer cells can be mimicked for optimum application in breast cancer research.

Dr. Adrian C. Shieh

School of Biomedical Engineering, Science, & Health Systems

Effect of Tubacin on the Acetylation of Tubulin and Synaptic Plasticity in a *Drosophila* Tip60 HAT Mutant Model

Maha Elgawly

Biological Sciences

Dr. Felice Elefant

Biology

Jessica Sarthi

Graduate student mentor

Epigenetic marks are post-translational histone modifications that affect gene expression by altering the packaging chromatin in the nucleus of eukaryotic cells. One such modification is acetylation, which is covalently linked to histone proteins by a family of enzymes called histone acetyl transferases (HATs). Studies from our laboratory show that the HAT Tip60 plays an important role in synaptic plasticity. For example, our microarray data shows that Tip60 is associated with the regulation of genes enriched for specific neuronal process involved in learning and memory. We also show that pre-synpatic loss of Tip60 HAT function causes a significant increase in synaptic bouton numbers at the *Drosophila* neuromuscular junction (NMJ), a well characterized model used to study synaptic plasticity. Intriguingly, this increase in synaptic bouton formation is accompanied by a decrease in the acetylation of tubulin, a modification involved in the organization of the cytoskeleton that is linked to bouton formation. Here, we will investigate whether Tip60 associated tubulin acetylation plays a direct role in controlling synaptic bouton formation. We hypothesize that restoration of tubulin acetylation in our Tip60 HAT mutant flies will at least partially rescue the defects in synaptic plasticity and locomotor activity caused by loss of Tip60 HAT function. To test this hypothesis, we are treating Tip60 HAT mutant flies with Tubacin, a histone deacetylase (HDAC) inhibitor that specifically inhibits HDAC6 from deacetylating tubulin, thus promoting enhanced tubulin acetylation in these flies. We will then assess whether this treatment will at least partially rescue the decreased locomotion and increased synaptic bouton formation we observe in Tip60 HAT mutant flies. These studies should have implications for the use of tubulin modification based therapeutics for potential treatment of neurodegenerative disorders associated with synaptic plasticity defects.

Changes in the Incidence and Distribution of Bird Species of Pennsylvania and New Jersey

Richard Alexander Furstein

Biological Sciences

Dr. James R. Spotila

Biology

In this project, I studied anthropogenic and environmental aspects of global warming, and other climatic changes. The changing climate will have ubiquitous effects for life on Earth, from the smallest phytoplankton to human beings.

My specific poster project focuses on one group of animals in a specific area affected by these changes; avian species in several survey areas across Southern New Jersey and Southeastern Pennsylvania. According to general circulation models (GCMs), changes in the local climate are predicted to impact these birds in different ways. Our models are taken primarily from the Climate Change Bird Atlas, published by the US Department of Agriculture's Forest Service, and model changes in these species' incidence (population density per unit area) and distribution (extent of their habitation range). Destruction of their breeding and nesting habitats and food scarcity (due to both anthropogenic and environmental pressures) seriously threaten these species' chances of survival in our vacillating environment.

Formation of Ordered Trimesic Acid and Melamine Nanowires

Taylor Grimes

Biological Sciences

Dr. Hai-Feng (Frank) Ji

Chemistry

Trimesic acid (TMA) and melamine (M) nanowires have demonstrated conductive properties that are an order of magnitude over the industrial standard of Nafion. The utilization of TMA=M is restricted due to the disorganized manner in which the nanowires are formed during the self-assembly procedure. To apply TMA-M as a proton conductor in fuel cells, the wires must be fabricated in a manner that enables organization and facile manipulation. By creating wires on patterned substrates through the evaporation of water from the TMA-M solutions, wires have formed in short, ordered arrays. This is the first step toward utilizing the low-cost TMA-M wires for fuel cell application.

MIR-153 REGULATION OF APP AND PTCH1 EXPRESSION

Umar Hafeez

Biological Sciences

Dr. James R. Spotila

Biology

Alzheimer's Disease (AD) is a neurodegenerative disease characterized by the accumulation of Amyloid Beta (Aβ) peptides in the brain. This protein is formed after the sequential cleavage of Amyloid Precursor Protein (APP) by β and γ secretase enzymes (Zhang et al., 2011). Conversely, the Sonic hedgehog (Shh) signaling pathway is responsible for cell division and development. The activation of Patched 1 (PTCH1), a major component of the Shh signaling pathway, serves to down regulate cell proliferation. Recent research has shown that increased APP Intracellular C-terminal domain (AICD) - a cleavage product of APP, leads to increased PTCH1 expression (Trazzi, et al., 2011). Micro RNAs (miRNAs) are short ribonucleic acids that regulate gene expression through translational repression. Through several online miRNA prediction site softwares, our lab identified mir-153 as a putative regulator of APP and PTCH1. Having identified mir-153 as a regulator of APP and PTCH 1 we can further understand the role of Sonic Hedgehog signaling and APP metabolism in Alzheimer's Disease.

Synthesis and Characterization of Polymeric Nanospheres for Drug Delivery Using Statistical Bioprocessing

Katya Hristova

Biological Sciences

Dr. Elizabeth Papazoglou

School of Biomedical Engineering, Science, & Health Systems

Antiretroviral therapy has proven effective in increasing life expectancy of those infected with HIV-1. However, drug delivery devices such as polymer nanoparticles are preferred over currently administered antiretroviral drugs for their long-term drug circulation, high bioavailability and low toxicity. For the purpose of the present project, nanospheres were prepared from polylactide (PLA) and poly(lactide-co-glycolide) (PLGA) using single emulsion solvent evaporation and spontaneous emulsion solvent diffusion methods, respectively. The selection of these synthetic polymers is based on their biocompatibility and biodegradability. We were specifically interested in two physical properties of the synthesized nanoparticles: size and polydispersity. Size in the nanometer range is important in that it facilitates the control of drug loaded nanospheres entry into the site of HIV-1 infection. Polydispersity index (PDI), on the other hand, is considered ideal within its smallest range leading to monodisperse particle suspensions. Design of experiments (DOE) was implemented as process characterization means for screening quantitative parameters that significantly effect size and polydispersity response. We were able to compare the magnitude of main effects and interactions of the tested parameters from analysis of variance (ANOVA) output generated by Minitab, statistical analysis software. Further, response surface methodology (RSM) was adopted for process optimization. Real-time monitoring and DOE analysis provides vital information that enables prompt adjustments to the on-going process leading to the development of a much more well understood nanosphere synthesis process.

ROLE OF HDAC4 AND HDAC5 IN HYPOXIA SENSING

Niti K. Jethava
Biological Sciences

Dr. Nianli Sang
Biology

Cancer causes very high mortality rates in the United States. While it is difficult for normal cells to survive in hypoxic conditions, tumor cells are able to thrive in these conditions, which are unfavorable for effective treatment by chemotherapeutics. Hypoxia causes cells to accumulate hypoxia-inducible factors (HIFs), which promote tumor growth. It has been shown that histone deacetylases (HDACs) are required for HIF-1 function. Two members of the histone deacetylase family, HDAC4 and HDAC5, have been implicated in the regulation of HIF-1. It is unclear, however, if hypoxia affects the expression levels of HDAC4 and HDAC5. Our goal was to compare HDAC4 and HDAC5 expression under normoxic and hypoxic conditions. We studied four different cell lines: HeLa (cervical cancer), Hep3B (liver cancer), MCF-7 (breast cancer), and 143B (osteosarcoma). Hypoxia treatments were achieved by culturing cells in the hypoxia chamber, in which oxygen concentration can be programmed. Normoxia conditions were defined by allowing cells to grow in standard CO_2 incubators. Western blotting was performed for each sample in order to compare the amount of HDAC4 and HDAC5 present. Our preliminary results show there is no difference in HDAC4 levels between different cell lines, or between cells treated with hypoxia or normoxia. Hep3B cells have higher levels of HDAC5 than the other cells, and Hep3B cells with hypoxia have more than Hep3B cells with normoxia. Determining whether HDAC4 and HDAC5 are regulated by hypoxia will contribute to a better understanding of hypoxia sensing and facilitate the development of more effective chemotherapeutics.

Transformation of *E. coli* with Fluorescent Reporter Genes for Use in Cyanobacteria

Martin Johnson

Biological Sciences

Dr. Shivanthi Anandan

Biology

Simara Price

Graduate Student Mentor

Cyanobacteria, a phylum of bacteria capable of photosynthesis, are paramount in ecology, the formation of the present atmosphere, and many biotechnology applications. Thus, much interest has been invested in studying this group. Many researchers focus on the constitutive proteins and signaling molecules that allow the bacteria to harvest energy through photosynthesis. In order to study the photosynthetic pathways, genes of interest must be isolated and tagged with appropriate reporter genes to allow desired experimentation. In this research, the plasmid vectors containing reporter genes were transformed into *Escherichia coli*, replicated, purified, and verified. This was carried out so that these reporter genes will later be used to tag genes of interest and used to study signaling pathways in cyanobacteria. The successful transformation of *E. coli* with five different reporter genes was accomplished. Freezer stocks of these bacterial strains were created, and are ready for future experimental use. These reporter genes will later be used to tag genes involved in light-responsive signaling, and tested in cyanobacterial models such as *Synechococcus elongatus*.

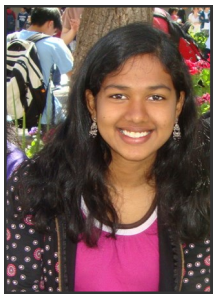
Testing the Role of Calcineurin in Alzheimer's Disease Using In Vivo and In Vitro Models

Piotr Jurgielewicz
Biological Sciences

Alzheimer's Disease (AD) is a neurodegenerative disease characterized by the formation of plaques in the brain, which are mainly composed of Ab. Unlike the case with many other diseases, the number of people with AD is increasing steadily, making it of utter importance to find a treatment method. Subcloning is a technique used in molecular biology to move a particular gene of interest into a host plasmid or vector. An in vitro model was created to check the effect of shrank on silencing the calcineurin gene, which can potentially be linked to the pathology and development of AD. To do this, the shRNA construct was subcloned into pGIPZ. For the in vivo model, the fruit fly *Drosophila melanogaster* was genetically created to express both human APP and BACE genes. The flies will undergo drug treatment for fk506 and Cyclosporine A (CsA). A climbing assay will be conducted to determine the effect of the drug in terms of improved cognitive function. The studies will demonstrate the putative role of calcineurin in AD as well as provide insight into possible pharmacological interventions that can be utilized to treat the disease.

Dr. Aleister Saunders
Biology

Role of Tip60 HAT Activity on Learning and Memory in *Drosophila*



Sravanthi Koduri

Biological Sciences

Dr. Felice Elefant

Biology

Age-related memory deficits have been associated with misregulation of neuronal genes due to aberrant epigenetic alterations in chromatin, specifically histone acetylation. Given the strong link between histone acetylation and cognition, it is essential to identify the HAT enzymes that create such marks. One promising candidate is Tip60, a HAT that transcriptionally controls select genes by acetylating histones and non-histone proteins. Tip60 forms a complex with the intracellular domain of the Alzheimer's Disease (AD) associated amyloid precursor protein (APP-AICD). This complex epigenetically controls transcriptional regulation of neuronal target genes that when misregulated, are linked to AD progression. Based on these findings, along with our laboratory's data supporting a role for Tip60 in AD-linked neuronal processes, we will investigate a potential role for Tip60 HAT activity in *Drosophila* memory formation by examining the morphological and functional effects of disrupting Tip60 HAT activity and overexpressing wild-type Tip60 on the *Drosophila* mushroom body (MB), the fly learning and memory center. In order to examine the morphological effects, double transgenic flies that express either a Tip60 mutant (lacking HAT activity) or additional copies of Tip60 wild-type protein along with a GFP marker will be generated. Any morphological effect on the MB will be examined using GFP staining and confocal imaging. To determine the functional effects of Tip60 HAT activity on learning and memory, the male courtship assay will be conducted and the courtship index (CI) will be used to assess learning and memory defects in mutant flies. The study's findings will provide insight into how Tip60 epigenetic misregulation can potentially lead to memory-related defects observed in age-related neurodegenerative diseases like AD.

SELECTION OF *PLASMODIUM YOELII* MALARIA PARASITES WITH INCREASED ADHERENCE TO VASCULAR ENDOTHELIUM

Hera Mahmood

Biological Sciences

Dr. James Burns

College of Medicine

Microbiology & Immunology

Erythrocytes infected with *Plasmodium falciparum,* the parasite that causes malaria in humans, are known to adhere to vascular endothelium, contributing to severe diseases including cerebral malaria and placental malaria. We hypothesize that malaria parasites that preferentially invade reticulocytes, such as *P. yoelii* 17X, also adhere to vascular endothelium localizing to sites of erythropoiesis including the spleen and bone marrow. Gene expression profiling studies in the rodent malaria parasite *Plasmodium yoelii* have identified a set of parasite genes whose expression is increased in *P. yoelii* 17X parasites from infected reticulocytes adherent to vascular endothelial cells compared to parasites from the non-adherent cells. The goal of this study was to select a *P. yoelii* 17X line that displayed an increased adherence to vascular endothelial cells. We have developed an in vitro assay to isolate the subpopulation of reticulocytes infected with *P. yoelii* 17X that adhere to vascular endothelium. Adherent subpopulations were then used to serially re-infect mice and repeat the assay so that after the 4th cycle, we can compare the *P. yoelii* 17X line selected for increased adherence with the unselected starting population of *P. yoelii* 17X. In comparing the selected line with the starting population we can evaluate the number of adherent cells, the effect of increased adherence on the course of infection in vivo, including the length of prepatent period, peak parasitemia, duration of infection, and the difference in gene expression of the *P. yoelii* genes. Information gained help to focus our studies on key parasite proteins required for adherence and enable the development of interventions to block adherence and reduce parasite replication.

Genetic Background Differences Used to Identify Genetic Modifiers in Amyotrophic Lateral Sclerosis

Aimee McMullin

Biological Sciences

Dr. Elizabeth Blankenhorn

College of Medicine

Microbiology & Immunology

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease affecting both upper and lower motor neurons. Familial ALS (FALS) affects 5-10% of cases and 20% of FALS cases show a mutation in the Cu/Zn superoxide dismutase (SOD1) gene. Mice containing extra copies of the human mutant gene SOD1 are both clinically and pathologically similar to the classic portrayal of ALS. Disease severity has been found to be affected by genetic background, which suggests the role of disease modifying genes. A genome wide scan of inbred strains, using the F2 generations of B6 and SJL mice, was used to identify QTLs between the two strains. Genetic differences were found on chromosome 17 around 5.74 cM. The SJL mice containing the chromosome 17 QTL were then bred to different lines in order to obtain the chromosome 17 insert on a different line. The mice were genotyped to identify which lines contained the SJL insert. The line which contains the chromosome 17 insert called the B17S line is currently being bred to mice containing the SOD1 transgene in order to create mice with both the region of interest and the transgene. These mice can be used to identify modifier genes, which affect intracellular pathways that lead to motor neuron degeneration. Identification of the modifier genes and also the changes in intracellular pathways can be used to treat disease.

Synthesis of Poly-(2,5-dichloro-1,4-phenyleneterephthalamide)

Tuyet-Nhung Nguyen

Biological Sciences

Poly-(1,4-phenyleneterephthalamide) (PPTA or Kevlar patented by DuPont) is a polymer of high-tensile strength derived from 1,4-phenylenediamine and terephthaloyl chloride. Its rigid crystalline structure makes it the perfect material for tires, bulletproof vests, and other items. This study focuses on the synthesis of PPTA with a new molecule, 2,5-dichloro-1,4-phenylenediamine, in the place of 1,4-phenylenediamine. The extra chlorine atoms are expected to enhance the strength of the overall structure. During this experiment, the synthesis of commercial PPTA was studied and successfully imitated as supported by TGA analysis. The incorporation of 2,5-dichloro-1,4-phenylenediamine into the process is currently in development. Future research entails perfecting the synthesis process for the new molecule and increasing the molecular weight of the product.

Dr. Hai-Feng (Frank) Ji

Chemistry

Hypoxic-preconditioning Increases Proliferation in the Subventricular Zone of Newborn Piglets

Kristina Nikolova

Biological Sciences

Dr. Jahan Ara

College of Medicine

Pediatrics

Neonatal hypoxic-ischemic brain injury is a common cause of long-term neurological disability in children. Despite advances in supportive care, no treatments for hypoxic-ischemic brain injury are available at present. Neural stem/progenitor cells (NSPs) provide the greater potential to regenerate neurons required to reconstitute the brain function. One of the strategies to activate endogenous repair systems is neuronal hypoxic-preconditioning (PC) which represents an adaptive response to prime the brain for protection against future injury. To determine whether hypoxic-preconditioning of neonatal brain increases the proliferation of NSPs in the subventricular zone (SVZ) of newborn piglets, one day old piglets were divided into normoxic and hypoxic-preconditioning groups. Normoxic piglets were subjected to 21% O2 for 3h and PC piglets were subjected to $8\%O_2/92\%N_2$ for 3h. NSP proliferation was estimated by pulsing single 5-Bromo-2-deoxyuridine (BrdU) injections (50 mg/kg body weight) intraperitoneally at 1, 3 or 7 days recovery, two hours prior to sacrifice. Tissue sections were stained for BrdU alone or double stained for either BrdU/NeuN or BrdU/MBP or BrdU/GFAP. Injections with BrdU after PC revealed a robust proliferative response within the SVZ. BrdU immunostaining was also evident in the striatum, white matter and cortex of PC piglets. The number of BrdU labeled cells in SVZ, striatum and white matter significantly increased after PC compared to normoxic controls ($P<0.05$). The BrdU positive cells colocalized with the neuronal marker NeuN, astrocyte marker GFAP and oligodendrocyte marker MBP. These studies demonstrate that hypoxic-preconditioning enhances proliferation in the SVZ of newborn piglet brain.

KISMET-DEPENDENT REGULATION OF GLUTAMATE RECEPTORS IN A *DROSOPHILA* MODEL OF CHARGE SYNDROME

Guovanna Shoukri

Biological Sciences

CHARGE Syndrome, an autosomal dominant birth defect identified by a number of phenotypic anomalies, is caused by mutations in the *Chd7*. The *Drosophila* homolog of CHD7 is kismet encoded by *kis*. Decreased levels of kismet in flies has shown to result in motor defects and hypotonia-like symptoms typically found in CHARGE patients, which suggests that kismet may have an effect on the mechanisms that regulate motor function. The defect in motor co-ordination was assessed by climbing assays. L-glutamate, a neurotransmitter released from the motor neuron, binds to the glutamate receptors (iGluR) at the *Drosophila* NMJ. We investigated the glutamatergic neuromuscular junction (NMJ) of *Drosophila*. We used immunohistochemistry on larval body wall dissections of flies with 90% knockdown in kismet to quantify the iGluRIIB sub-type of glutamate receptors, at the post-synaptic muscle membrane. We observed a decrease in the iGluRIIB subunit of these flies when compared to controls. Further, we will quantify active zones which are the sites for glutamate release at the pre-synaptic component of the NMJ. Thus far, we have successfully optimized for the active zone marker antibody and hypothesize that with decreased levels of kismet, the relative number of pre-synaptic active zones in experimental flies will decrease. Furthermore, we are optimizing for the iGluRIIA subunit antibody. Based on the behavioral and postural defects in flies with decreased levels of kismet, we suggest that there is a similar importance of CHD7 in CHARGE patients. Our study will contribute to better understand the etiology of CHARGE Syndrome.

Dr. Daniel Marenda

Biology

Rescuing Neuronal Defects and Analyzing the Role of kismet in Cardiac Function In A *Drosophila* Model of CHARGE Syndrome

Sylvia Shoukri

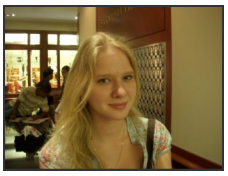
Biological Sciences

Dr. Daniel Marenda

Biology

Drosophila melanogaster, also known as the fruit fly, is an excellent model organism used to analyze the pathogenesis of CHARGE syndrome. This syndrome is an autosomal dominant disorder characterized by mutations of the *Chd7* gene. The homolog of this gene, found in *Drosophila*, is known as *kismet* which shares a high degree of protein homology with the human *Chd7* gene. Through larvae and adult fly brain dissections and immunohistochemistry, it was found that this transcription factor is essential for proper axonal pruning and neuronal cell migration in specific neuronal populations studied thus far. Currently, we are working to rescue the defects seen in these neuronal populations with previously identified molecular targets which are the steroid hormone, ecdysone receptor and the proneural gene, *atonal*. Additionally, we are also analyzing the role of *kismet* in the regulation of glutamate receptor expression in the heart and its affect on cardiac function. It is shown that with a knock down of *kismet*, there may also be a decrease in heart size and overall morphology; therefore, indicating the importance of this protein. With this research, we hope to validate the molecular targets studied by rescuing defects seen in our CHARGE model flies. We look to potentially find novel therapeutic targets to help CHARGE patients and hope to shed light on this disease.

Subcloning of an shRNA Construct Targeting Calcineurin into a Lentiviral-vector pGIPZ



Yekaterina Zavyazkina

Biological Sciences

Subcloning is a technique used in molecular biology that is used to transfer a piece of DNA from the parent vector into the destination vector. This research project aims to clone a short hairpin RNA, or shRNA fragments, from the parent vector named pSM2 into the destination vector named pGIPZ. The shRNA prevents a segment of mRNA from being translated into protein, therefore silencing the expression of a gene. The shRNA fragment to be cloned in pGIPZ targets the gene named Calcineurin.

Firstly, the pSM2 vector has to be restriction digested with enzymes MluI and XhoI to obtain the shRNA fragment targeting Calcineurin out of the vector. PGIPZ is also restriction digested with the same enzymes to cut this destination vector. A ligation reaction is set up where the shRNA fragment is ligated into the cut pGIPZ vector by the enzyme T4 DNA ligase. Once the reaction is set up, the ligation mixture is transformed into chemically competent DH5α E. coli cells. The transformation mixture is then plated on LB agar plates with Ampicillin resistance. Growth of bacterial colonies suggests successful subcloning of the shRNA fragment into PGIPZ. The colonies are then picked, and the DNA is extracted so that it can be cut with XhoI and MluI to double check that the right shRNA fragment is cloned, and cut with SacII to check for recombination. The results from the research project show that the shRNA fragment has been successfully cloned from pSM2 into pGIPZ.

Dr. Aleister Saunders

Biology

The Measurement and Prediction of non-Aqueous Solubility to Control Reaction Outcomes

Evan Curtin

Chemistry

Dr. Jean-Claude Bradley

Chemistry

With knowledge of the solubility of the reactants and products, we can choose a solvent to optimize the reaction and isolate the product through simple filtration. Solubility data was determined via experimentation and was extrapolated along with a melting point to predict solubility in a variety of solvents at different temperatures. Specifically, this information will be used to optimize the Ugi reaction. Information pertaining to the Ugi reaction is obtained by investigation of imines, which are intermediates in the Ugi reaction. Imines can be synthesized by reactions of aldehydes and amines, reactants that can be easily obtained.

O-GlcNAcase as a Novel Regulator of Breast Cancer Growth and Invasiveness

Christopher Schultz

Chemistry

Cancer cells have been shown to have enhanced glucose uptake and altered glucose metabolism. Rather than undergoing oxidative phosphorylation to obtain ATP, cancer cells use glycolysis as their primary means of generating ATP. About 2-5% of glucose enters the Hexosamine Biosynthetic Pathway producing the terminal substrate UDP-GlcNAc, which can then be used by O-GlcNAc Transferase (OGT) to add O-linked GlcNAc moieties onto nuclear and cytosolic proteins. Our lab has shown that breast cancer cells exhibit increased O-GlcNAc and OGT levels, and this plays a role in breast cancer cell proliferation and invasiveness. The purpose of our work has been to examine the potential role of O-GlcNAcase (OGA), the enzyme that removes O-GlcNAc modification in breast cancer. Through western blotting, we have shown that OGA levels are decreased in both ER+ and ER- breast cancer cell types compared with normal mammary epithelial cells. We then knocked down OGA in MCF-7 cells (a breast cancer line) using RNAi technology and monitored anchorage independent growth and invasiveness via soft agar and 3D culture. Additionally, we have examined the effect of OGA depletion on levels of the oncogenic transcription factor FOXM1 and the cell cycle regulator p27 via western blotting. These data present the possibility that restoration of OGA may attenuate invasiveness and proliferation in the context of breast cancer.

Dr. Mauricio J. Reginato

College of Medicine

Biochemistry & Molecular Biology

Activation of Tris(amino-pyrazole)zinc Bromide through Template Synthesis

Lee Serpas
Chemistry

Dr. Elizabeth Papish
Chemistry

The synthesis of tris(pyrazole)zinc halide salts are known in the literature, but not much is known on whether new reaction pathways can be established with these salts. One such reaction pathway is template synthesis, reactions involving the activation of the pyrazole ligands in the zinc salt and coordinating them to a linking group or atom. This reaction pathway can lead to the formation of metal complexes supported by pyrazolyl chelates. For our study, we used tris(amino-pyrazole)zinc bromide salt and performed a series of reactions to determine if template synthesis on this salt is successful. Our first study investigated the reaction involving formaldehyde, base and zinc salt to determine whether a tris ((pyrazolyl)methyl)amine zinc bromide complex is obtainable. Our secondary study involved the reaction of KBH4 and zinc salt to determine whether a tris(pyrazolyl)borate zinc bromide complex is formed. Our future goal from these studies is to develop new zinc complexes containing hydrogen bonding groups that can be further reacted at the metal center.

Community Newspaper Coverage of Japanese-American Internment

Alissa Falcone

Communication

Dr. Ron Bishop

Culture & Communication

For most Americans, the "Day of Infamy" is known as December 7, 1941, when the Imperial Japanese Navy launched an air attack on the American military base Pearl Harbor in Hawaii. However, for most Japanese-Americans, another date relevant to America's involvement in World War II is equally notorious. On February 19, 1942, President Roosevelt signed Executive Order 9066, which essentially authorized the internment of 120,000 American citizens of Japanese ancestry and resident aliens from Japan. Ten Japanese-American relocation camps were later constructed in seven states in western United States. Out of these, two camps were built in Arizona: Poston, in southwestern Arizona, and Gila River, about 30 miles southeast of Phoenix. This study is an analysis and examination of the coverage of the internment camps provided by local community newspapers. In order to research this, I located and requested local newspapers from outside of each camp, in addition to contacting nearby libraries, museums, and historical societies for additional information, such as obituaries or biographies of personnel involved with the aforementioned newspapers during the time of internment. I also researched and located people from the papers as well as surviving internees.

The Effects of Weather Conditions and Anthropogenic Oxygen Depletion on Diamondback Terrapin (Malaclemys terrapin) Activity and Abundance

Lauren Donaghy

Environmental Studies

Dr. Harold W. Avery

Biology

Barnegat Bay, New Jersey, is increasingly threatened by the high volume of human activity and the concomitant influx of nutrients; nutrient loading leads to eutrophy, which ultimately leads to the loss of submerged aquatic vegetation (SAV). The diamondback terrapin depends on these SAV beds for survival, as the terrapin's diet consists primarily of crabs and snails, which in turn consume aquatic vegetation. Through measuring the dissolved oxygen, presence of underwater invertebrates, and rates of terrapin captures at three different study sites within Barnegat Bay in the summer of 2011, I determined the relationship of weather conditions and dissolved oxygen depletion to terrapin activity and abundance. Since terrapins depend on invertebrates for sustenance, higher terrapin trapping success rates may be related to greater invertebrate presence. In areas of oxygen depletion, there may be fewer terrapins present because invertebrates that rely on dissolved oxygen perish or move. Weather conditions such as barometric pressure and rainfall may also affect terrapin behavior. Low-pressure weather systems and rainfall may trigger increased rates of terrapin activity and capture rates. Terrapins depend physiologically on the fresh water that rainfall provides, and therefore they may become more active during such weather conditions. Positive correlations between low atmospheric pressure, rainfall, and higher food abundance to capture rates of terrapins are expected. Understanding how wildlife such as terrapins respond to anthropogenic impacts such as oxygen depletion, and natural weather conditions, are important to conservation and management programs for threatened wildlife.

Public Reason and International Morality

Kathryn N. Bassion

International Area Studies

Dr. Douglas V. Porpora

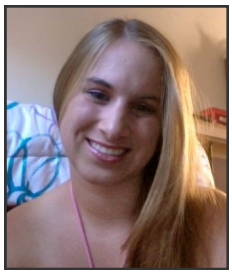
Culture & Communication

The Abu Ghraib scandal and 2003 Iraq War and the resulting media coverage has changed the face of foreign relations for the United States of America. A statistical analysis of media coverage focuses a clearer lens on how moral matters at an international level, such as war, torture, and terrorism, are debated in newspaper opinion pages, online discussion groups, and television. An examination of French media commentary provides a useful basis for cross-examination. This research will indicate that religion has been largely privatized and moral discourse has followed suit. The public revert to prudential arguments rather than moral judgments due to the ambiguous nature of morality. It is imperative that morality's "collective reflections" are characterized not as unreasoned intuition but articulated as a conversational deliberation of norms that form the basis of our society.

Study of Police Officer Testimony in Preliminary Hearings

Sean Craig

International Area Studies



Mariah Trisch

General Engineering

Dean Daniel M. Filler

Earle Mack School of Law

Police officers have often been referred to as professional witnesses because they are called to testify in court so often. Judges or juries may view police as more accurate and credible than civilian witnesses due to their expertise and experience. However, the accuracy and credibility of police testimony should not be taken as a given. Some studies have demonstrated that police officers are more prone to view a citizen as partaking in criminal activity. Extended periods of time may pass between the incident and the court date and as the memory capacity of a human is limited, testimony may be inaccurate. Additionally, police may stretch truth to insure their account of facts complies with the Fourth Amendment. This past year the ACLU brought a class action lawsuit against the City of Philadelphia that alleged that thousands of people are illegally stopped and searched on the streets of Philadelphia. In light of this case, Bailey v. City of Philadelphia, the number and reasons for police stops on the streets of Philadelphia have become prevalent issues. This study seeks to find whether police testimony provided in hearings reflects repeating patterns. The study focuses on police testimony in preliminary hearings pertaining to alleged drug deals during the summer of 2011. Data was collected from the South West and East Detective Districts through observing courtroom proceedings. Data was organized and trends discovered. Findings resulted from searching for similarities in testimony. Review and organization of data resulted in the discovery of patterns within police testimony; however, reasons these patterns exist cannot be determined without further research.

Newton's Method and Roots of Polynomials Associated with Painlevé Equations

Leland Machen
Mathematics

My project was to study the roots of various polynomials associated with the Painlevé Equations, which have numerous applications to a wide variety of topics. The roots of these polynomials have very interesting patterns, which is quite unexpected. Typically a random polynomial will have roots scattered throughout the complex plane, especially as you look at larger and larger polynomials. However these special polynomials form patterns such as squares and triangles.

I began by writing Java code to compute the roots of the polynomials utilizing Newton's Method. I was able to refine this by creating initial guesses based on the discernible patterns formed by the roots. I then modified my code to create images to further analyze the polynomials. For every pixel in the region, I determined to which root and how quickly that point would converge by using iterative steps of Newton's Method.

Dr. Ronald Perline
Mathematics

At first it could take between several minutes and several hours to render each image, depending on the resolution and complexity of the polynomial. However I had a huge breakthrough when I was able to write a combination of Java and C code that allowed me to compute using my Graphics Processing Unit (GPU) as opposed to my Central Processing Unit (CPU). GPUs are so powerful because they are designed to process large amounts of calculations in parallel, which meant that I could calculate every pixel in the image simultaneously, instead of one at a time. This allowed me to render images in a matter of milliseconds, making it far easier to study the intricate patterns within.

The Behavior of Magnetic Nanodots for Information Storage

Gabriella D'Urbano

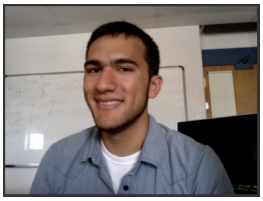
Physics

Vortices are what make up the storage capacity of our computers and much of the rest of our current technology. The purpose of this project was to study the difference in storage abilities of vortices by their state. Vortex state is characterized by its polarity and its chirality, both of which are independent of one another; because of this, a difficulty arises in controlling the vortex state. Through the manipulation of the geometry of the domain, vortex state can be better controlled. Through the study of the geometry and state of the vortices the capacity and energy efficiency of computers can be greatly increased. Since actual measuring instruments are beyond the scope of this project, the study of these domains was accomplished through simulations by the use of the Object Oriented MicroMagnetic Framework. It was concluded in this project that certain geometries of domains far better control the vortex state.

Dr. Goran Karapetrov

Physics

Searching for a Nuclear Georeactor with Anti-Neutrinos



Jeremy Gaison

Physics

A possible energy source for the Earth's magnetic field is a geo-reactor, a natural nuclear reactor at the core of the planet. To determine the feasibility of this geo-reactor, we analyzed data from the Kamioka Liquid scintillator Anti-Neutrino Detector (KamLAND) experiment to set limits on the power output of this hypothetical nuclear reactor. Making use of measurements of the anti-neutrino rate detected by KamLAND, we estimate the thermal power of the geo-reactor.

Based on the 10 years of data collected by KamLAND, the most likely power output of this geo-reactor is 11.1(+9.9, -8.7)TW. This result is more than 1σ above zero. While these results suggest the existence of a geo-reactor, the energy output is higher than expected (3-10 TW). Also, the sum of reactor heat (11.1 TW) and expected radiogenic heat (19-31 TW) falls within measurements of direct heat flow from the Earth which are between 30 and 44 TW.

Dr. Jelena Maricic

Physics

Statistical Analysis of Galaxy Clusters Using Weak Lensing Reconstruction

William Giang

Physics

Dr. David Goldberg

Physics

We compare weak lensing reconstructions with numerical simulations of galaxy clusters. The simulations predict elliptical profiles, and parameterized models are used to break the mass-sheet degeneracy. Navarro-Frank-White (NFW) and Singular Isothermal Sphere (SIS) profiles are commonly used to describe the clusters.

Future work includes studying the effects of cluster orientations and observer position.

Star Formation Rates and HI Gas in Void Galaxies

Robyn Smith

Physics

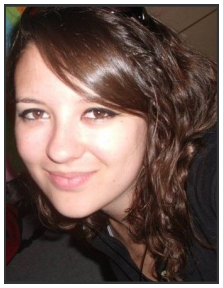
Dr. Michael Vogeley

Physics

Galaxies tend to cluster and form a filamentary structure throughout the universe. Found throughout this larger structure are voids – regions that are significantly less dense than the cosmological average. Understanding the effect of the surrounding environment on a galaxy's star formation rate and photometric properties is crucial in order to determine how galaxies and the universe have evolved. The goal of this project is to study the star formation rates and photometric properties of void galaxies utilizing data from the Sloan Digital Sky Survey (SDSS) and the Arecibo Legacy Fast ALFA Survey (ALFALFA).

Accurate calculations of star formation rates and photometric properties rely on two things: 1) correctly identifying optical matches to radio data from ALFALFA, and 2) using reliable photometry of optical data. The resolution limit of ALFALFA is too low to distinguish between galaxies that are very close together, so we rely on the positional accuracy of the radio source to identify optical matches. Once a confident optical match is found, we inspect the photometry because SDSS tends to incorrectly deblend low surface brightness galaxies. Where there appears to be a serious error, we run a separate algorithm to redo the photometry. Once we compile a sample of confident matches, we will compare the efficiency of star formation in galaxies in voids and non-voids by calculating the ratio of stellar mass to gas mass and the ratio of star formation to gas mass.

Approaches to the Restoration of Competency to Defendants Deemed Incompetent to Stand Trial: Do They Work?



Anna Danylyuk

Psychology

Dr. Kirk Heilbrun

Psychology

Incompetence to stand trial is an area within forensic psychology that is in great need of further research. Many studies have been aimed at measuring competency, but too few focus on the treatments of defendants after they have been adjudicated incompetent to stand trial. This study considers the historical background and contemporary research on CST to establish which interventions appear to be most effective in the restoration of competency. Problem-oriented approaches that target specific functional deficits relevant to incompetence, rather than the non-specific treatment of symptoms of severe mental illness, appear to yield the best post-treatment results.

Support Models for High-Functioning Students on the Autism Spectrum in College

Emily Morris

Psychology

Dr. Felicia Hurewitz

Psychology

Background: High-functioning adolescents on the autism spectrum are increasingly more likely to pursue postsecondary education. As a result, some colleges and universities have started to create programs designed to smooth this population's transition into adulthood. Autism support is offered in various approaches. Some of the programs aim to support students by facilitating their academic success and improving their sociability. Others focus on refining personal living skills and vocational preparation. Many utilize peer mentors or social coaches or provide additional psychological services. The programs were ultimately created to strengthen the quality of life for autistic individuals.

Method: Ten autism support programs in the United States were studied in depth. The following aspects were investigated: academic support, social support, psychological support, independent living support, campus and community support, program criteria, the admissions process, and fees. The programs were then assessed based on supports recommended by adolescents on the autism spectrum and their families.

Discussion: The programs vary from intensive to available as-needed. Some programs are intended for students seeking a standard degree, while others are not degree granting. Social skills practice followed by academic assistance were deemed the most crucial supports. While there are claims that these types of college support programs enhance the quality of life for persons on the spectrum, minimal research has explored the overall productiveness of these programs. We propose necessary areas of future research, including criteria that may be used during and after college years to measure outcomes.

Effects of Claw Length and Proportion to Body Size on Interspecific and Intraspecific Competition for Limited Resources in *Trachemys scripta elegans* and *Pseudemys rubriventris*

Johnathan Daniel Guest

Undecided
Science

The claw length of juvenile turtles relative to body size is thought to be a physical characteristic that gives an individual or species a competitive edge. Juvenile turtles with larger claws in proportion to body size may correlate with more frequent feeding and basking interactions, which may play a role in a turtle's ability to obtain resources. Assuming that the ratio of claw length to plastron length (Cl:Pl) is a characteristic that enables juvenile turtles to better utilize resources, the individual or species with a lower Cl:Pl ratio should be able to feed and bask more easily. This study examined how the Cl:Pl ratio of an invasive turtle species, *Trachemys scripta elegans*, and a native species, *Pseudemys rubriventris,* impacts the ability to obtain resources. Six *T.s. elegans* and six *P. rubriventris* were housed in a single tank, with a stationary platform used for basking and feeding that was monitored by camera. This experimental design was replicated three times. The length of the middle claw on the right forefoot of each turtle was measured weekly to the nearest 0.1 mm using digital calipers. The results of this study show that the Cl:Pl ratio was slightly lower for *T.s. elegans* than *P. rubriventris*, suggesting that *T.s. elegans* may have a competitive advantage. However, the correlation between Cl:Pl ratio and increased competitive behavior is yet to be determined.

Dr. Harold W. Avery

Biology

Development and Characterization of Anion Exchange Membranes for use in Alkaline Fuel Cells

Rishon Benjamin

Chemical Engineering

In the recent years, solid polymer electrolyte membranes have garnered much interest. Its wide range of applications in fuel cells and the ability to do away with the use of fossil fuels makes it a promising innovation of the 21st century.

However, the Hydrogen-Oxygen fuel cell that was developed makes use of proton exchange membranes (PEM) and platinum as a catalyst, thereby making it expensive. During the STAR program, I worked on developing and characterizing anion exchange membranes (AEM) for use in fuel cells, the major benefit of which is that AEMs can function with non-precious metals as catalysts.

My focus was primarily on AEM characterization. I performed dimensional analysis and water uptake measurements on the membranes to determine how the membranes behave in solvents such as water and methanol. Next, I used Electrochemical Impedance Spectroscopy to measure the ionic conductivity of these membranes. I then performed Differential Scanning Calorimetry on them to analyze how they behaved at varying temperatures. Lastly, I prepared Membrane Electrode Assemblies for the standard H2-O2 fuel cell and performed fuel cell experiments, which served as a control for the AEMs. The above experiments were also performed on two different types of PEM's so as to create a basis for comparison.

Dr. Yoseff Elabd

Chemical & Biological Engineering

Our results showed that while AEM's are economically more efficient, they do not perform as well as the standard PEMs that are being used. However, if AEMs are able to match the power output of standard H2-O2fuel cells, they could prove to be a marvelous source of clean energy.

MWNT/Polyurethane Nanocomposite for Stretchable Negative Index Material

Harrison Bradley

Chemical Engineering

Dr. Hai-Feng (Frank) Ji

Chemistry

Creation of negative index materials (NIMs) has been documented as early as the late 1990s, and most of this work uses a complex combination of split -ring resonators and straight metallic wires. These materials demonstrate both negative magnetic permeability and negative electrical permittivity over the same frequency range. More recent work has introduced a simplified approach, using arrays of short wire pairs and continuous wires that are more compatible with conventional fabrication techniques. Our current work focuses on creating a stretchable NIM so the refractive index of the material has a negative value at different frequencies when stretched. Recently, a stretchable conductive nanocomposite has been successfully made from multi-walled carbon nanotubes dispersed in polyurethane. We will pattern this composite on an unmodified polyurethane layer, according to the short wire pair NIM structure. The frequency over which the short wire pair structures exhibit a negative refractive index has been shown to be inversely proportional to the length of the short wires. Therefore, by creating this structure from stretchable materials, we hope to easily modify the resonant frequency of the wire pairs. This should result in a NIM that is effective over a frequency range controllable by stretching. The material will have applications in defense (such as stealth aircraft), health (such as superlenses), etc.

Trap Grease Conversion to Biodiesel and its Economics

Jacklyn Briguglio

Chemical Engineering

Trap grease, also known as brown grease, is a waste product from the food service industry. trap grease is a heterogeneous mixture of lipids, water, food particles, detergents, and other undesirable components. Due to its high lipid content, trap grease is a viable feedstock for biodiesel production. A procedure to isolate lipids from trap grease was implemented and optimized during the project. Upon mild heating (60C) the lipids in trap grease coalesce and rise to form a lipid layer that can be decanted and filtered. Several analytical tests, including titration, Thermogravimetric Analysis, Nuclear Magnetic Resonance, and Mass Spectroscopy, were used to measure the composition of trap grease before and after conversion to biodiesel. The lipid layer was composed of approximately 86% free fatty acid which can be converted to biodiesel using an acid catalyzed bubble column reactor. Results show that raw trap grease contains between 30% to 50% lipids of which nearly all can be converted to biodiesel. Using yields from this project and collaboration with Russell Reid, a waste management company that collects trap grease, an economic analysis of a trap grease to biodiesel pilot plant is being developed.

Dr. Richard Cairncross

Chemical & Biological Engineering

Exfoliation of MAX phases to create MXene

Joshua Carle

Chemical Engineering

MAX phases are ternary metal carbides and/or nitrides that contain at least three different elements; an early transition metal (M), an A-group metal (A), and carbon and/or nitrogen (X). The MAX phases are found in ratios of 2:1:1, 3:1:2, or 4:1:3 and the structure is composed of alternating M and X layers interleaved by an A layer. The goal of the research was to exfoliate the MAX phases by removing the "A" layer, leaving the MX layers (MXene) that in principle can be used in the same way as graphene and other similar two-dimensional materials. This was attempted by wet chemistry; combining different powdered MAX phases with acids and bases of varying concentrations. They were left to react for varying times, usually between 2 hours and 10 days, and were done at either room temperature or about 50°C. Currently, 211, 312, and 413 MAX phases have been exfoliated using hydrofluoric acid. Testing is continuing to see whether or not other acids or bases can attain the same results. Due to compositions that are quite different from graphene, the MXenes could be useful in applications that graphene is not or could be more effective. Such uses of MXene include, but are not limited to, lithium ion batteries, pseudocapacitors, and/or other electronic applications.

Dr. Michel Barsoum

Materials Science & Engineering

Increasing the Production Output of Carbon Nanotubes via Chemical Vapor Deposition

Anthony Durbano

Chemical Engineering

The purpose of the project is to increase the production of carbon nanotubes so that they can be used in various scientific applications. In many types of production that occur in the Materials Science and Engineering Department, making the carbon nanotubes can often be the rate-limiting step.

The current process for manufacturing nanotubes involves chemical vapor deposition (CVD). This process involves heating a carbon-containing gas to the point where it decomposes and deposits carbon on the given surface. The surface used for creating nanotubes is a porous anodic aluminum oxide (AAO) membrane. The pores act as tube-shaped templates for creating the nanotubes, as the carbon is deposited in a tube shape.

Dr. Michael Schrlau

Materials Science & Engineering

Originally, the process was only thought to be able to use 6 AAO membranes per CVD run. The goal of the project was to increase this to 100 membranes per run. The amount of membranes per run is directly proportional to the amonunt of nanotubes produced. By gradually increasing the amount of membranes, the production eventually was able to reach 100 fully deposited membranes.

With the production greatly increased, carbon nanotube manufacturing no longer has to be the rate limiting step of longer processes.

Applying Oxide Absorber Layers to ETA Solar Cells

Samuel Hardy

Chemical Engineering

Extremely thin absorber (ETA) solar cells have high conversion efficiency because the thin absorber layer prevents recombination and are the current focus of the nanomaterial for energy application and technologies (NEAT) lab. These cells are made from a hole conductor (p-type), an absorber and an electron conductor (n-type). Since these cells use much less material their cost is lower than that of standard solar cells. The current configuration of the ETA solar cells being produced in the NEAT lab is copper thiocyanate (p-type) on top of cadmium selenide (absorber) on top of zinc oxide nanowires (n-type). However cadmium selenide is somewhat expensive and dangerous since it is made out of cadmium. However both the copper thiocyanate and cadmium selenide layers can be replaced with a layer of copper (I) oxide. A copper (I) oxide layer can be deposited on zinc oxide nanowires through electrodeposition. To this date I have successfully deposited copper (I) oxide onto zinc oxide nanowires and filled the pores between wires with copper (I) oxide. Since the copper (I) oxide has been determined to be morphologically viable then in the coming weeks I will begin to make fully functioning cell with copper (I) oxide and test their efficiency.

Dr. Jason Baxter

Chemical & Biological Engineering

Fabrication of Nanofiber-based Electrodes for Use in Lithium-Air Batteries

Alice Hu

Chemical Engineering

Most laptops use lithium-ion batteries because of their high energy to weight ratio. Research is being conducted to develop lithium-air batteries to improve the energy density of lithium-ion batteries by tenfold. The aim is to develop a hybrid organic/inorganic nanofiber-based electrode for lithium-air batteries that incorporates multi-phase boundaries where all reactants are present together for the electrochemical reaction to take place efficiently. Nanofibers have been produced using a process called electrospinning that uses a strong electric field to thin a polymer solution forming ultra thin fibers with diameters in the range of 50-500nm.

As a first step, nanofibers from poly vinyl alcohol (PVA)/water/ manganese acetate solution were fabricated and then calcined at 700oC. The calcination process burned away PVA and synthesized porous nanofibers of manganese oxide nanoparticles, which have been shown to be excellent catalysts for Li-air batteries. SEM was used to make sure that the nanofibers retained their morphology after the calcination and XRD was conducted to characterize the crystal structure.

Dr. Vibha Kalra

Chemical & Biological Engineering

To incorporate carbon (for electron conduction) in these nanofiber electrodes, PVA/water/ manganese acetate solution was spun coaxially with a polyacrylonitrile (PAN)/dimethylformamide (DMF) which, when calcined, can form carbon nanofibers decorated with catalyst nanoparticles on their outer surface. In order to ensure that the nanofibers were coaxial, SEM and microtoming techniques were used and XRD was used again to characterize the crystal structures.

Having an excellent catalyst and a means of electron conduction, a nanofiber-based electrodes for use in lithium-air batteries are not far.

Poly(3-hexylthiophene) as an Organic Hole-Conductor in Extremely Thin Absorber Photovoltaics

Paul Lachaud

Chemical Engineering

Dr. Jason Baxter

Chemical & Biological Engineering

The purpose of this project is to investigate Poly (3-hexylthiophene) (P3HT) as an organic hole-conducting (p-type) layer in organic-inorganic Extremely thin absorber (ETA) solar cells in planar and nanowire array morphologies. ETA layer provides high surface area with a thinner layer, leading to lower charge recombination by having a thin film absorber coated on geometrically structured material. Organic polymers are appealing in solar cells because of their potential to be cheaply processed on large scale production through roll-to-roll processing. Poly(3-hexylthiophene) is a promising polymer for photovoltaic applications due to its high charge mobility compared to other polymers. In these cells, Zinc Oxide nanowires (ZnO NW) prepared by chemical bath deposition (CBD) or ZnO thin films prepared by dip-coating are utilized as the electron acceptor (n-type). Cadmium Selenide (CdSe) deposited by electrode position is utilized as a light absorbing layer between the transparent n-type and p-type materials. The P3HT was deposited on the ZnO core/CdSe shell nanowires with a 2% by weight solution of P3HT in Chlorobenzene by spin coating. Scanning electron microscopy (SEM) show that P3HT infiltrates the ZnO NW/CdSe arrays. Further experiments will be completed to determine the effect of P3HT compared to Poly(3, 4-ethylenedioxythiophene) (PEDOT) on the current-voltage characteristics of these cells in various ZnO nanowire and planar arrangements.

Controlled Growth of Nanowires for Solar Cell Applications

Daniel McPherson

Chemical Engineering

An extremely thin absorber (ETA) solar cell is a cell that has a high solar energy conversion rate. It has an n-i-p semiconductor arrangement that is composed of electron carrier, absorber, and hole carrier layers. To create the ETA solar cells, zinc oxide (ZnO) has been selected as the primary electron carrier, cadmium selenide as the absorber layer, as well as a number of hole carriers such as electrolyte solutions of potassium ferricyanide and potassium ferrocyanide, copper thiocyanate, and P3HT. In order to maximize efficiency in ETA solar cells, nanowire arrays have been used to decrease the thickness of the absorbing layer in the cell while still containing the same volume of the absorbing layer compared to a planar cell. However, there have been problems when trying to deposit the hole conducting layers of the cell on top of ZnO nanowires covered in cadmium selenide due to a lack of space between the wires. In response, a method is being developed to create a less dense array of ZnO nanowires through use of an extremely thin layer of TiO2 above a dip-coated ZnO seed layer. This layer was created by spin coating a solution of .033M titanium isopropoxide and .033M diethanolamine and is believed to block the nucleation of nanowires on the ZnO seed layer so that the number density of nanowires decreases.

Dr. Jason Baxter

Chemical & Biological Engineering

Reconstituted Limestone

Meredith Snyder

Chemical Engineering

Dr. Michel Barsoum

Materials Science & Engineering

It is believed that in the process of making the Great Pyramids, the Egyptians cast blocks of reconstituted limestone instead of carving them from natural limestone. Their recipe consisted of water, lime, clay or diatomaceous earth, and an aggregate. This simple formula is earth friendly, relatively cheap, easy to find and sustainable in proper ratios. Ordinary Portland Cement (OPC) is what is most commonly used in concrete around the world. However, it is responsible for putting 5% of the worlds CO2 pollution into the air. Besides its contribution to pollution, it's expensive and it cracks after awhile. Using the idea behind the Pyramids, 2" x 4" cylinders were made and tested for strength using the Instron machine at 7,14, and 28 days. The cylinders were composed of CaO (lime), Diatomaceous Earth, Granulated Limestone (aggregate), and water. The purpose of making and testing the cylinders was to determine if the formula would be strong enough withstand a real-life setting.

A proof of concept involving this formula is the construction of a garden shed at a living community in South Philadelphia. If this shed can be built and it resists natural weather and wear and tear, it proves the idea behind this research. It legitimizes the fact that this cheaper and more environ mentally friendly concrete is an option for mass production. If construction companies switched from OPC to this simpler method of reconstituted limestone, they could significantly cut down the pollution in the world. Besides the pollution factor, its low cost would make it suitable for third world nations struggling to make shelters and various buildings. Testing and research will be continued to create a sturdy and sustainable shed.

Waste to Fuel: Cultivating Algae for Oil Using Landfill Waste

Eliya Hurd

Civil Engineering

Dr. Mira Stone Olson

Civil, Architectural, & Environmental Engineering

This project is designed to evaluate the economic feasibility and efficiency of using landfill leachate and gas streams to grow algae that could be used to produce biofuel. As waste decomposes in landfills it produces landfill gases, both carbon dioxide and methane, as well as landfill leachate. If these waste streams could be recovered and used as feedstocks for biofuel synthesis, landfills could in turn become on-site biorefineries.

The first step towards creating an on-site biorefinery in a landfill is to determine the growth conditions under which algae produce the highest yield of fuel-grade lipids. Batch experiments were used to determine the optimal leachate dilution that would support algal growth. Samples were tested daily for chlorophyll concentration using a Fluorometer. The fluorescence reading could then be used to calculate the concentration of algae in the sample.

Graphing the sample's fluorescence versus time in hours gave a clear depiction of which dilution provided the optimal conditions for the algae. The growth curves showed that any dilution over 20 percent leachate did not allow for any algal growth, and dilutions between 1 and 10 percent allowed for the most. More batch experiments will need to be conducted in order to find the optimal dilution, as well as tests to determine the lipid concentrations in the algae.

These results will be used to design a pilot-scale bioreactor, which will then be tested and used to create a bigger biorefinery to be placed in a landfill.

Calibration of Orifice Reduction Device for Measuring Flow Rates in Hydrology Experiments

Jeffrey Resnick

Civil Engineering

Dr. Franco Montalto

Civil, Architectural, & Environmental Engineering

A major concern in cities is how to deal with the vast amounts of storm water that they receive. Since concrete, metal, and asphalt dominate the terrain in urbanized areas, there are fewer natural places that absorb water during a rainfall event. Therefore, it is necessary to reduce the amounts of rainfall that actually enter the sewer system in cities, so that water treatment facilities do not get backed up to the point where they must release untreated water back into the environment. By building a rainfall simulator, careful measurements can be observed in a laboratory setting that will tell developers, builders, and city planners alike what combinations of vegetation and soil are best to reduce runoff. In conjunction with the rainfall simulator, an experimental plot has been built from which runoff and infiltration rates will be measured. In order to measure these rates, orifice reduction devices will be used. The ORD acts as a flow meter for the rainfall simulator, so when a rainfall event is simulated, the quantity of runoff water can be calculated. The depth of water in the ORD is measured using a pressure transducer, and in order to equate the depth to a flow rate a calibration procedure must be performed. This work will present the results of the calibration procedure for two ORDs, which will later be used in conjunction with the rainfall simulator.

Prioritizing Repairs on Long Span Bridges

Delia Votsch

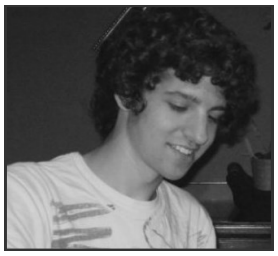
Civil Engineering

There are widespread concerns about the condition of the nation's infrastructure, but limited knowledge about how to prioritize among the many needs. This project aims to survey experts on nine different repairs needed on a long span bridge. Identifying and contacting potential respondents who have the specialized expertise needed to take the survey is a large portion of the project. Once a sufficient number of respondents have been reached, the data will be taken from the survey, and analyzed. If the data will show a consensus regarding the priority and necessity of the range of repairs, then this can inform consensus guidelines for prioritization. If a consensus is not found then the areas of disagreement can be identified from this survey and serve to guide future deliberations and research to arrive at a consensus.

Dr. Patrick Gurian

Civil, Architectural, & Environmental Engineering

Adiabatic Circuits and Clocking



Richard Andrew Benton

Computer Engineering

Dr. Baris Taskin

Electrical & Computer Engineering

The traditional CMOS circuit families that are most common in today's computer electronics are very fast and easy to construct. However, these circuits are not the most efficient. The 2n_IPGL circuit family can create a 70% power savings and the use of a Rotary Clock can increase power savings as opposed to a clock tree. The combination of these to techniques could save even more power, but requires adjustments to the Rotary clock for compatibility. This project explores the creation of 2n_IGPL circuit layouts and the use of a Rotary Clock when paired with these circuits.

RETWEETING ON TWITTER

The purpose of this project is to collect tweets from the social networking website Twitter to ascertain the correlation between a tweet being posted again by another user (a retweet) and various properties of the user, the user's followers, and the tweet itself. These properties include the presence of a hashtag in the tweet, the length of time the user has had the Twitter account, and the number of followers of the user. This project is part of a research goal to understand how information propagates through online social networks and how some media (e.g., videos) become viral. This understanding of the characteristics of information propagation has applications in the development of marketing strategies by businesses, development of public policies by governments, development of defenses against virus propagation by computer professionals and the development of social theories by sociologists.

Michael Mitrione

Computer Engineering

Dr. Harish Sethu

Electrical & Computer Engineering

High Performance Simulation

Michael J. Conway

Computer Science

Dr. Jeffrey Johnson

Computer Science

It is impossible to analytically solve a gravitational system involving an arbitrary number of bodies; moreover, it is infeasible to conduct experiments on this scale. In order to study these n-body systems, it is necessary for astrophysicists to design and run computer models based on the fundamental law of gravitation. Unfortunately, the computational load in performing such simulations grows quadratically with the number of particles, as each particle pair must be considered. Various techniques, ranging from approximation algorithms to hardware-level parallelism, have been employed to make n-body simulations faster. The Astrophysical Multipurpose Software Environment (AMUSE) gathers a wide range of astrophysical simulators written in several low-level languages, such as FORTRAN and C, and provides a uniform high-level Python interface. However, even this interface requires significant programming experience to operate properly. The main goal of this project was to continue the development of the GPUnit graphical interface for running AMUSE simulations. Pilot runs identified areas of the program requiring further development, such as support for running simulations on a remote cluster. Based on this preliminary information, numerous design improvements and additional features were implemented. The resulting program made the capabilities of the AMUSE framework more readily available to novice users. It is expected that these modifications will allow researchers to take advantage of the full potential of the AMUSE software.

Multitouch Surfaces as Musical Interfaces

Ryan Daugherty

Computer Science

Dr. Youngmoo Kim

Electrical & Computer Engineering

Multitouch surfaces allow users to interact with computers in ways that would have never been possible with traditional computer input devices. The goal of my research was to create and analyze multitouch musical interfaces and study how a user interacts with them.

Three different programs were made: one that limits the sounds a user can make but almost always sounds good, a sound synthesizer with keys arranged in a specifically designed pattern to make certain sound combinations easy to play that dynamically generates sounds, and a traditional piano interface that interacts with a physical grand piano.

By examining these different interfaces and watching how users use them, we will know more about how users interact with multitouch surfaces and be able to design future musical interfaces that are easier for the musically inexperienced to use.

Multi-band Dipole Antennas for Cognitive Radio

Anthony Matsanka

Electrical Engineering

Dr. Kapil R. Dandekar

Electrical & Computer Engineering

As wireless communications continue to evolve, frequency crowding and antenna size are becoming larger issues. New antennas designs are needed to fit devices and work with new intelligent software. One such new antenna type is the multiband antenna. The length of an antenna's arm corresponds to the frequency that they resonate at, which allows a signal to be sent wirelessly. Multiband antennas take advantage of this property because they are comprised of more than one arm. As an exploration of multiband reception and transmission, a multiple nested frame dipole antenna with three bands was designed. The antenna was computer modeled with Ansoft High Frequency Structure Simulator (HFSS) and optimized for the 1.8, 2.4, and 3.5 GHz frequency bands. It was constructed using a printed circuit board milling machine. The antenna was then measured with a network analyzer. It was found to have strong signals at the three desired frequencies. This antenna design will be used in conjunction with a software define radio testbed known as the Wireless Open-Access Research Platform (WARP). Using the multiband antenna, WARP will perform cognitive radio techniques to assess if a frequency band is being used, and switch operating modes to make use of bands that are not in use. The overall goal of this work is to demonstrate the potential performance gain when a radio system is capable of adapting its operating frequency based on the assessment of the frequency bands available for use.

Replacing Carcinogenic Polystyrene with Alginate Foam

Jared Ely

Materials Science & Engineering

Dr. Caroline Shauer

Materials Science & Engineering

This project attempted to discover whether biocompatible alginate foam could potentially replace polystyrene as a building material because polystyrene (Styrofoam) was recently labeled a carcinogen by the National Toxicology Program. Different patents were gathered which contained methods for producing different types of alginate foams and analyzed for relevance. Next, the materials for creating the potential replacement foams were collected and the different foams were made. After performing qualitative analysis on the foams, the foams were subjected to a compressive test on an Instron machine. It was found that the alginate foam had a much lower Young's Modulus and compressive strength than polystyrene, meaning that it has a lower mechanical strength. More tests, such as thermal conductivity and absorbency, must be performed to determine whether or not the alginate foam can successfully replace polystyrene as a construction material.

KOH Activation of Carbon Onion Supercapacitors

Peter Vincent Palena III

Materials Science & Engineering

Dr. Yury Gogotsi

Materials Science & Engineering

Carbon onions, or onion-like carbon (OLC), is a nanostructured carbon material that can be used for supercapacitor applications. It is known that OLC displays characteristics of a supercapacitor at much faster charge-discharge rates compared to traditional materials, such as activated carbon or carbide-derived carbon (CDC). The goal of these experiments was to alter the structure of the OLC to increase the capacitance while maintaining capacitive behavior at fast charge-discharge rates.

OLC was submitted to an activation process to remove some of the carbon atoms on its surface, creating a rough exterior or even pores, hence increasing the surface area and capacitance. Potassium hydroxide (KOH) was used as the activating agent. By varying the time and temperature of the activation process, different surface textures were formed.

Nitrogen gas-sorption confirmed that micropores (<2nm) had been created in the material. The electrochemical performances of the samples were tested using cyclic voltammetry (CV) to measure capacitance and resistance at high scan rates. A scan rate is proportional to how fast the capacitor is charged and discharged. Ideal performance was categorized as high capacitance with low resistance. The CV results showed that a more intense reaction process, meaning longer time or higher temperature, produced a material with higher capacitance, but also an increased resistance. At high scan rates, the less intense reaction had more capacitive performance. These results suggest that a lower temperature than the tested values may provide the ideal conditions for synthesis. Further work includes experimenting with lower temperatures and lower scan rates.

Using Biowalls to Sustainably Reduce Human Exposure to Indoor Volatile Organic Compounds

Young Kwang Lee

Materials Science & Engineering

Dr. Michael Waring

Civil, Architectural, & Environmental Engineering

Although concentrations of indoor contaminants such as volatile organic compounds (VOCs) are not significantly high according to occupational standards, the fact that the majority of Americans spend excessive amount of time indoors makes it a large exposure pathway and perhaps a critical health issue. Traditionally, indoor air quality has been controlled by ventilation, diluting the contaminated air with new outside air. Because the new air must match indoor temperature, increasing ventilation air demand increases the operational cost and energy use of the building. In an effort to reduce energy use and associated negative impacts on the environment, biofiltration has emerged as an alternative method to indoor air filtration. Later this fall, the Drexel Integrated Sciences Building will open with a "Biowall" biofiltration system. In a Biowall, the indoor air is recirculated through plants rooted into a porous textile through which air is drawn, so that VOCs are consumed by microbes living on the plant roots. To measure the efficiency of removal, an aeroponic system is constructed to mimic the Biowall, equipped with various laboratory parts such as Swagelok fittings and aeroponic home garden system. Assuring that the modeling of such apparatus would resemble that of ideal system, the apparatus is modified, having rubber sealing and additional tubing to distribute air inflow evenly. In conjunction, a modeling study is performed to optimize the operational characteristics of the real Biowall. Results show that increasing the airflow through it and maintaining a small range of water temperature leads to the most VOC removal.

Growth Mechanics of Gold Core-Shell Nanowires

Ian Riley

Materials Science & Engineering

Dr. Jonathan Spanier

Materials Science & Engineering

With the growing demand for high speed, miniaturized electronics, the scientific community is extremely interested in the high potential of nanowire devices, especially the possibility of using core-shell nanowires as memory storage devices. A pressing problem with current memory storage technology is that as the area representing a single bit is decreased, so is the bit's stability. Previous work by the Mesomaterials lab has found that by putting a thin magnetic shell around a nanowire, a highly stable nanoscale bit can be created. If the Mesomaterials lab is to use these core-shell nanowires effectively, they must have a consistent method of growing nanowires with specific dimensions. The goal of this project was to investigate how changes in various electroplating conditions, such as current, solute concentration, and growth time affected the nanowire's properties. The resistances of these wires were also tested to find a relationship between wire length, wire diameter, and resistance. The completed research on the nanowire growth mechanics will be used to further investigate their properties and potential, eventually integrating many different cores and magnetic shells until the best core-shell nanowires are discovered for any application.

Laser-Induced Reduction of Graphite Oxide

Jonathon E. Affleck

Mechanical Engineering

Graphene is a material with exceptional electrical, thermal, mechanical, and optical properties. The preparation of high quality graphene sheets or flakes on a large scale and in an inexpensive manner is essential for wide spread applications of this prospective material. Graphite oxide (GO) is a very good candidate to be used as a precursor for production of graphene, as it can be derived by wet chemistry reactions from inexpensive graphite powder. Then GO can be reduced to form chemically modified graphene, in which a large portion of oxygen-containing functional groups are removed by chemical reaction or by thermal treatment.

Dr. Zhorro Nikolov

Centralized Research Facilities

Here we report on the preparation and properties investigation of deoxidized GO by UV excimer laser irradiation. The excimer laser through a photothermal process heats the GO particles dispersed in aqueous suspension and helps to reduce the oxygen bonded in them. As a result a laser induced transformation of GO into laser converted GO (CGO) is observed. A wet chemistry method to produce GO has been verified and the GO and CGO samples were characterized using Raman, FTIR, XPS, TEM and SEM, The reduction of GO in this way is a fast and efficient method with the potential to become an easy pathway to produce modified graphene for a variety of applications.

A Battery- Powered, Ultra-Low-Noise Waveform Generator and Amplifier for Probing Solid-State Artificial Atoms

Alex Benjamin

Mechanical Engineering

Dr. Roberto Ramos

Mechanical Engineering & Mechanics

The 21st century has witnessed the invention of the basic components of a quantum computer - a computer that solves problems faster than classical computers running on binary logic. These components are called "quantum bits" or "qubits." One such qubit is a solid-state device, called the superconducting Josephson Junction, whose "0" and "1" states correspond to its superconducting and non-superconducting states. At Drexel University, qubits are being probed by electrical current and microwaves.

The goal of my research project was to optimize an electronic circuit that detected and amplified minute voltages when the qubits switched from their superconducting to normal states while isolating these minute signals from unwanted, low-frequency noise (60 Hz) specifically those intrinsic to power outlets and commercial equipment.

Towards this goal, I designed and tested a battery-powered amplifier capable of amplifying low signals with precision and eliminating noise intrinsic to its commercial counterparts. The circuit, consisting of high-performance, ultra low-noise IC's, was assembled on a breadboard, tested, packaged onto a PCB and shielded in a modular box; this design replaced Stanford Research Systems' commercial operational amplifier. The amplifier was used to create histograms of superconducting-to-normal switching events and the widths of the histograms, which are indicative of the presence of unwanted noise, were compared to the widths of the histograms obtained in using commercial amplifiers. While the use of custom-built, DC-powered amplifiers does not guarantee precision and isolation from unwanted noise, it can reduce unwanted interference and resolve plots that are signatures of distinct quantum energy states critical to building a quantum computer.

AUTONOMOUS SPACE ROBOTICS

Robert J. Davies, Jr.

Mechanical Engineering

Dr. Jin Kang

Mechanical Engineering & Mechanics

A main issue in space exploration is the inability to quickly and efficiently fix problems on satellites while they are in space. In order to make adjustments to damaged satellites, a crew of astronauts must physically approach them, costing significant amounts of time and money. A potential solution to this issue is utilizing a team of robots to repair the satellites rather than a costly unit of humans. The robots could be stored in the satellite and deployed when problems arise. However, when robots move on a freely moving satellite, they disturb its movement and ability to communicate. If multiple robots follow particular paths around the satellite, they may be able to counteract one another's movement, thus allowing it to maintain its original position. In order to determine the relationship between the robots and the satellite's position, tests were created to simulate a frictionless, space-like environment. These tests consist of a platform suspended from a ceiling and a platform suspended on an air table, testing the rotational and translational effects, respectively. Several robots were placed on each of the platforms. The one suspended from the ceiling has been successful thus far, exhibiting definitive rotation when robots were onboard. The air table platform, however, struggled to hold the weight of several robots. Tests will soon continue with more powerful air equipment. If these tests accurately demonstrate the effect of moving robots on a freestanding space object, remote satellite repair will become an even greater possibility.

SMALLER IS HARDER

Robert A. Hall, Jr.

Mechanical Engineering

Dr. Michel Barsoum

Materials Science & Engineering

Through the use of Nano-indentation, the hardness and elastic modulus of a sample can be found. For this research, two mica samples, muscovite and biotite, were observed. The samples were placed in a controlled environment with the load and tip size being the only variables. Four hemispherical tips of micron size, 1, 5, 21, and 100μm were used with the load varying based on the tip used. A load vs. displacement plot was acquired from the Nano-indenter, from which both a stress vs. strain and harmonic contact stiffness vs. contact radius (S vs. a) curve were derived. In observing the stress-strain curves of the samples we able to determine when these samples transition from elastic to plastic in their deformation as well as their elastic modulus. In addition, the S vs. a curves provide an alternate to finding the modulus, which was almost the same as the modulus calculated from stress-strain curves. The load-displacement curves display when the surface of the sample has been pierced, creating a pop-in. Through observing the pop-ins using a scanning electron microscope (SEM) we are able to see that when the sample is no longer able to sustain the load, it sometimes leaves an explosion-like crater. Using tips of different sizes to find these properties proved that smaller size is stronger in terms of the stress allotted by each tip.

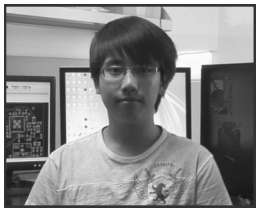
Inkjet Fabrication of Hybrid Solar Cells

Elizabeth Hallman
Mechanical Engineering

Inkjet printing can be used in large scale commercial applications and is also compatible with organic and inorganic polymers. In recent years, improvements in device performance have been seen in the development of organic-inorganic solar cells. Most studies on solar cell fabrication have focused on using lab-scale spin-coating methods to deposit the organic polymer active layer. Spin coating is a highly inefficient way to deposit layers. In this poster, we present our results in using an Dimatix printing device for inkjet printing of poly(3-hexylthiophene) (P3HT)/ [6,6]-phenyl-C61-butyric acid methyl ester(PCBM) ink materials for large-scale processing of hybrid solar cells. The effects of jetting parameters of the printer, such as wave form, jetting frequency, and drop spacing, on film thickness and uniformity are discussed in detail. Performance of the cells, in terms of short circuit current, open circuit voltage, fill factor, and efficiency are discussed. Improvement upon these results can be completed in future research. Implementation of printed cells into commercial applications would result in a more economically efficient use of power.

Dr. Ying Sun
Mechanical Engineering & Mechanics

Development a Validation of an In Vitro Model of Blast-TBI



Shimin Huang

Mechanical Engineering

Dr. Arye Rosen

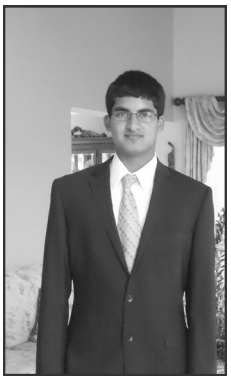
School of Biomedical Engineering, Science, & Health Systems

Xu Meng

Graduate Student Mentor

Researchers have been using large shock tube to generate shock wave, for blast-induced traumatic injury (bTBI) studying. However, the exact mechanisms of energy transmission from the low level blast waves to the brain, and the resulting mild injury, are unknown. Also little is known about cellular resistance to the blast waves. Thus, there is a need to design a novel model, mimicking the shock tube, to study the cells' acute response. My research involves simulating the blast overpressure (BOP) generated by the large shock tube in a smaller environment - a Petri dish, in which the cells are cultured, and monitoring the real-time cells' activities by microscope. Based on the frequency analysis of the BOP waveform from the literature, the actuator is used as the source. A blood pressure sensor and a hydrophone are chosen to validate this idea. The blood pressure sensor is small enough to work in the Petri dish and the hydrophone is used to calibrate the blood pressure sensor. After calibration, the blood pressure sensor is used to measure the shock wave produced by the actuator in the Petri dish. Based on the above measurements, a better actuator with position and acceleration control will be designed for more precise monitoring of movement and desired BOP waveform. Subsequently this injury model and the microscope will be used for our acute bTBI study purpose.

A Graphical User Interface for Analyzing Parametric Effects on Polymer Electrolyte Fuel Cell Performance



Arvind Kalidindi

Mechanical Engineering

Dr. Emin Caglan Kumbur

Mechanical Engineering & Mechanics

One of the selling points of fuel cells is their remarkably high theoretical efficiency when compared to other power producing engines. However, the maximum efficiency that is used in these comparisons is unachievable because of major losses that the fuel cell experiences due to losses from entropy, reactant crossover, reaction activation, resistance, and fuel concentration. In order to find ways to reduce these losses, researchers run copious experiments to produce polarization curves that graphically display the effects of the major losses. This study develops a mathematical model that can be used to construct a polarization curve based on user-inputted parameters of a polymer electrolyte (PEM) fuel cell to show researchers the expected losses in their fuel cell design. The polarization curve shows the expected actual voltage of the fuel cell at a specific current output, which can be analyzed to understand the voltaic losses of the fuel cell. A mathematical model describing the voltaic losses of the cell was developed from known electrochemical and thermodynamic equations. This mathematical model was then validated using experimental data and parameters from three studies and yielding an average error between 0.01 and 0.06 V. In order to make the model more conveniently usable by researchers, a graphical user application was created that allowed users to modify operational and assembly parameters and observe changes to the polarization curve. Optimization and polarization analysis tools are also provided in the application to aid users in finding the best design for their cell.

Characterization of a Vortex Generator

Kristaps Kancans

Mechanical Engineering

The purpose of this research was to build and characterize a new vortex generator for perturbing live bluegill sunfish and robotic fin systems. Characterization would allow for the quantification and precise application of forces to robotic fins or fish. The new generator design eliminated the previous problems of pressure drop off, noise, and nozzle size. It replaced a water pump with an air pressurized vessel, added a more space efficient mounting system, and replaced the original valve with a silent one. Vortices were tested using video analysis and force plate readings. A correlation between several variables, such a water input pressure and vortex speed, has been established. Further research will continue to model variables that have not yet been explored.

Dr. James Tangorra

Mechanical Engineering & Mechanics

Automating Repetitive Web Interaction

Michael Lucidi
Mechanical Engineering

Dr. Bruce Char
Computer Science

The point of this project is to use Selenium IDE, a program normally intended for web testing, to automate a long series of inputs into a website. Selenium has the capabilities to record a series of actions and save the run as a JUnit Java file, which can then be executed from an external application call. Automation remedies many problems associated with performing a repetitive set of actions; repetitive jobs can be completed in several clicks rather than a thousand clicks, human error in inputting data is completely removed, and the length of time needed to finish a long set of inputs is effectively reduced to a fraction of its original time.

More specifically, this piece of software is being used to streamline a very long series of actions performed on the MapleTA homework website. Professors and aides must perform a long series of actions in order to complete simple tasks, such as preparing students for their finals; Selenium simplifies these tasks and performs them much more efficiently than human input can. Once testing through MapleTA has been completed, the program can be extended to automate other important website tasks across Drexel's campus and other websites in general.

THERMO-MECHANICAL PROCESSING ROUTES FOR AZ31

Sean Rodeheaver

Mechanical Engineering

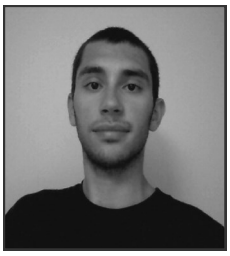
Dr. Surya Kalidindi

Mechanical Engineering & Mechanics

In an effort to increase fuel efficiency and decrease CO2 emissions, the automotive industry is investigating magnesium (Mg) alloys because they are lightweight and have a higher specific strength than metals typically used in automobiles today, e.g. aluminum and steel. These alloys have been employed in numerous cast applications, but cannot fulfill their weight-saving potential because they currently lack the formability to be used in wrought applications. If Mg alloys are to be employed in new applications, a reliable physics-based model to predict the material behavior during forming is necessary to speed up this process. However, there currently exist several gaps in our understanding of the fundamental mechanisms of plastic deformation in Mg alloys to develop reliable models.

One complication is that the mechanical behavior of Mg alloys is strongly dependent on grain size, as grain size influences the extent of different deformation mechanisms such as slip and twinning. It is easy to achieve grain sizes from 10-25 μm; however it is difficult to produce material with larger grain sizes to study the effect of grain size on the deformation behavior. Therefore, a range of thermo-mechanical processing routes were explored to achieve a larger grain size on the order of 100 um in Mg-alloy AZ31 (Mg with 3 wt.% Al and 1 wt. % Zn). A two-step process was found to significantly increase the grain size. Each step involved a small compressive strain parallel to the c-axis followed by annealing to recrystallize the material.

Optimization of Solar Panel Lay Down



Armando Salome

Mechanical Engineering

The solar panels are used to power satellites that are in orbit; if the solar panels are not attached properly, the solar panels could break or pop off in space leaving the satellite without power, resulting in a waste of both time and money. The purpose of this project was to come up with ways to optimize the solar panel lay down procedure used for the solar panels on satellites. The methods previously used can be described as quite crude, time consuming, and arduous. To tackle this project I first tried the original method to put down solar panels and then, later, I took time to come up with inventions and improvements to the process. I created a tool that helps evenly spreads the silicone adhesive which is normally done by hand, leaving air bubbles between the cells and the board. The improvements that I made have both expedited and, simplified the process allowing the job to be done with a smooth application of silicone. It is important that this procedure be done quickly because the tasks requires use of a silicone adhesive which is only usable for twenty minutes after it leaves the bottle. The method presented resulted in much smoother and evenly distributed contact points compared to the sample prepared using the previous 'manual' method.

Dr. Jin Kang

Mechanical Engineering & Mechanics

ROBOTICS

David Torres, Jr.

Mechanical Engineering

The objective of the project was to program a robot to autonomously navigating a course to reach designated locations. The robot was a LEGO NXT Mindstorms Robot and was programmed in NXC (Not Exactly C) language. A GPS and electronic compass was used to allow the robot to know its orientation, heading, and location. Once given a final destination, the robot would be able to drive itself to the end point. The algorithm allowed the robot to correct itself if it veered off course by calculating the necessary corrections based off the information from the compass and GPS. A feedback controller was used in the code to make these corrections. It used the data from the GPS and compass to calculate how far it was from the goal (the error) and adjusted the robot to make sure it was going in the right direction. The robot was able to successfully navigate the course, but it took a long time to complete. The problem was that the data from the GPS did not update quick enough to allow the robot to correct itself properly. In order to correct this problem, a more accurate, faster updating GPS sensor would have to be used to give the robot up-to-date information and correctly reorient itself. A more complicated algorithm, such as a Kalman Filter, could also be used to more precisely adjust the robot and eliminate error.

Dr. Paul Yu Oh

Mechanical Engineering & Mechanics

DIALOGUES WITH DARWIN STICKY NOTE PROJECT

Connie Lin

Information Systems

Dr. Sean Goggins

iSchool

Participatory design in museums can engage the public with technology as simple as a sticky note. Much of participatory design research focuses on incorporating advanced technology to regain public interest. However, low-fidelity methods have their own value and appeal. This research focuses on one such project in an attempt to shift the balance. Within the "Dialogues with Darwin" exhibition at the American Philosophical Society Museum from April 17, 2009 - October 17, 2010, visitors were encouraged to "continue the dialogue" by posting their own thoughts, comments, and questions on 3x3 inch sticky notes on two wall panels. This study aims to discover trends in visitor posts through grounded theory and frequency analysis of a systematic random sample of the 2,293 sticky notes uploaded on the museum's Flickr account. The sticky notes were found to fall largely into three categories: sense-making, exhibit appreciation, and the science vs. religion debate. To further classify the 'science vs. religion' posts, rhetorical analysis was used to ascertain trends in the modes of persuasion used by each side of the debate. This study reflects the broader attitudes and opinions of our society today. The project additionally demonstrates the ability of low technology to engage audiences and to act as a unique medium for discourse surrounding controversial topics.

Electronic Community Resource Database

Ekene Arinze

Information Technology

Dr. Michelle Rogers

iSchool

Health/Medicine 2.0 is becoming more popular as the use of the Internet advances. We know that the Internet is used to search for health related information but what we are trying to understand better is how online health provisions are meeting patient needs. We also want to find out what features of medicine 2.0 various medically oriented websites currently have. By analyzing the results of a recent survey done at a north Philadelphia health clinic, my research team and I were able gain better understanding of how patients use the Internet to search for health related information and how useful the information is to them. The next step in my work included an extensive study of websites such as, WebMD and MedicinePlus, to determine their levels of incorporation of Medicine 2.0 features such as, openness and participation. These findings will be used to redesign an existing prototype user interface for St. Christopher's hospital. This website will ultimately be a tool that primary care providers and patients can use to access resources for healthier living within their local community. For example, the tool could be used to find the locations of nearby community fitness centers. Based on our findings, we are aiming to integrate the Medicine 2.0 features into our interface. We will then conduct usability tests to make sure that the new features are easy to use and understand.

Privacy and Security in Social Media

Prateek Balasundaram
Information Technology

Christopher Myers
Information Systems

Victor Khou
Software Engineering

Dr. Christopher C. Yang
iSchool

The main focus of this project involves the issue of privacy with regards to social media websites. The term "social media" refers to the interactive manner in which information is exchanged; through user communication and social interaction, media of all different types can be relayed through the Internet. The different social media (SM) websites tested include Facebook, Twitter, LinkedIn and Digg. All SM websites contain a privacy policy stating how information is used by the platform and how such information could be passed on and used by third parties.

The initial goal of the project is to understand what types of information are being entered by the user on SM platforms. With this information on the SM servers, certain data can be gathered using application programming interfaces (APIs). These APIs are actually provided by the SM websites and allow developers to gather non-private information from users.

The second part of the project is to see how this gathered information can be analyzed to create connections between different people, events, topics and articles. This effectively builds a social network specific to certain criteria. Based on what the search returns, it allows for tracking trends and for extrapolation for what can happen in the future. This sort of searching can have useful applications in the future, as it can allow companies to see the effectiveness of advertising campaigns or even predict events that are evolving from the Internet space to the real world, such as the massive protests that broke out in Egypt.

SMART CLOSET

Alyxis Johnson

Information Technology

Dr. Jennifer A. Rode

iSchool

A smart closet is a device that allows users to view the contents of their closet with a simple touch of their finger, adding ubiquitous computing into everyday interactions with clothes. Instead of manually opening a closet and sorting through numerous clothing items, the clothing in the smart closet will be tagged with RFID tags allowing the user to view the closet virtually, making it easier for the user to create outfits and also keep track of multiple aspects of their clothing such as when an item has been last washed, or if an item is currently loaned out to a friend. After analyzing the results of the ethnographic and speed dating studies that were conducted, a user interface (UI) design for the loaning aspect of the closet was created. This task consisted of several subtasks, which included: loaning an item, browsing through loaned items, retrieving items, and browsing through borrowed items. The smart closet research is being done in conjunction with Dr. Hans Gellerson of the University of Lancaster and Dr. John Zimmerman of Carnegie Mellon University. Future research will consist of real world implementations using the smart closet in addition to further iterations of the design.

Privacy and Security in Social Media

Benjamin Kos
Software Engineering

In software engineering, the need to constantly rewrite the same components for similar projects can lead to a loss in productivity. Projects that produce and consume reusable software components are therefore potentially more efficient, though reusable software tends to be more difficult to design and build. Additionally, the resulting product tends to be more complex.

The overall objective of this project is to explore the implications of designing software to make it more reusable. The method will be a case study approach using an existing, on-going open source project being worked on by Drexel students. The case study will examine and analyze the design changes and complexity addition created in generalizing product features to increase reuse potential.

Dr. Gregory Hislop
iSchool

The case study software product is a package to support building Web repositories of educational materials. This work is being done as part of a larger NSF National Science Digital Library project related to computing education. Initial tasks for this project have included learning about the case study product and work done thus far to build an initial version, and literature review of prior work in designing software for reuse.

Preliminary results indicate that substantial design revision and additional complexity are required to provide generality in the product. Efforts thus far have focused on database and user interface changes. In both areas, generality requires significant change. For example, addition of a parent child table can integrate flat information structures into informational hierarchies.

Cost and Policy Issues of Active Space Debris Removal Technology

Mathilde Berger

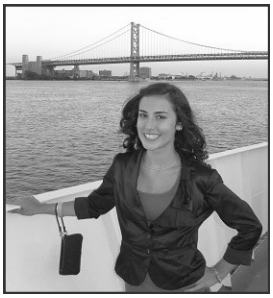
Business & Engineering

In the past 20 years, there has been an increasing focus on the problem of space debris polluting Earth's orbits. With more than 520,000 of these defunct satellites, rocket bodies, and other pieces of space refuse floating in Low Earth Orbit (LEO), spacecraft are being damaged and experts warn that a cascading effect may render orbits unusable for decades. In turn, the international space community has responded with mitigation guidelines and proposals for active space debris removal solutions. However, legal, political, technical, and economic challenges are now impeding progress towards the goal of a debris-free LEO. The objectives of this research are to identify the related legal and policy constraints, formulate potential legal and policy solutions, and finally provide cost estimates and recommendations for implementing one particular debris removal device. By reviewing scholarly journal articles, primary legal documents, and other works we are able to develop our own conclusions and recommendations on these objectives. Based on these analyses, we conclude that the United Nations and other international agencies must generate new legislation and agreements in order to overcome the legal and political challenges facing orbital debris removal. Also, we find that In Situ Low-Earth Orbit Plasma is a technically feasible and affordable space debris removal option. With the use of these legal, policy, and technical solutions, Earth's orbits may once again be clean and safe for future use and exploration.

Dr. Neil Desnoyers

Decision Sciences

HERAKLES



Dawn Armentani

Business Administration

Dr. Eva Thury

English & Philosophy

The purpose of the Herakles Project has been to examine and gain greater understanding of the many literary adaptations of Herakles throughout ancient Greek and Roman history. This has been done through an analysis of several primary sources in English and Greek, including Sophocles' Women of Trachis, Euripides' Herakles, and Apollonius Rhodius' Argonautika. Galinsky's The Herakles Theme, a secondary source, was also studied. This phase of the project showed a wide range of personalities and values, ranging from Herakles as a tragic hero to a hero on the comic stage. The Herakles theme of the ancient world was then compared to a contemporary adaptation of the mythological hero in the movie Les Travaux D' Hercule (1958). This modern adaptation of Herakles as a powerful and beneficent warrior hero contains many direct correlations to ancient portrayals of the mighty hero and highlights the culture and values of the mid twentieth century. Further research will focus on the Herakles theme in Italian cinema of the later twentieth century, as well as on scholarly work examining the significance of Herakles in ancient times.

Research in Corporate Disclosure Practices

Brandon Cohen

Business Administration

Dean Roger Dennis

Earle Mack School of Law

For my project, I was asked to compare the actions of several companies over the past decade which have been reprimanded for actions taken that the public, specifically investors, were unaware of. The companies, specifically top executives, were involved in many underhanded business activities. These activities were used to project a more positive outlook of the company to hide the internal turmoil that was obvious within the companies. By comparing news articles and company documents to facts brought out in various court cases and complaints, I was able to see how these companies and executives continuously lied and misrepresented their companies' financial status. While I focused on one company in particular (Qwest Communications), each company I researched engaged in business practices which altered the image of the company. Despite projecting a positive image for the company, each enterprise eventually faltered in a serious manner, whether the result was bankruptcy or severe penalties. The lack of transparency of each company resulted in numerous investors losing millions of dollars because they were simply unaware of the true problems of the companies. Understanding these results is important because any investor is always concerned about the truthfulness about a company's public statements so that they feel confident in their investments.

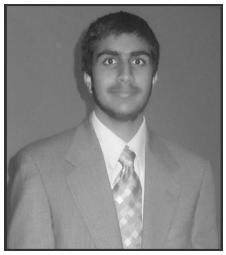
Comparative Analysis of Technology Transfer Offices in the Greater Philadelphia Region

Louis Luong
Business Administration

Dr. Vadake Narayanan
Finance

The purpose of this project is to identify the factors that influence the performance of the offices of technology commercialization. The case studies of the technology transfer offices (TTO) in the greater Philadelphia area were documented. Information has been collected through archival sources and through semi-structured interviews using a questionnaire developed for this purpose. By comparing the structure and the processes of these offices, I intend to create insight into the functioning of the TTOs and benchmark some of the best practices in university technology commercialization.

MIS Jobs / Smartphone Protection & Hacking



Farjad Mir

Business Administration

Study 1: Exploration of MIS job market with emphasis on skill sets

Type of Research: Qualitative

Methodology: Text Analysis through text mining

Description: In this study, data was extracted from Management Information Systems (MIS) related job advertisements in Career Builders. These advertisements were coded and analyzed using co-occurrence and similarity matrices to identify relationships among the skill sets, educational background, experience and knowledge required for the various positions. This was achieved using QDA Miner, a text mining tool.

Outcome: Document on MIS careers for LeBow Advising Center and for all business students.

Dr. Murugan Anandarajan

Management

Study 2: Exploring factors which motivate smart phone users from protecting themselves from potential hacking.

Type of Research: Quantitative

Methodology: Survey

Description: The theoretical basis of this study the Protection Motivation Theory, which states that people's intention to protect themselves is based on perceived threat and coping. A survey was developed to capture people's perceptions about this phenomenon. The data from the survey will be analyzed using regression and conclusions will be derived.

Outcome: Leading to Potential a larger study.

Funding of Nonprofits in Natural Disasters

John Nabial

Business Administration

Although donations are crucial to assist nonprofits in supporting the victims of natural disasters, little is known about how these donations are made and how they affect people's normal donation behavior. This research project therefore explores how the occurrence of natural disasters, and specifically the 2005 South Pacific Tsunami, affects philanthropic behavior. Using survey data on approximately 8,000 households, we explored how donations are made to disaster relief, what factors contributed to how much a family gave to the tsunami, and whether disaster giving reduces the amount given to other charities. Using the statistical analyzing program STATA, we were able to take out any misrepresented statistics to "clean" the data. Following this, we were able to use the program to explore several relationships between disaster giving, normal giving, and what demographic features affect them. Through this analysis we were able to discover several significant relationships, some of which can be found through graphical representation on the poster being presented. With knowledge of these types of giving patterns, people will be able to judge how they can give more effectively, governments will be able to allocate resources more effectively by putting them towards areas that receive less giving, and nonprofits will be able to understand where their donations are coming from and the groups of people that are more likely to donate. It also paves the road for future research where giving patterns for the same families can be analyzed across different years.

Dr. Teresa Harrison

Economics

What is the Source of Analyst Value?

Tanmai Rayavarapu

Business Administration

Dr. Naveen Daniel

Finance

The purpose of this project is to find the source of analyst value. We know that sell-side analysts generate value but what causes an analyst to make these revisions? Our hypothesis and our primary contribution will be to document that analysts generate new information about the firms they cover, and that this new information is the main driver behind the value generated by their reports.

After the passage of the Regulation Fair Disclosure (Reg FD in short) in October 2000, which barred firms from selective disclosure to favored analysts, shareholders etc, we identified that new information would be particularly important. Therefore we planned to download reports from Investext from the years 1999 and 2003 from the same analysts of randomly selected firms. We hope to identify the justification for an analyst's changes. We then categorize the motives behind the generation of a new report.

This is still an ongoing study so much more data is left to accumulate before results are shown however with the data coming in, our results and findings should link the abnormal returns to the amount of new information that is there.

Overall, we want to see if analysts actually do bring new information. Does stock price at any time actually reflect information given? Does information drive stock prices? In effect, we want hope to see that analysts do add value.

CEO Overconfidence

Peter Yocum

Business Administration

Dr. Hiu Lam (Helen) Choy

Finance

A CEO's confidence in his company can be an important indicator of the firm's overall health and performance. CEOs of well performing companies are portrayed as confident and charismatic. However, sometimes a company's leader can be over-confident, and overstate the performance or future prospect of his or her organization leading to unintended consequences. This study attempts to investigate the effects of CEO overconfidence on a firm's performance through an archival approach. An online news database was used to gather secondary data which is then analyzed to collect data about CEOs, their confidence levels, and the performance of their firms. At this point, no definitive conclusions can be drawn from the data collected, but the results of this study will prove important to understanding the relationship between the personal traits of CEOs and the performance of their firms, and the ability to estimate how various types of CEOs will respond or perform in different circumstances.

Exploring the Relationship between State Laws and Data Breach Incidents

Tian Zou

Business Administration

This project aims at exploring the relationship between the stringency of state laws and the frequency of data breach incidents. I work on collecting, analyzing and interpreting data breaches incidents, which is also known as identity theft, including hacking, virus, stealing, accidental loss and malicious use or sell security information. This issue recently has become a global problem and imposes huge threats to the stability of our society.

First, I rank state laws by the level of stringency. Does the state law require informing potential victims, and does the letter include different variables such as summary of the incident, company's apology, contact information and fee payable to credit monitor services.

Dr. Murugan Anandarajan

Management

Second, I create a database of data breach incidents in US from 2004 to date. The database contains over 3200 incidents and organizes them by using 25 variables, such as type of firm, type of breach, number of affected people, nature of the breach, location, etc.

Third, I identify and code notification letters that sent to consumers whose personal information was stolen to see did companies in each state strictly follow the state laws.

Fourth, with 34 variables, I track fluctuation of breached organizations' stock prices to see the impact of data breach incident on stock performance. I combine the first 3 parts of this project and conduct exploratory data analysis. Furthermore, I use regression model to identify criminal patterns and impact on stock price fluctuation.

R&D Policies for SMEs: A Cross-country Analysis

Ananth Bevinahally

Economics

Dr. Christopher Laincz

Economics

Given its overarching reach, and provided with the right stimulus, small and medium-sized enterprises (SMEs) could provide a very valuable social benefit. In the European Union, SMEs are seen as the drivers for economic recovery and growth. The systemic deficiencies with small firms such as unavailability of easy credit, paucity of infrastructure and susceptibility to losses have prompted governments to devote special policies to SMEs. I compared the approaches of the United States and the EU in aiding small enterprises and the impetus given to the development of R&D. I studied the most efficient methods of effusing the subsidies to small firms and the indirect effects that the aforementioned subsidies have on the market. Since the target audience for such policies number is in the tens of millions, there is an element of populism involved with the governments. In this positive analysis, using my findings, I have evaluated the merits and demerits of subsidizing SMEs.

NJ Pine Barrens Ecology: Education and Informational Website for Conservation Efforts at the Air National Guard Warren Grove Range

Melanie Jeske

Economics & Environmental Studies

Dr. Walter F. Bien

Biology

The Department of Defense (DOD) under The Sikes Act of 1960 (amended 2009) is required to implement conservation and rehabilitation programs on federal lands. In cooperation with the Department of the Interior, US Fish and Wildlife Services, and state agencies, each military base is required to develop an Integrated Natural Resources Management Plan (INRMP), which guides environmental stewardship and biodiversity conservation. Drexel University, Laboratory of Pinelands Research (LPR), for the past twelve years has conducted biodiversity conservation and mitigation projects at the Warren Grove Range in support of the Warren Grove Range INRMP. Owned and operated by the New Jersey Air National Guard 177th Fighter Wing, the Warren Grove Range is an air-to-ground gunnery range located in the New Jersey Pinelands. To satisfy several task orders outlined in the INRMP, we (LPR) are developing an informational website that will promote greater awareness of the value that the Warren Grove Range brings to the public and local community. The website will include information on the military mission at WGR, Pinelands ecosystem, fire management, community outreach, Drexel University research projects, environmental stewardship, and educational resources. Much of the information on the website will be based on scientific data and research conducted by LPR, while literature and internet sources will also be used for educational purposes. The New Jersey Pinelands is home to many threatened, endangered, and at-risk species, further highlighting the importance of biodiversity conservation to the region. The creation of an educational website focused on native species, biodiversity conservation, and other natural resources will help to further educate the public and promote greater community awareness on the importance of environmental stewardship and the military mission at Warren Grove Range.

SMARTPHONE MARKETING

Robyn Freedman

Finance

We chose to study the differences between Apple iPhone users and Android phone users. The differences ranged from needs and wants in a phone to personality traits that prove that two different marketing strategies can be used. We first found information that had already been collected about the differences between the two phone users including personality types and previous marketing campaigns. Following that we created a survey and found data on each users favorite feature, most used feature and their overall comments on the phone. From this we developed a user profile including that iPhone users value phone design when picking their phone, perceive themselves as creative, and are pretentious in needing a elite phone. Android phone users tend to be more function-based; they love the basics of being able to text, use the phone, and having easy access to all of the features. This data is extremely important in developing a marketing strategy because it becomes obvious what features to highlight when advertising the phone. For example, if iPhone were to attempt to take some of Android's market share, they would just want to highlight features that attract the Android's user's profile. Other information found shows Android users' lack of interest in using their phone as an MP3 player which with further research could show that it stems from Apple's large market share on online music and Android's lack of long battery life. The profiles of each phone user could be used in marketing campaigns worldwide.

Meg Miller

Marketing

Dr. Hyokjin Kwak

Marketing

PREVENTING CHILDHOOD OBESITY

Hai Duong

Nursing

Dr. Renee Turchi

School of Public Health

Community Health & Prevention

Many patients face the challenge of being overwhelmed with information while feeling powerless as to go about their newfound situation. They know what to do; the next step is how to do it. It is no longer breaking news that obesity is a huge problem in the United States and more so in children. Its prevalence remains in families with low incomes. With resources already established in the community, the task becomes to connect these families. By charting the community, validating resources, and developing an online database, information can be gathered to be delivered to informed patients ready to take action. Patients will become more esteemed to adopt more nutritious diets and work towards more active lifestyles. After setting foot out into the community, the online database will be more occupied with resources ready for inquisitors to utilize and become a tool used by caregivers, patients, and the general public alike to be more aware of the resources already present in our neighborhoods.

THORAX GEOMETRY QUANTIFICATION OF PEDIATRIC ANIMAL MODELS

Rohan S. Agarwal

Biomedical

Dr. Sriram Balasubramanian

School of Biomedical Engineering, Science, & Health Systems

Currently, animal models are used to replicate scoliosis in-vivo in order to study progression of spine deformities and the effect of corrective surgical procedures. One of the limitations of using quadruped animal models is their ability to accurately represent the scoliotic spine and associated thorax deformities occurring in bipedal humans. Very limited information is available on the geometric characteristics of the spine and thorax for the various animal models used in scoliosis research. This dearth of knowledge is even more in the pediatric literature. Our research aims to study the geometric characteristics of the spine and thoracic cage of various age and size matched pediatric animal models with humans. In addition, biomechanical experiments will also be performed to evaluate the effect of abnormal spine curvature on the compliance of the pediatric thorax. From animal CT scans the thoracic geometry of each animal will be analyzed and an appropriate animal model for the human pediatric thoracic cage will be created.

HYDROGELS IN REGENERATIVE MEDICINE

Wayne Cheng

Biomedical Engineering

Dr. Yinghui Zhong

School of Biomedical Engineering, Science, & Health Systems

Hydrogels are networks of polymer chains that are water-insoluble, usually found as a colloidal gel in which water is the dispersion medium. The natural qualities of hydrogels give it a degree of flexibility similar to natural tissue due to its structure and significant water content. Due to their unique biocompatibility, flexible methods of synthesis, range of constituents, and desirable physical characteristics, have been the material of choice for many applications in regenerative medicine. They can serve as scaffolds that provide structural integrity to tissue constructs, control drug and protein delivery to tissues and cultures, and serve as adhesives or barriers between tissue and material surfaces. In our project, the properties of hydrogels, which are important for tissue engineering applications and the inherent material design constraints and challenges, had to be considered.

For our experiment, we focused on the drug release of alginate gels. Alginate gels have also been used in drug delivery applications. To reduce the diffusion of hydrophilic drugs through alginate gels, drugs can be trapped in the polymer through ionic complexation. Alginate gels have also been used to encapsulate cells for cartilage repair and solutions of chondrocytes and alginate have been injection molded into anatomically shaped implants, have used alginate gels to culture explants of periosteum for cartilage tissue engineering, Alginate has further been utilized in surgical dressings, and even for suppressing the absorption of radioactive strontium in the body.

Metagenomic Comparison of Different Ecosystems

Jacob Allen Clouse

Biomedical Engineering

This project uses the fast UniFrac metric of comparing and contrasting different environments based on the varying richness and abundance of microbial communities present. Such analysis simultaneously uses genetic and/or amino acid sequences from all species present within a sample and is therefore called "metagenomic." Microbial samples containing bacteria, archaea, and fungi are collected from several different environments, from farm soil to underwater sea vents. Specific nucleic acids coding for a protein and specific amino acids comprising a protein are sequenced. Using the Naïve Bayes Classifier, these sequences are compared and contrasted to uncover details about the environments from which their samples originated. The goal of this project is to shed light on the how certain ecosystems have developed and changed over time. It will also reveal which environments are surprisingly most similar to or different from each other.

Dr. Gail L. Rosen

Electrical & Computer Engineering

BioDB: Integration of Biological Knowledgebases

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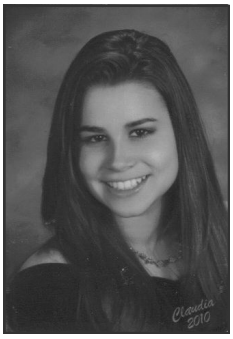
Within the past decade, advances in technology have drastically changed the fields of biology and medicine. The availability of high-throughput experimental biological data has created challenges in storage and analysis of this data. With multiple data sources and institutional providers, it becomes impractical to make use of the available data in an integrated workflow. The BioDB project seeks to provide a solution by incorporating genomic and proteomic databases into a single programming library, one that will provide a clean interface that allows users to query the data for a specific gene ID, sequence, or pathway. An Object Relational Mapping approach is used to represent various biological data tables as programmable objects. Various biological entities are transparently linked using public gene mapping tools, such as NCBI, EBI, and AmiGO. A local database system is created and populated on an as-needed basis to provide a caching mechanism. BioDB will be used to perform an integrated analysis of microarray datasets, where genes will be mapped to their biological pathways using the KEGG Pathway Database. The result is a fast, simple tool that combines all biological data from a variety of sources into a single platform. BioDB is expected to become an "enabler" in many biological and medical applications. The transparent access and modeling of the biological entities it provides will help answer many questions whose integrated investigation was hitherto impractical. A case study investigation of microarray databases could potentially help discover new genes and their pathways involved in cancer and metastasis.

GLYCATED COLLAGEN INHIBITS ENDOTHELIAL CELL RESPONSE TO SUBSTRATE STIFFNESS



Claudia Gutierrez

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Endothelial cells (EC) comprise the single cell barrier that lines all blood vessel. These cells are responsible for controlling permeability, inflammation , and wound healing. EC adhesion to the substrate depends on cell-extracellular matrix (ECM) interactions as well as substrate stiffness. As substrate stiffness increases, EC develop a more spread morphology. In diabetic patients, hyperglycemia induces ECM glycation which stiffens the matrix and affects cell-ECM adhesion. We hypothesized that ECM glycation would alter cell response to substrates of different stiffness. Endothelial cells were seeded onto polyacrylamide (PA) gels with varying shear modulus (0.3kPa, 5 kPa, 10 kPa, 30kPa). The gels were coated with either native (NC) or glycated (GC) Type 1 collagen. After 24 hours, cells were labeled for actin and nuclei and imaged using fluorescent microscopy. Cell area and aspect ratio were then quantified using ImageJ. Cell area on both GC and NC increased substrate stiffness. However, from 0.3kPa to 30kPa gels, cells on gels coated with NC increased in area by 336%, while on GC cell area only increased by 220%. Cell aspect ratio on NC also increased with gel stiffness, however cells on GC did not follow this trend. This study provides further understanding of how diabetic conditions alter cell response to substrate mechanics.

Dr. Alisa Morss Clyne

Mechanical Engineering & Mechanics

Quantification of the Three-Dimensional Structural Characteristics of the Normal and Scoliotic Spine and Thoracic Cage for Pediatric Subjects

Muzammil Hasan

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Idiopathic Scoliosis is a disease that affects many children during their developmental and growth years. Because of deformation of the spine the thoracic cage deforms as well, which compromises the function of internal organs, leading to significant health problems. Currently, no data exists on detailed quantified thoracoanatomy of the normal and scoliotic pediatric thorax. Through this study, data from normal and scoliotic pediatric patients is obtained from the Children's Hospital of Philadelphia and quantified for various parameters related to spine and rib growth. Data obtained from the current study would provide quantitative explanation of previously reported rib asymmetry differences in scoliotic thorax, provide geometrical and structural details necessary for the development of pediatric computational models, and help clinicians gain insight into scoliosis.

Glycoproteomic Biomarkers for the Early Detection of Liver Cancer in the AFP- Subpopulation

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Biomedical Engineering

Dr. Anand Mehta

College of Medicine

Microbiology & Immunology

Hepatocellular carcinoma (HCC), a primary cancer of the liver, is one of the most common cancers in the world. In certain Asian and African countries, HCC due to infection with the Hepatitis-B Virus (HBV) is the most common cancer, and one of the most deadly, with a 5-year survival rate of less than 13%. In fact, once the patient starts to show symptoms and is diagnosed, the average survival time is only 3 to 6 months. The biomarker currently used to diagnose HCC is Alpha-Fetoprotein (AFP). Due to it's less than adequate sensitivity, however, many individuals go undiagnosed. The purpose of this study is to identify potential biomarkers that may be used in conjunction with AFP in order to increase the percentage of people with HCC that can be diagnosed and treated years before the cancer starts showing symptoms, a point at which recovery is extremely unlikely. In order to find a biomarker that will identify those individuals that AFP misses, a specific sample set will be used of individuals with HCC that had low levels of AFP. If a successful biomarker for this group could be identified, then sensitivity and specificity of a combined screen (with AFP) would improve. This investigation will be performed using High Performance Liquid Chromatography (HPLC) to identify the sugar components of serum glycoproteins. Then, the protein analogue will be identified using mass spectroscopy and lectin pulls. Lastly, a high-throughput screening assay will be developed to allow for the validation of the biomarker candidates.

CHEST STIFFNESS IN PORCINE MODEL

Nathan Lear

Biomedical Engineering

Dr. Matthew Maltese

CHOP Anesthesiology & Critical Care Medicine

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Cardio pulmonary resuscitation (CPR) is an emergency procedure that is performed to perfuse the brain and heart via external chest compressions and return normal heart function via defibrillation. The stiffness of the chest changes and can result in a varied amount of force to reach the required depth during compressions. The purpose of this study was to analyze how chest stiffness changes during the resuscitation event and how this change affects compression depth, blood pressure, and return of spontaneous circulation. Ventricular fibrillation was induced electrically or through asphyxiation and went untreated for seven minutes before CPR was attempted to restore circulation. Chest compression and pressure data were collected through the defibrillator and PowerLab computer program. Data was then imported into MatLab for analysis. Through analyzing the data graphs were produced which showed compression depth and pressure plotted together. As time increased, the compression depth increased slightly and this can be attributed to a change in chest stiffness over time. It became easier to compress the heart and as a result blood pressures increased as well. Through further data analysis on other swine models and a more complete analysis of the data, other conclusions will be drawn regarding the specific chest stiffness and how much it changed over time.

THE ALL POWERFUL HURRICANE

Phuong Nguyen

Biomedical Engineering

The objective of this research project is to observe the effect of warm water on hurricane development. It will be interesting to understand how changing water temperature would affect the hurricane intensity and the number of hurricane that occurs in a year. Historic hurricane data is collected from the NASA Earth observatory website and modeled with experimental data. The data will show the intensity and number of hurricanes over several years in response to average global temperature during each hurricane season. There are many instances in the past decade that the hurricane started small but due to the warm water, it became stronger. For example, Hurricane Katrina stared out as a category 1 hurricane but it became a category 5 after it absorbs the warm ocean water. Hurricane Katrina alone took 1,300 lives and causing over 100 billion dollar's worth of damage. Hurricane only happen during the hurricane season and the Atlantic hurricane season begins at June 1st and end at November 30th. With both the experimental data and the data from the NASA Earth observatory website, the relationship between the hurricane and the temperature will be apparent. Future studies can focus more on building stronger house that can withstand strong hurricane and finding ways to stop the earth from warming up the water and preventing the hurricane from becoming stronger than it already is.

Dr. James R. Spotila

Biology

Surface Modification of PMMA for QLIDA Assay

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The original goal of this project was to identify a substance that would modify the surface of a PMMA capillary, in order to functionalize it for a QLIDA assay, more effectively than sodium hydroxide. Sulfuric acid was tested as a possible alternative, and the signal strength of those capillaries were compared to those of sodium hydroxide-modified capillaries. However, the results of these tests indicated that neither of these compounds was significantly improving the results of the assay. This realization led to a separate experiment, in which the PMMA capillaries we were currently using were compared to the old capillaries. After performing the same assay in each type, we found that the new shipment was indeed of lower quality than the old shipment. This meant that the new shipment was unusable for the QLIDA assay.

Relationships between the Roots of Polynomials and the Roots of their Derivatives

Neharika Ramani

Biomedical Engineering

Dr. Ronald Perline

Mathematics

Finding the roots of a polynomial function is a fundamental problem in mathematics. People are most accustomed to finding roots by setting the polynomial function, f(x), equal to zero, and solving for x. Newton's method, however, states that the root of a polynomial is at a fixed point where g(x)=x where g(x)=x-(f(x)/f'(x)). A point near the root is estimated, and plugged into this equation; the result is then plugged back into the same equation, and the process is repeated until (f(x)/f'(x)) is almost 0, indicating that there is a fixed point/root.

This project explores the relationship between the roots of a polynomial and the roots of its derivatives. One aspect of these relationships is described by the Gauss-Lucas theorem (GLT). The GLT states that the roots of the derivative of a function, P', lie within the convex hull of the roots of the original function, P. To prove this theorem, one shows that the roots of P' are fixed points the following function related to the GLT, g(z)= i/(abs(z- i))2)/ (1/(abs(z- i))2). A starting point, sufficiently close to the root of P', was chosen as z in the GLT, and the same iterative process as mentioned in Newton's method was performed. The desired result , would have been having the points approaching the root of P'. However, after testing several polynomials, most commonly the points in the GLT marched in towards the root of the derivative, and then out towards one of the roots of the original polynomial. Various numerical experiments have been performed to see if this information can be used to compute the roots of the derivative polynomial.

Objects of Daily Living In Cardiopulmonary Resuscitation

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Cardiopulmonary resuscitation (CPR) is an emergency medical procedure that restores breathing and a normal heart rhythm to those that experience cardiac arrest following accidents, injuries, cardiac arrest, stroke, and airway obstruction. While CPR is a vital basic life skill, oftentimes, bystanders are reluctant to provide quality CPR due to lack of training and decreased retention of previously acquired CPR skills (Swor at el. 2008). The quality of CPR can be improved by providing laypersons with an inexpensive and accessible option to practice skills subsequent to taking a course. The objective of this study is to compare applied force and resulting deformation of compressions conducted on daily objects of living with the thoracic force and deflection data from chest compression cycles conducted on varying age groups of patients. Phillip MRX with QCPR defibrillator (Phillips Electronics N.V) was used to collect force and chest deformation data on compressions done on the various household objects. Objects included a football, soccer ball, pool noodle, Nerf football, toilet paper, soda bottle, and a life jacket. This data was applied to a parallel spring force damper model in MATLAB (The MathWorks, Inc.) to obtain the mean elastic force at varying depths and the stiffness coefficients of the objects. The elastic force and displacement relationships were then compared to that for different age groups of humans (Maltese at el. 2008). It was found that toilet paper roll held similar elastic force and displacement properties to that of the 8-22 year olds and that a life jacket held similar properties that of the 6-year-old group. These objects that hold force and deflection properties akin to those of the human chest for the different age groups will allow for an economical and accessible method to further practice of CPR skills without the need of standardized training. In the future, studies can be conducted to determine the effectiveness of using objects of daily living to improve the quality of CPR and retention of skills.

THE RELEASE OF CHYMOTRYPSIN THROUGH HYDROGEL

Bhavit Vora

Biomedical Engineering

Spinal cord injury is one of the most prevalent problems in today's society. The overall objective of this project was to use biomedical engineering principles to create a delivery system for the regeneration of spinal cord tissue. Our delivery systems were comprised of an alginate gel which was used to release the protein chymotrypsin. One of our delivery systems used dextran sulfate as an addition to alginic acid, while the other system used just alginic acid. The release of chymotrypsin was used to model the release of Nerve Growth Factor (NGF) in the human body. We chose negatively charged Alginic acid to create our alginate gel due to the fact that alginate is compatible with human body and easily binds with positively charged chymotrypsin. The chymotrypsin from the alginate gel was released in to Hank's Buffer, a model for cerebrospinal fluid, and measured every 24 hours through fluorescence testing. To aid in the measure of its release, the chymotrypsin was labeled with FITC (a fluorescence molecule). After 12 days of measurements, our results showed that our systems can be successfully used to release chymotrypsin. The results met our original objective by showing that alginate gel is a practical delivery system to treat spinal cord injury. However, the next step would be to modify this delivery system to control the rate of release of the growth factor into the body and thus prolong the treatment as necessary.

Dr. Yinghui Zhong

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Space Curves and the Bicycle Problem

Rebecca Wright

Biomedical Engineering

Dr. Ronald Perline

Mathematics

Although the geometry of curves in the plane and space is very well known, there remain some surprisingly simple problems which have not been fully investigated. In our project, we study the "bicycle problem": suppose a front tire of a bicycle traces out a certain (closed path); what can you say about the geometry of the path swept out by the rear tire? Among the various questions on can imagine, three important ones are: 1) Given the tracks of the rear and front wheel, can you tell which way the bicycle went; 2) if the track of the front wheel is a smooth simple closed curve can one ride the bicycle so that the rear wheel track also closes up; 3) can one ride a bicycle in such a way that the tracks of the rear and front wheels coincide?

For the most part, these problems have been studied in the context of planar curves. Our project involves investigating three dimensional analogues of the problem, in particular using the geometry of spherical curves (curves which lie on a sphere) to come up with new examples of closed bicycle paths.

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We applaud and thank you.

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