Three Minute Thesis

CAAH

Rhetorics, Communication and Information Design

Vampires and Video Games

Authors: Lauren Woolbright
PI/Advisor/Mentor: Jan Holmevik

The video game world is saturated with images of burly men with weapons, scantily clad women, and a wide variety of monsters. Game mechanics generally involve violence, either in the enemies the player must fight, or in the changes the player can inflict on the physical world. For the sake of money and marketing, the game industry has made certain choices about what they will design and how they will portray gender, race, animals, and environments. Rather than merely critique the industry for its cowardice and slavish conformity to its tradition, I will make the kind of game I want to see in the world. My dissertation project is to design a video game that brings gender and race in particular to the fore, a game that will open discussions about what it means to be a woman, to be mixed race, to be considered a monster. Beginning at the end of the Victorian vampire novel The Blood of the Vampire, my game will allow players to take up the character Harriet and explore the streets of London, first as a ghost, then as a living woman, coming to terms with who she is—or ought to be.

They Were Soldiers Once: Rhetorics, Fictions, and Narratives of the Vietnam and Iraq Veteran

Authors: Sharon Henry
PI/Advisor/Mentor: Dr. Cynthia Haynes

If the average American were asked, “What do you think of when I say Vietnam veteran?” some images that would come to mind are the reluctant draftee, the dysfunctional soldier who couldn’t adjust to civilian life, the disabled veteran, or the addicted veteran. Where do we get these images? It is my conjecture that the media of Vietnam were not only influenced by the historical events of the ‘60s and ‘70s, but they in turn influenced America’s perceptions of the historical events of Vietnam and America’s reactions to current events in the Middle East. Specifically, the American public’s perceptions of military men and women have ranged from one extreme to the other, moving from the vilification of Vietnam soldiers to the heroification of Iraq War soldiers. Contributing to these mythologies are the narratives and the rhetorics used by various forms of media: film, literature, television, and blogs, among many others. The purpose of this research is to examine how historical events influenced these media, how these media have come to influence American ideas of the historical events, and how history and media come together to influence American perceptions of the soldiers and veterans of the current war in Iraq.

CAFLS

Biochemistry and Molecular Biology

Spider Dragline Silk Inspired Fibers With Unique Properties

Authors: Peng, Congyue; Russo, Julia; Gravgaard, Charlene; McCartney, Heather; Gaines, William; Marcotte, Wil
PI/Advisor/Mentor: William R. Marcotte Jr.

Biomimetic fibers that resemble the structure and function of spider dragline silk and that can be consistently produced in large quantities would be in high demand and provide opportunities for exciting advances in medical and engineering applications. Our objective is to assemble the building blocks of dragline silk sequences from golden orb-web spider, to express the proteins in transgenic tobacco and to purify the proteins for fiber production. The plant-derived proteins consist of native Spidroin 1 or Spidroin 2 N- and C-termini flanking various copies of respective consensus repeat domains (mini-spidroins). We confirmed gene insertion and RNA transcription by Polymerase Chain Reaction (PCR) and reverse-transcriptase PCR, respectively. Mini-spridroins were purified by affinity chromatography. Freeze-dried mini-spidroins formed gelatin-like fluids which exhibited extending continuum property. When treated with acid, cross-linked by glutaraldehyde and diluted in phosphate buffer, the concentrated mini-spidroin caused condensation of gellan gum counterion resulting in a thin film at the interface. The film can be pulled into fibers that are resistant to water, methanol or ethanol. When observed under the microscope, the fibers are auto-florescent with micro-fibril ridges along the fiber axis. Fibers produced from mini-spidroins alone or in mixtures resulted in fibers displaying unique physical properties.

Biological Sciences

MULT1E/mIL-12: A Novel Bifunctional Protein for Natural Killer Cell Activation

Authors: Mrs. Ashlee Tietje, Dr. Jinhua Li, Dr. Xianzhong Yu, Dr. Yanzhang Wei
PI/Advisor/Mentor: Dr. Yanzhang Wei

Natural killer (NK) cells have the potential to be effective killers of tumor cells. They are governed by inhibitory and activating receptors like NKG2D, whose ligands are normally upregulated in cells that are stressed, like cancer cells. Advanced cancer cells, however, have ways to reduce these ligands' expression, leaving them less detectable by NK cells. Along with these receptors, NK cells also require activating cytokines, like IL-12. The goal of this study is to develop a novel bi-functional fusion protein for enhanced NK cell activation. The proposed protein combines the extracellular domain of the NKG2D ligand MULT1E and mouse IL-12. It is hypothesized that when expressed by tumor cells, the protein will activate NK and other killer cells using the NKG2D receptor, and deliver mIL-12 to the NK cells where it can interact with the IL-12R and enhance cytotoxicity. The fusion protein, when expressed by engineered tumor cells, indeed activated NK cells in vitro as

assayed by increased production of INF-γ and cytotoxicity and significantly reduced tumor growth in vivo. Although the study is preliminary, the data suggest that the MULT1E/mIL-12 bi-functional fusion protein is an effective activator of NK cells for cancer treatment.

Environmental Toxicology

Role of Environmentally Relevant Chemical Mixtures on Stress Responses in Daphnia magna (Water Flea)

Authors: Namrata Sengupta
PI/Advisor/Mentor: William S. Baldwin

Daphnia magna is a popularly studied model organism in environmental toxicology. The fates of several individual chemical contaminants have been well investigated in the ecosystem and different animal species. However it is challenging to understand or predict the potential effects of chemicals when they are in a mixture. My research investigates into the synergistic and independent effects of certain chemical mixtures on the responsiveness of a freshwater model organism. We are looking into the molecular mechanisms that alter toxicity of relevant environmental toxicants such as atrazine (herbicide), pyriproxyfen (JHA insecticide) and triclosan (consumer product antibiotic). We have recently found that atrazine can induce detoxicification enzymes in Daphnia and provide protection from other toxicants such as triclosan, when exposed in mixtures. The research will also focus on understanding the crucial role of diet in rendering an organism less or more sensitive to ecological stressors. Increased knowledge of how chemicals interact as mixtures will help us to better use scientific data to develop reasonable solutions for regulating chemical mixtures and managing land and water resources that are contaminated or relatively “clean”.

Food Technology

BACTERIAL RECOVERY, TRANSFER TO HANDS AND SURVIVAL ON RESTAURANT MENUS

Authors: Ibtehal Alsallaiy, Paul Dawson, Inyee Han
PI/Advisor/Mentor: Paul Dawson

Some non-food contact surfaces such as restaurant menus are not routinely cleaned and thus may be a potential contamination risk. The objectives of this study were to detect bacteria on restaurant menus, test the rate of bacteria transfer from menus to consumers and determine the survival rate of bacteria on the menu surface. The average mean of Total Plate count (TPC) was 28 CFU/15cm² sampling area on a menu during busy periods and 15 CFU/15cm² sampling area on a menu during less busy periods. The Staphylococcus count had an average mean of 6 CFU/15cm² sampling area on a menu during busy periods and 2 CFU/15cm² sampling area on a menu during less busy periods. The interaction between the restaurant and traffic periods in regards with Staphylococcus spp. was significantly different ($P= 0.0212$) at a P-value of <0.05. The interaction between the restaurant and traffic periods in regards with TPC was significantly different ($P< 0.0001$) at a P-value of <0.05. The average transfer rate was 11.17%, with a standard deviation of 10.45% between subjects. Survival rate of bacteria was 1.40% after 24 hours and 1.34% after 48 hours, respectively. These results indicate

bacteria can transfer from menus and survive on them.

Genetics

Small RNAs, big impacts: How microRNAs help plant survive under adverse environmental conditions

Authors: Shuangrong Yuan, Zhigang Li, Dayong Li, Qian Hu &Hong Luo
PI/Advisor/Mentor: Hong Luo
Environmental stresses are limiting factors in plant growth and development, especially for the agricultural productivity. Due to the sessile nature of plants, these stresses are unavoidable. To enhance stress resistance of plant, numerous stress responsive genes encoding for particular functional proteins have been identified. However, the comprehensive understanding of plant response to these stresses remains unclear due to the complexity of the stress responsive network. The discovery of plant microRNAs, a class of endogenous small RNAs, sheds light on this question for the reasons that 1) they coordinately regulate multiple genes; 2) they control diverse biological processes, including plant responses to environmental and nutritional stresses. To determine how microRNAs help plant survive under adverse environmental conditions, we generated the transgenic turfgrass with constitutively expressing of a miRNA gene and evaluated its performance under soil salinity stress at morphological, physiological and molecular levels, respectively. Our data demonstrate that transgenic plants exhibit improved tolerance to salt stress. To understand the underlying molecular mechanisms, three abiotic stress responsive genes have been identified as targets of the miRNA. The results indicate the potential of manipulating plant miRNA in improving plant resistance to environmental stresses.

Microbiology

Environmental Stimuli Alter Exposure Risk of Legionnaire's Disease

Authors: Kathleen Jwanowski
PI/Advisor/Mentor: Dr. Tamara McNealy
Legionella pneumophila is a pathogen that causes a pneumonia like disease called Legionnaire's Disease. This bacteria exists in most man made water sources such as cooling towers in biofilm and planktonic states. The infection is caused when water that has free swimming Legionella in it is aerosolized and inhaled. Metal ions that exist naturally in cooling towers are believed to disrupt the stability of L. pneumophila biofilms, causing a release of the bacteria into the water. In order to understand how this reaction occurs, genes homologous to responsible for copper and gold response in other bacteria were studies to see if there was a similar effect in L. pneumophila. Using green fluorescent protein as a reporter gene, 0uM, 20uM, and 50uM concentrations of copper and gold were added to broth cultures. The fluorescence was measured over time to determine levels of gene activity. The results from the cultures grown in the presence of copper or gold showed increased expression as the concentration of gold increased. These results correspond to the expression of this operon in other organisms which also show an increase when grown in the presence of copper or gold.

Packaging Science

Understanding Polymer Chain Diffusion During Heat Seal

Authors: Russell T. Cooper
PI/Advisor/Mentor: Dr. Duncan Darby

Heat sealing is one of the most commonly utilized methods to close plastic packaging. No matter how well a product is prepared or how suitable the packaging material is, a compromised seal creates a risk of product contamination or damage. Preliminary testing was conducted to confirm that elemental analysis can be employed to measure and track the polymer chain entanglement distance in a heat seal interface. Thin films were cast extruded from low density polyethylene (LDPE) and polyethylene-co-acrylic acid (EAA). LDPE was heat sealed to EAA with a hot bar sealer at varied heat seal conditions. Cross sectioned seal interfaces were analyzed with Scanning Electron Microscopy (SEM) and Energy-dispersive X-ray Spectroscopy (EDX). The oxygen species within EAA were exploited in an attempt to measure the distance that EAA polymer chains diffused into LDPE polymer chains. Ultimately, elemental analysis was useful in measuring the presence of oxygen species. However, the weight percentage differential of oxygen between EAA and LDPE was not large enough to track polymer chain diffusion. Changes in methodology are to be explored as well as different methods such as charged-tip atomic force microscopy. SEM imaging of stained seal interfaces will be utilized to supplement SEM and EDX results.

CBBS

Applied Economics

Are Revisions of USDA's Commodity Forecasts Efficient?

Authors: Ran Xie, Olga Isengildina-Massa, and Julia L. Sharp
PI/Advisor/Mentor: Olga Isengildina-Massa

This study evaluates the revision inefficiencies of all supply, demand, and price categories of World Agricultural Supply and Demand Estimates for U.S. corn, soybeans, wheat, and cotton. Significant correlations between consecutive forecast revisions are found in all crops, all categories except for the seed category in wheat forecasts. This study also develops a statistical procedure for correction of inefficiencies. The procedure takes into account the issue of outliers, the impact of forecasts size and direction, and the stability of revision inefficiency. Findings suggest that the adjustment procedure has the highest potential for improving accuracy in corn, wheat, and cotton production forecasts.

Business Administration

Management, Millennials, & Motivation

Authors: Harold P. Hughes
PI/Advisor/Mentor: Jamie Patterson

Managers today are facing new challenges. Advancements in technology are affecting every industry, making higher education and specialized skills vital, even in entry-level positions. Considering that Millennials are seeking careers that allow them to both maximize income and create a social impact,

managers of today are facing challenges that were previously nonexistent. They must balance the need for employees that possess specialized/traditional skills with the desire that they also have soft skills. Finding the balance between these needs and wants is the crux of Organizational Behavior. As this field grows, we find that uncovering the motivation of individual employees can prove beneficial for both the employees and the employers alike. Understanding how to apply elements of Strategic Management, Organizational Behavior, and Game Theory is critical in assessing each employee's motivation. These are critical components used in hiring decisions. As the job market becomes more specialized and skilled, competition amongst employers for top candidates will grow. With that, it is important for companies to evaluate the needs of each job role and the needs of potential candidates to continuously hire the right person for the right job. Managers today must satisfy employee desires to be successful in business continuity and prosperity.

Economics

Dynamic Sequencing of Drug Treatments for ADHD Patients with Medicaid Coverage

Authors: Anna Chorniy
PI/Advisor/Mentor: Professor Thomas Mroz
Almost 10% of children aged 4-17 were diagnosed with attention deficit hyperactivity disorder (ADHD) in the U.S. in 2007. While many believe that ADHD drugs are overprescribed, very little is known about the existing prescribing practices, physician learning processes, and relative efficacies of various ADHD treatment strategies. The evidence suggests that children diagnosed with ADHD face significant uncertainty regarding efficacy and severity of adverse effects of ADHD medications. Almost half of these children switch therapies during the first six months of treatment. I extend Crawford and Shum (2005)\'s model to explore the effects of various drug and behavioral therapies on the overall treatment cost, adherence, and disease duration, accounting for patient heterogeneity in response to treatment for ADHD. Using South Carolina Medicaid claims data for 2003-2012, I estimate a dynamic model of demand for ADHD drugs under uncertainty. I will explore the potential to develop better guidelines that can improve the quality of drug-patient matches and patients outcomes. In an immediate extension of this research, I will link each child's medical records to their school attendance and academic performance to estimate effects of ADHD medication on academic and behavioral outcomes among children diagnosed with ADHD.

Impact of selection method of Insurance Commissioner on insurance markets

Authors: Ghanshyam Sharma
PI/Advisor/Mentor: Dr Robert Tollison
Insurance Industry is regulated at the state level by an Insurance Commissioner. Each state has an Insurance Commissioner. In some states, Insurance Commissioner is elected (through direct ballot) by the people, in other states Insurance Commissioner is apppointed by the Governor. States

in which Insurance Commissioner is elected by the people have significantly lower car insurance premiums as compared to states in which the Insurance Commissioner is appointed - about $300 less for a period of six months. Appointed Insurance Commissioners extract lower tax revenues from the Insurance industry as compared to Elected Insurance Commissioners. This is because public officials respond to the incentives they face. Elected regulators are directly answerable to the people and hence create conditions which lead to lower insurance premiums for the people. Appointed regulators are not directly answerable to the people. So they dont care about people that much. In fact they are pro-industry. They can extend favors to the industry - allow them to charge higher prices and extract lower taxes in return for favors like campaign contributions.

Industrial/Organizational Psychology

The Role of Social Support in Getting Military Personnel into Mental Health Treatment

Authors: Kristen Jennings
PI/Advisor/Mentor: Dr. Thomas Britt
Service members of the United States military occupy jobs that are unlike most in the exposure to exceptional stress and the potential for traumatic on-the-job experiences. Because of the nature of their job duties, many soldiers are vulnerable to developing mental health problems. Even more problematic, many soldiers experiencing mental health problems are not getting the treatment they need. The present study examined how different sources of social support can influence a soldier's decision to seek treatment. More specifically, the study examined unique influences of family and friends, fellow unit members, and leaders. Using data from 1,728 active duty soldiers, results indicated that different sources of support for treatment-seeking are related to whether or not soldiers seek treatment through positively affecting their attitude toward treatment. Support from family and friends were found to be most related to attitude and treatment-seeking. These relationships also depended on the functional impairment caused by the problem, as the effect of support on treatment-seeking through attitude toward treatment was strongest for those soldiers with problems causing low or moderate impairment. The results of this study can be used in designing applications to enhance social support resources that are most effective for getting soldiers into treatment.

CES

Automotive Engineering

New Stochastic Method for Fault Detection

Authors: Sara Mohon
PI/Advisor/Mentor: Dr. Pierluigi Pisu
Technological systems are becoming more and more vulnerable to faults that may lead to damage of property or human lives. Therefore, detection of faults is extremely important. Most systems are dynamic systems and can be

studied using cell-to- cell mapping. The dynamic state space of the system is gridded into cells that the system may occupy as time evolves. Using this framework, the probability of cell transitions can be computed using various approaches. Transition probabilities are important because if a system transitions to a cell that has low probability then a fault may be occurring. The most common approach to calculate transition probabilities is the Monte Carlo method. The movements of many initial random points inside a cell are calculated. These points will move to new cells or stay within the original cell and the probability of cell transitions are calculated. The new stochastic method proposed by the author uses the flow within the system vector field to predict transitions. Only the flow through the perimeters of the cell are considered and transition probabilities are constructed. The advantage of the new method is it can be performed during system operation and can detect faults quicker than the Monte Carlo method.

Bioengineering

Lactate's Metabolic Influence on Breast Cancer Progression

Authors: Arthur Nathan Brodsky
PI/Advisor/Mentor: Dr. Sarah Harcum

For women in the United States, breast cancer is responsible for almost one out of every four deaths. High levels of the metabolite lactate have been shown to correlate with poor outcomes as well as treatment resistance in women with breast cancer. Additionally, lactate has been shown to stimulate metastasis – the process by which cells from a primary tumor migrate to other organs and form secondary tumors – that is responsible for 90% of all cancer deaths. Unfortunately, we do not yet know how lactate promotes these activities at the molecular level. Using metabolic flux analysis, we will look at how lactate exposure influences breast cancer metabolism at three different stages – normal breast cells, early stage breast cancer, and advanced, metastatic breast cancer. Once light has been shed on how lactate is metabolized throughout the various stages of breast cancer progression, tools can be developed to recognize and diagnose this breast cancer activity. Additionally, we may then be able to design therapies that complement our existing treatments in order to increase survival amongst breast cancer patients.

A Better Way to Make Heart Valves

Authors: Hobey Tam, Naren Vyavahare
PI/Advisor/Mentor: Naren Vyavahare

Over 300,000 heart valve replacements are performed annually giving rise to a $1.25B heart valve market with 7% annual growth. In emerging markets such as China, India, and Brazil, this growth is 11 – 15%. The current market gold standard is animal tissue heart valves treated with glutaraldehyde, a fixative that allows for the animal tissue to be implanted into humans. Unfortunately, these heart valves fail within 10-15 years due to calcification and structural degradation. This poses a clinical need because we have young and middle aged patients needing heart valve replacements. The problem lies in the use of glutaraldehyde because it has been shown to predispose tissue to calcification and does not stabilize the entire structure of the tissue.

Therefore, we have developed and provisionally patented a novel fixation technique that utilizes alternative chemistries to produce an implantable biomaterial that is resistant to calcification and structural degradation. We have confirmed these claims by lab bench testing and materials properties testing as well as a small animal study. We have also found that our new biomaterial may be more biocompatible than the current market gold standard. These added improvements in efficacy could hold the potential to substantially increase implant life.

Chemical Engineering

Recovering liquid lignin as a renewable biofuel or biopolymer

Authors: Julian Velez, Adam S. Klett, Mark C. Thies
PI/Advisor/Mentor: Mark C. Thies
Lignin is the second most abundant biopolymer on earth and has the potential to become an inexpensive and renewable platform for the production of aromatic chemicals, bio-based materials, and clean biofuels. Isolating lignin from paper mill black liquor in a dry, low-ash state would result in an excellent biofuel with essentially the same energy content as coal. In collaboration with Liquid Lignin Company, we have developed the SLRP® process for recovering from paper mill black liquors a liquid-lignin phase of reduced ash content in the form of a low-viscosity, easy-to-process fluid. The properties of this liquid lignin are such that a very low ash (< 1.0 wt %) lignin can readily be produced from it. In this work, we study the phase behavior and molecular properties of the liquid-lignin phase isolated from papermill black liquor in order to produce a more effective and efficient recovery of the lignin, as well as to produce liquid-lignin fractions with the desired properties for the convertion of lignin into bio-based materials and chemicals.

Chemistry

DESIGN AND SYNTHESIS OF NOVEL MOLECULES FOR SELECTIVE RECYCLING OF URANIUM IN NUCLEAR WASTE

Authors: A. Kirstin Sockwell, Modi Wetzler
PI/Advisor/Mentor: Modi Wetzler
Decades of nuclear power and weapons production have generated hundreds of billions of gallons of radioactive waste, most of which is sitting in corroding containers and, in some cases, leaking into groundwater, making nuclear waste recycling extremely important. Much of nuclear waste is comprised of reusable uranium, but the process has advanced little since the Manhattan Project. The waste also contains many other metals which exist in a spherical form while uranium exists in a cylindrical form, uranyl. Our objective is to design and synthesize a molecule that would selectively bind the cylindrical form of uranium instead of the spherical form of other metals and thereby enable nuclear waste cleanup. Other proposed methods use molecules that require ten synthetic steps and only bind one half of the cylinder, but we have created a molecule in three synthetic steps that should bind the entire cylinder. We are using spectroscopic techniques to verify complete binding of the uranyl cylinder, and will then follow up with measurements to prove the selectivity of our molecules for uranium versus other metals. These

molecules will allow for the selective removal of uranium from nuclear waste, consequently lowering the amount of nuclear waste in the environment.

Civil Engineering

Development of Integrated mixture proportioning and workability characterization technique for pervious concrete

Authors: Betiglu E. Jimma

PI/Advisor/Mentor: Prasada R. Rangaraju

Pavements such as airport runways, highways, parking lots, and sidewalks are vital parts of the infrastructure system. The construction of pavements involves compaction and densification of all layers. The compaction effort makes the pavement sections and the underlying ground stiff and impermeable- which prevent the natural flow of precipitation. As a result, runoff from pavement surfaces goes to streams and rivers causing several environmental problems.. Recently, engineers have been developing new type of pavement to mitigate these environmental problems. Pervious concrete pavement is one these pavement systems which provide sustainable pavement solutions. Its high porosity allows water to pass through to the underlying ground. It also allows some pollutants such as oil to stick in its internal pores and to be decomposed by bacteria. Utilizing pervious concrete for pavement application restore the natural condition of water flow to the ground to recharge the ground water system. However, the strength and other mechanical performances of pervious concrete have several limitations. Therefore, the purpose of my research is to improve the performance of pervious concrete by improving its mixture proportioning techniques. So far results have shown that the improved mixture proportion technique improves the construction process and the performances of the pavement.

Framework for the design of sustainable, resilient and functionally serviceable bridge infrastructure

Authors: Srimaruthi jonnalagadda

PI/Advisor/Mentor: Dr. Brandon Ross

The quality of infrastructure in United States has been on steady decline in the past two decades and has now reached alarming levels. Ageing, structural deterioration and loss of functional relevance are the primary reasons for this infrastructure crisis. Their repairs and retrofits are demanding trillion of dollars within 40 to 50 years of construction. This raises concerns on the very sustainability of our infrastructure. One of the major causes of infrastructure failures is loss of functional relevance or functional obsolescence. Functional obsolescence can make structures unfit for functional usage even when they are structurally sound. This research identifies the impacts of functional obsolescence and attempts to create a design framework for optimizing the functional capacity of the bridge infrastructure with sustainability metrics of life cycle costs in normal as well as extreme event scenarios (resilience). Thus, this is a 3-way optimization triangle with functional serviceability, life-cycle-cost and resilience as its 3 corners. With their criticality, safety and longevity being primary indicators of performance, bridges are most qualified for this study. Nevertheless, the framework is applicable to all types of civil infrastructure where functional

relevance and sustainability are major concerns.

Computer Engineering

Large-Scale Gene Network Alignment

Authors: Karan Sapra
PI/Advisor/Mentor: Dr. Alex Feltus, Dr. Melissa C. Smith
Co-expression networks been invaluable in our understanding of species systems biology, but they took months to construct and analyze. There are literally thousands of networks that the we and other groups would like to construct to address specific plant systems biology hypotheses, but these studies are currently unrealistic due to computation time rather than scientific constraint. We apply optimized algorithms that take advantage of all dimensions of parallelism including spatial and temporal concurrency to exploit many-core architectures crossed with multi-node platforms such Nvidia's GPUs and Intel's Xeon-Phi architecture. Using these optimized algorithm for alignment large-scale gene interaction networks for various species and ask fundamental biological questions that could not be asked before.

Electrical Engineering

Bite Counting: A simpler approach to dealing with obesity

Authors: Surya Prakash Sharma
PI/Advisor/Mentor: Adam Hoover
Obesity is a growing problem, with 35% of adult american population being obese. This is roughly 78 million people. Like any budget problem we lose of gain weight by consuming or expending calories. New gadgets like the Nike Fuelband, the Fitbit series of sensors, and the Jawbone UP measure the amount of movement or exercise done by a person to give an estimate of the calories burnt in a day. We look at another approach, which is to count the number of calories consumed in a day. The bite counter technology uses sensor\\\\\\\'s similar to the ones found in a smartphone, but puts it on your wrist instead, so that movement can be tracked. Based on this movement, we can approximate the kind of food you eat, and then the calories. With the magic of computing and machine learning, we hope to make it happen.

Engineering and Science Education

The Connection Between Physics Identity and Interdisciplinary Affinity

Authors: Tyler D. Scott
PI/Advisor/Mentor: Zahra Hazari
This work seeks to understand how students' interdisciplinary affinity (defined by interest and competence beliefs) can help develop a stronger physics identity and better understand what interdisciplinary affinity means and how to asses it. Physics identity is a way of conceiving how an individual sees themselves in relation to the field of physics. Therefore, it is not only a useful way to understand the recruitment and retention of students to physics, but also a way of understanding how the culture of physics is perceived by students. Increasing physics identity among students can help them engage with physics beyond the physics classroom. By making sense of

these complex dynamics, the physics education community can take on the twin issues of training more physicists and changing the common negative perceptions of physics. Also, while research examining interdisciplinarity is popular, it suffers from imprecise definitions and poor ability to measure desired outcomes. Therefore, this work seeks to establish a system of studying interedisciplinary affinity and its connections to physics identity. Results will include practical ways in which physics educators can engage a broader range of students and new frameworks for use in studies of interdisciplinarity and physics identity.

Industrial Engineering

Performance Improvement Methodology

Authors: Dotan Shvorin
PI/Advisor/Mentor: Dr. Kevin Taaffe
The Netafim Company is a world class corporation for manufacturing irrigation products based on an Israeli patent of drippers. In 2009 Netafim had more than 150 factories around the world and a wide range of products. The polymer injection manufacturing process incurred 3% defects, which in mass production translates to a financial burden. The factory was not able to reduce the level of defects in the manufacturing process. By using industrial engineering approaches an analysis methodology was developed that would enable the factory to reduce the defects in the manufacturing process. Although improving the manufacturing performance is a difficult procedure, improving the performance of a professional athlete might be more challenging. As a former professional junior Tennis player and a fellow Tennis Coach, one of the difficulties of Coaching is the understanding of how to reduce performance errors. Our current research is focused on adapting the SDI methodology into the world of player performance in competitive sports. Results have been encouraging thus far. The System Development Interpretation methodology is a way to combine field experience and statistical tools in order to understand how defects are being created in the system and offer creative pathways for performance improvement.

Engineering Hospital Discharge Instructions: Investigating the Effects of a User-Centered Approach

Authors: Haley Vaigneur
PI/Advisor/Mentor: Dr. David Neyens
The hospital discharge process requires improvement, specifically following the requirements in the Patient Safety and Affordable Care Act (also known as Obamacare). This law aims to reduce the number of excessive avoidable readmissions. Discharge Instructions (DI) are documents intended to provide patients with information regarding their hospital visit and instructions on how to continue home-based care. About 78% of patients do not have a complete understanding of their DI, and while the Joint Commission has mandated six items to be included on DI, there are very few recommendations for their presentation or format. The objective of this work is to conduct a study to evaluate how different forms of DI influence the readability and retention of novice DI readers. By taking a user-centered approach, this study will investigate DI characteristics that produce the best

user (patient) performance for readability and comprehension. An experiment will be conducted to analyze user performance while reading DI. Several activities will be included in the experiment including a visual search task, a memory questionnaire, and subjective assessments. It is expected that there will be quicker and more accurate information obtained from a user-centered designed DI than a conventional DI.

Materials Science and Engineering

Shape Memory Nanofoams for Unattended Sensing

Authors: Anna Paola Soliani, Yuriy Galabura, Bogdan Zdyrko, Spencer Novak, Kathleen Richardsoa, Vivek Singh,
PI/Advisor/Mentor: Igor Luzinov
The current research focuses primarily on the development of polymeric nanostructured foams that can selectively sense the immediate chemical environment and retain memory of the specific exposure event(s). These functional polymer materials show a strong interplay between the tailored structure of the system and the functionality of the material. Specifically, 50-300 nm thick polymeric nanofoams with a gradient chemical composition along the sample have been obtained. The nanofoams possess the behavior of a shape memory material. At room temperature, the nanofoams are thermodynamically unstable, but kinetically trapped in a porous shape. Upon exposure to various analytes, the polymeric coatings locally and irreversibly change their internal structure at the nanolevel. Active changes in the optical characteristics of the nanofoam coating can be used to monitor the permanent alteration in the film nanostructure. Consequently, these nanofoams will be efficient and highly sensitive coatings for diverse evanescent waveguide- and resonator-based optical monitoring systems. It is expected they will have a broad usage in unattended sensing applications.

Mathematical Sciences

Efficient decoupling of a fluid-structure interaction problem via optimization

Authors: Paul Kuberry, Dr. Hyesuk Lee
PI/Advisor/Mentor: Dr. Hyesuk Lee
Fluid-structure interaction (FSI) models describe how a fluid and structure exert forces against and deform one another. FSI describes the flow of blood through arteries, air over a wind turbine blade or airplane wing, or even ink moving through a printer head. The development of efficient algorithms for numerically simulating this physical phenomenon are necessary in order to make their adoption realistic in engineering design. Bringing the fluid and structure into contact with one another and then enforcing that their velocities and stresses match along their interface of contact brings a host of algorithmic issues not faced by either fluid or structure solvers alone. We propose an approach to efficiently and robustly decouple the FSI problem into an optimization problem, which will never require solving the entire FSI problem at once. We introduce a control which plays the role of the stress along the interface and then we optimize over that control until we also satisfy the continuity of velocity. This approach allows the user to continue using the software and algorithms that have been developed for solving

either the fluid or structure system, for which there is a large body of research, and with which they are familiar.

Mechanical Engineering

Unexpect Phenomena of Charging at Nanopore

Authors: Peng Wu
PI/Advisor/Mentor: Qiao Rui

Having high power density and extraordinary service life, supercapacitors are emerging as a promising candidate for future electrical energy storage. The unique strengths of supercapacitors come from the large energy physically stored at nanoscale pores among nanoporous materials. However, wide application of supercapacitors faces twofold limitations. On one hand, their moderate energy density needs improving. On the other hand, improving the energy density should not sacrifice the high power output of the supercapacitors. Fundamental research is needed to break the current energy density bottleneck of supercapacitors without sacrificing their high power output. In this work, for the first time, we propose a theory framework which can elucidate the complex relation between the pore size of nanoporous materials and the energy density. The theory provides the guideline to manufacture materials to maximize the amount of energy stored. Furthermore, a collaboration between theory and numerical simulation is conducted to elucidate the physical process of power storing and releasing at supercapacitors. The results highlight that the dynamics properties of electrolytes need to be reexamined at nanoscale confinement. With the help of these research, new opportunities are open on the design and engineering of supercapacitors.

Reservoir-Based Dielectrophoresis (rDEP) for concentration and separation of cells/particles.

Authors: Saurin Patel and Dr. Xiangchun Xuan
PI/Advisor/Mentor: Dr. Xiangchun Xuan

Dielectrophoresis (DEP) is the translation of a particle either along (i.e., positive dielectrophoresis) or against (i.e., negative dielectrophoresis) an electric field gradient if the particle is more or less polarizable than the suspending medium. The polarizability of a particle is dependent on its electrical and mechanical properties. This makes DEP a versatile tool for particle and cell handling, especially in microdevices due to its favorable scaling. Traditional DEP is realized through patterning pair(s) of microelectrodes onto the surface of a micro channel. Recently DEP has also been implemented by the use of channel geometry, which can be the variation in channel cross-section or the curvature of the channel itself. Both methods, however, rely on in-channel electrical or mechanical parts to create electric field gradients, which complicate device fabrication and causes fouling trouble due to electrochemical reactions and electrothermal flow effects etc. Reservoir-based dielectrophoresis (rDEP) is a newly developed microfluidic method that exploits negative dielectrophoresis induced at the reservoir-microchannel junction to manipulate particles inside a reservoir. As the rDEP focusing, concentration and separation of particles all take place inside a reservoir; the entire microchannel can be spared for pre- and post-

analysis. This makes the rDEP method perfectly positioned for lab-on-a-chip applications.

Single Drop Particle Scavenging

Authors: Steven Fredericks
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Every day industrial processes produce particles in the form of dust or smoke, and these particles are introduced to the atmosphere. A common method for removing these particles is to use water sprays to capture particles as they travel through a smokestack. Using this method there is a size range of fine particles which are difficult to remove from the air. Unfortunately, these particle sizes are the most harmful to respiratory functions, as they tend to be deposited deep within the lungs. To help remove more of these particles a single spray drop falling through a smokestack is considered. As this drop falls it will change shape. By optimizing these shape oscillations it is theorized that the amount of particles scavenged by a spray drop will increase. To study this, a single drop is acoustically levitated while exposed to particle laden air, and the number of particles collected is measured. By manipulating the acoustic field supporting the drop it is possible to induce shape oscillations, and study their impact on particle removal.

CHEHD

Parks, Recreation & Tourism Management

Recreational Experiences of Undocumented Young Adults

Authors: Austin Langley
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The purpose of this study is to create an understanding of the recreational experiences of Latino young adults of the 1.5-generation who do not have a legal immigration status in the United States. This population faces a unique set of challenges in their transition to adulthood and their pursuit of higher education. Three common factors among undocumented young adults who have been successful in school are extra familial mentors, positive social supports, and supplementary educational programming. Contact theory is the idea that increased contact between social groups promotes a decrease in discrimination and an increase in inclusion and understanding. Currently, there is little research that explores how this population engages in recreation. This research will seek to understand how recreational experiences of undocumented young adults contribute to contact theory and the three factors related to success in school. Qualitative semi-structured interviews, with undocumented young adults over the age of 18, who qualify for Deferred Action for Childhood Arrivals and who are enrolled in higher education, will be used. The data will be transcribed verbatim and analyzed thematically. Due to the difficult access to this population, snowball sampling will be used beginning with college-level instructors who know or teach undocumented students.

Exploring the Mediating Role of Leisure Behavior in the Relationship

between Identity Status and Well-being during Emerging Adulthood

Authors: Cindy L. Hartman
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Emerging adulthood, a developmental life phase occurring roughly between the ages of 18 and 25, is a time where many individuals do not feel like adults, yet do not identify as adolescents either (Arnett, 2000). A unique developmental task of emerging adulthood is identity formation. Psychosocial identity, or an individual's exploration of and commitment to self, involves balancing internal goals and values with the external forces of their peers, family and society. Psychosocial identity is often used to distinguish groups of individuals from others in terms of differing identity statuses during emerging adulthood. Those emerging adults with solidified psychosocial identities demonstrate higher positive functioning (e.g., self-esteem) and lower negative functioning (e.g., anxiety), while those with uncommitted identities demonstrate the opposite (e.g., Schwartz et al., 2011). While factors contributing to identity development have been identified (e.g., authoritarian parenting style, positive peer influence), little is known about the role of leisure behavior in mediating the relationship between identity status and well-being. This "Three Minute Thesis" talk will introduce this developing dissertation topic by presenting possible connections between identity statuses, well-being and leisure behavior during emerging adulthood. Potential implications for those working with emerging adults (e.g., student affairs professionals, counselors) will be discussed.