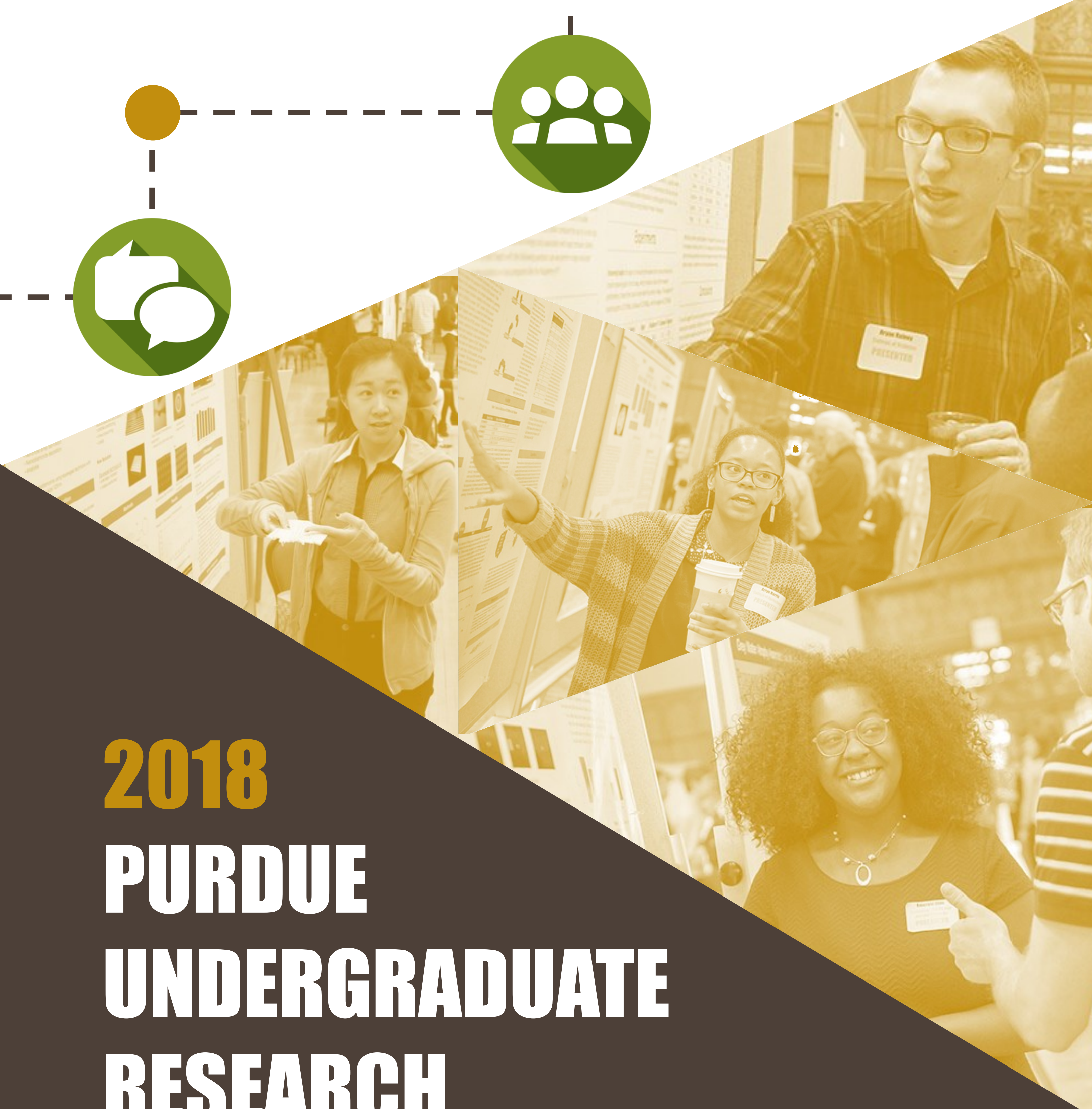

2018 PURDUE UNDERGRADUATE RESEARCH CONFERENCE

APRIL 10, 2018

West Lafayette, Indiana

PURDUE UNDERGRADUATE RESEARCH CONFERENCE

SCHEDULE OF EVENTS

APRIL 10, 2018

8:30 — 9:30 AM	**Oral Presentations I, STEW 214**
9:30 — 10:30 AM	**Oral Presentations II, STEW 214**
10:30 — 11:30 AM	**Oral Presentations III, STEW 214**
12:00 — 1:00 PM	**Poster Presenter Set-Up**
1:00 — 4:30 PM	**Poster Symposium, PMU Ballrooms**
4:30 — 5:30 PM	**Awards Ceremony, PMU Ballrooms** *Remarks from President Mitch Daniels & Senior Vice Provost Frank Dooley, PhD*

Oral presentation session schedule and the poster symposium layout are found later in this program.

Refreshments are available throughout the oral presentations and poster symposium.

PURDUE
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Purdue Undergraduate Research Conference Oral Presentation Schedule

	PRESENTATION START TIME	STEW 214-A	STEW 214-B	STEW 214-C	STEW 214-D
SESSION 1 (8:30 to 9:30 am)	**8:30**	*Incidence of QTc Monitoring and Prolongation in Pediatric Patients* **Alexandra Bednarz** College of Pharmacy	*Using R2* as a MRI Marker for Iron Accumulation in the Brain of Welders* **Jennifer Davis** College of HHS	*An Analysis of Social Climate at Purdue University and its Effects on the Minority Experience* **Maya Black** College of Science	
	8:50	*Patient-Physician Communication on Tapering Opioid Medication Dosage* **Audrey Caprio** College of HHS		*Maternal Outcomes of Pregnant Women Taking Tumor Necrosis Factor-alpha Inhibitors* **Veronica Bonderski** College of Pharmacy	
	9:05	*Agricultural Change Over-time within the Wabash River Watershed* **Taylor Blanford** College of Agriculture	*Neurodevelopmental Alterations of Lead and Radiation in Zebrafish* **Boghos Taslakjian** College of HHS	*Discovery and Sequencing of Mycobacteriophage* **Jamie Arabshahi** College of Engineering	
SESSION 2 (9:30 to 10:30 am)	**9:30**	*Improved Troubleshooting Aircraft Electrical Faults Process* **Hyung Jee** Polytechnic Institute	*Developing Cryoprotective Nanoparticles for DMSO-free Cryopreservation of Natural Killer Cells for Cancer Immunotherapy* **Stella Jung** College of Pharmacy	*Impact of Active Learning on Future Student Performance* **Andy Gao** College of Science	
	9:50	*Botanical Air FIltration & Purdue Biowall Research* **Joseph Overdorf** Polytechnic Institute	*Marketing Analytics And Recruitment Practices* **Joshua Chan** Krannert School of Management	*High Expectations and High School Choice* **Bridget Curry** College of Liberal Arts	
	10:05	*Effects of Biostimulant on Productivity and Quality of Lettuce and Tomato* **Gaotian Zhu** College of Agriculture	*Thin Film Adhesion Measurements through Wrinkle to Delamination Transitions* **Allison Chau** College of Engineering	*Polluted Parasites: The Effects of an Endocrine Disruptor, Bisphenol A, on a Trematode Parasite* **Ellie Reinhart** College of Science	
SESSION 3 (10:30 to 11:30 am)	**10:30**	*Development of Novel ELP-Based Transcriptional Regulators for Improved Biomanufacturing* **Juya Jeon** College of Engineering	*Anthropologists as Cultural Mediators: Improving Access to Human Rights for U.S. Asylum Seekers* **Baylee Bunce** College of Liberal Arts	*The Less Known Generation Alpha* **Sakhi Aggrawal** Polytechnic Institue	*Patient-Physician Communication on Tapering Opioid Medication Dosage* **Kiara Hughes** College of Science
	10:50	*In Vitro Characterization of Delta Opioid Receptor Pharmacology* **Kendall Mores** College of Pharmacy	*Alleged Antitrust Violations in Collegiate Athletics* **Joshua Groh** Krannert School of Management	*Sex Differences in Reward Seeking and Safety Behaviors in a Fear-Safety-Reward Discrimination Learning Paradigm* **Makenzie Norris** College of Science	*Breeching Security: Identifying the Security Gaps Created by Technological Advancement* **Zach Tipton** College of Liberal Arts
	11:05	*Understanding Condom and Pharmacy Vending Machine Attitudes and Behaviors in Italy* **Gabrielle Wise** College of HHS	*Pathways into Engineering: A Multi-Institution Comparison* **Anna Francis** Polytechnic Institute	*Motor Preparation For Expected but Undefined Movements* **Mitchell Tillman** College of HHS	*Effects of L-Glutamine Supplementation on Meat Quality of Porcine Muscles from Pigs Exposed to Transportation/ Weaning Stress and Climate Stress* **Krizia Lepiz Conejo** College of Agriculture

Start Time: 8:30am :: **Room:** Stewart 214-A :: Life Sciences

College of Pharmacy

Incidence of QTc Monitoring and Prolongation in Pediatric Patients

Author:

Alexandra Bednarz

Abstract:

QTc-prolongation (QTc-p) may lead to cardiac arrhythmias and sudden cardiac death. Recent guidelines encourage electrocardiogram (ECG) monitoring for hospitalized adults based on risk factors, including receipt of QT-prolonging medications, history of long QT syndrome, electrolyte abnormalities, renal or hepatic dysfunction, and structural heart disease. These guidelines encourage similar practices in children, although data supporting this recommendation are sparse. Furthermore, while drug-induced QTc-p can occur in pediatric patients, its incidence is not well characterized. The purpose of this study is to evaluate current ECG monitoring practices in pediatric patients receiving QTc-prolonging medications, as well as determine if recommended adult guidelines are routinely followed.

This retrospective chart review included patients less than 18 years admitted to Riley Hospital for Children between 1/1/2016 – 11/28/2017. Included subjects received one or more of the following medications known to cause QTc-p: citalopram, chlorpromazine, escitalopram, erythromycin, fluconazole, haloperidol, methadone, quetiapine, risperidone, and olanzapine. Excluded patients had a diagnosis of congenital short QT syndrome. Data collection included demographics, QTc prolonging medications, and ECG information. The primary outcome is frequency of baseline and follow-up ECGs while receiving a QTc prolonging medication. The secondary outcome is frequency of QTc-p, defined as QTc interval ≥460 milliseconds or an increase ≥50 milliseconds from baseline.

Ninety-one patients have been included to date. Thirty-three (36.2%) patients received a baseline ECG and 13 (14.3%) received at least one follow-up ECG. The most common QTc prolonging medications were oral methadone (20.9%) and chlorpromazine (15.4%). Two (2.2%) patients who received baseline ECGs had QTc-p at follow-up.

Research Mentor: Emily Israel, Pharmacy Practice

Start Time: 8:30am :: **Room:** Stewart 214-B :: Life Sciences

College of Health and Human Sciences

Using R2* as a MRI marker for Iron Accumulation in the Brain of Welders

Author:

Jennifer Davis

Abstract:

Iron (Fe) is a common component in the Earth's crust and has been found in large quantities in brains afflicted by neurodegenerative diseases. As part of efforts to quantify Fe accumulation in the brain using magnetic resonance imaging (MRI), 47 welders and 38 controls were recruited and scanned. Fe concentration in the brain was measured by acquiring R2* maps calculated from MRI images. R2* is a MRI parameter known to be proportional to the amount of Fe in the region. Whole-brain R2* maps were co-registered with structural images using SPM12 and segmented into 10 different brain regions using Freesurfer. R2* in chosen regions of the brain (e.g. left and right accumbens area, amygdala, caudate nucleus, cerebellum cortex, cerebellum white matter, cerebral white matter, hippocampus, pallidum, putamen, and thalamus proper) were averaged and compared between welders and controls. Visual assessment of the data showed apparent differences in Fe deposition between welders and controls, but were not statistically significant using student's t-tests.

Research Mentor: Ulrike Dydak, Health Sciences

Start Time: 8:30am :: **Room:** Stewart 214-C :: Social Sciences/Humanities

College of Science

An Analysis of Social Climate at Purdue University and its Effects on the Minority Experience

Author:

Maya Black

Abstract:

Purdue University has a disparity between the percentage of its racial and ethnic underrepresented minority (URM) students and non-minority students. This disproportion, along with the social climate at Purdue, often leads to a negative experience for URM students. This “Minority Experience” is often at odds with narratives portrayed by Purdue University which leads to misunderstandings and decreased URM student success.

This project aims to look at if the social climate of Purdue impacts racial and ethnic URM students in terms of GPA, campus engagement, graduation rate, and retention rate in addition to more qualitative experiences such as emotional/mental health and feelings of belonging. Using surveys and institutional data from the Office of Institutional Research, Assessment and Effectiveness (OIRAE), we aim to see how Purdue’s social climate affects our racial and ethnic URM population in comparison to universities from across the country and to see if there is a disparity in racial and ethnic URM success due to our campus social climate. We also hope to identify is there are positive factors which increase the success of racial and ethnic URM students such as intra-URM interaction. The goal of this research is to see if there are any tangible improvements that can be implemented on campus in order to improve the Minority Experience at Purdue University.

Research Mentor: Jason Ware, Honors College

Start Time: 8:50am :: **Room:** Stewart 214-A :: Social Sciences/Humanities

College of Health and Human Sciences

Patient-Physician Communication on Tapering Opioid Medication Dosage

Authors:

Audrey Caprio

Kiara Hughes

Abstract:

Opioid misuse can lead to a barrage of medical issues and even death. Even though literature has shown that long-term use of opioids is ineffective in chronic pain management, many providers continue to prescribe these medications at alarming rates. Along with an increase in use, providers and patients alike find conversations regarding pain and pain management strategies “strenuous,” “hostile,” and “a major source of frustration.” Improving communication by breaking down these barriers is essential in the prevention of opioid misuse. To conduct the study of patient-physician communication, Dr. Shields (Purdue) and Dr. Mathias (IUPUI) recruited 36 patients from Eskenazi Hospital outpatient clinics to complete pre-observation surveys and record three sequential visits with their primary care provider. After transcription by the research team, undergraduate research assistants rated transcripts on tapering (reducing or eliminating) opioid use. Physician’s discussions were rated on a 5-point scale of how much they discussed the need to taper opioid use, and patients were rated on the same scale on how much they talked about their need for maintaining or increasing opioid dosages. Physicians discussing tapering and patients requesting the same or more opioids were highly correlated 0.85 ($p < .001$). This indicated that when physicians suggest tapering, patients might become alarmed and protective of their need for opioids. When patients mention maintenance or an increase in opioids, physicians respond with concerns about opioids and promote tapering of dosages. Future studies will examine interventions to increase tapering conversations.

Research Mentor: Cleveland Shields, Human Development and Family Studies

Start Time: 8:50am :: **Room:** Stewart 214-C :: Life Sciences

College of Pharmacy

Maternal Outcomes of Pregnant Women Taking Tumor Necrosis Factor-alpha Inhibitors

Authors:

Veronica Bonderski

Sarah Hood

Anthony Giazzon

Abstract:

Little data is available surrounding the safety of tumor necrosis-alpha inhibitors during pregnancy. Small studies present conflicting data on whether these drugs present increased risk for poor outcomes when used in pregnancy. Consistent, long term safety data is lacking, leaving many women with inflammatory conditions unsure of how to control their disease if they become pregnant.

Using the Indiana Network for Patient Care, we pooled data for women between the ages of 18 and 44 years old who had a recorded pregnancy between 2002 and 2017. We then included women who had an ICD coded diagnosis for select inflammatory conditions, including but not limited to rheumatoid arthritis, psoriasis, or Crohn’s disease, prior to their pregnancy. The search was further narrowed to women who had filled a prescription for select tumor necrosis-factor inhibitors within 90 days of their pregnancy confirmation. Our search resulted in 390 women that fit these criteria. From there, we assessed which women had a poor pregnancy outcome such as spontaneous abortion, pre-eclampsia, or prematurity.

The rate of outcomes we observed in our cohort appear to be consistent with what is seen in the general population. Increased rates of pre-eclampsia were observed, which may be contributed to pathophysiology of the inflammatory diseases themselves. Large prospective registry studies should be conducted to strengthen the safety evidence base. Until then, patients should weigh the risks and benefits with their obstetrician and rheumatologist when continuing tumor necrosis-alpha inhibitor therapy during pregnancy.

Research Mentor: Michael D. Murray, Pharmacy Practice

Start Time: 9:05am :: **Room:** Stewart 214-A :: Life Sciences

College of Agriculture

Agricultural Change Over-time within the Wabash River Watershed

Author:

Taylor Blanford

Abstract:

Over three conceptual eras, Native American, Early Settler, and Modern, the people groups that dominate the Wabash River watershed and its agriculture have changed along with many aspects of agriculture, while some aspects of agriculture have remained relatively constant. This paper summarizes the changes and consistencies in field location, crops grown, technology used, value for the river and land, and gender roles within agriculture in the Wabash River watershed during the three eras. Field location has moved from the banks of the Wabash to everywhere but the banks of waterways in the watershed. Of the crops grown in the watershed, corn has been the most prolific and constant across all three eras. Technology has changed drastically over the three eras, from hand tools to modern tractors, combines, and plows. The value for the land and river itself has changed from an intrinsic all-important value to Native Americans to a profit-based value to modern producers. Finally, gender roles in agriculture also changed drastically from totally female run agriculture in the Native American era to male dominated agriculture in the Early Settler and Modern Era.

Research Mentor: Lisa Welp, Earth, Atmospheric, and Planetary Sciences

Start Time: 9:05am :: **Room:** Stewart 214-B :: Life Sciences

College of Health and Human Sciences

Neurodevelopmental Alterations of Lead and Radiation in Zebrafish

Author:

Boghos Taslakjian

Abstract:

Lead (Pb) is used in many industrial products causing widespread exposure. Pb is known to cause cancer, neurodevelopmental alterations, and cardiovascular diseases. Today, about 500,000 U.S. children ages 1-5 have high lead levels, exhibiting symptoms like headaches and decreased IQ. Radiation is increasingly used in the medical field, doubling the annual radiation exposure since the 1980s. Radiation is known to cause cancer, neurological and cardiovascular diseases. Children are more susceptible to radiation and Pb damage than adults given early stages of development. In this study, zebrafish were used to evaluate the synergistic toxicity effects of Pb and radiation on neuronal development. Zebrafish embryos were dosed immediately after fertilization with 0, 10, or 100 parts per billion (ppb; µg/L) of Pb, and, at 24 hours post fertilization (hpf), were exposed to 0, 0.11 or 1 Gray of photon radiation. At 120 hpf, the end of embryonic development, morphological assessments (body length, head length, head width, and brain length) and behavioral assessments (distance moved, velocity, movement to center point, and no movement to center point) were measured. Morphological assessments indicated that exposure to Pb alone and interaction between Pb and radiation led to significantly shorter body lengths compared to controls ($p<0.05$). Exposure to Pb alone, radiation alone, and interaction between Pb and radiation led to significantly shorter head widths compared to controls ($p<0.05$). Exposure to Pb alone and interaction between Pb and radiation led to significantly shorter head lengths and brain lengths compared to control ($p<0.05$). Behavior assessments indicated that exposure to Pb alone and interaction between Pb and radiation led to significantly significantly less distance moved and velocity ($p<0.05$).

Research Mentors: Jennifer Freeman, Health Sciences; Linda H. Nie, Health Sciences

Start Time: 9:05am :: **Room:** Stewart 214-C :: Life Sciences

College of Engineering

Discovery and Sequencing of Mycobacteriophage

Authors:

Jamie Arabshahi

Ashley Otero

Janice Chan

Elena Haskins

Abstract:

As a part of the HHMI Sea Phage Project, environmental samples of mycobacteriophage are being taken worldwide to sequence their genomes and learn more about their capability for medical therapy in substitution of antibiotics. One of the bacteria mycobacteriophage target and infect, is mycobacterium tuberculosis, which infects 10.4 million and kills roughly 1.7 million people per year. In addition, it has developed deadly strains of antibiotic resistance. To find bacteriophage, soil samples are collected from the environment, and the bacteriophage are purified and amplified before being added to the Sea Phage Database. To estimate genes, programs such as DNA Master, Phamerator, Starterator, BLAST, and GeneMark use information such as coding potential, similarity to other genomes, and ribosome binding sites. Using the information of how mycobacteriophage target mycobacterium could lead to new treatment methods for bacterial based infections.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Start Time: 9:30am :: **Room:** Stewart 214-A :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Improved Troubleshooting Aircraft Electrical Faults Process

Authors:

Hyung Uk Jee

Micah Koeneman

Sung Jun Bang

Abstract:

The authors present a study of an enhanced avionics maintenance procedure and its potential to meet the goals of the recent technological trend in the aeronautical industry. The purpose of this project is to establish a proof of concept for the use of infrared cameras, as means to troubleshoot electrical faults on an aircraft. The focus of this project is to utilize Lean Six Sigma continuous improvement (DMAIC) approach to improve upon a rising problem of increased aircraft downtime for maintenance, especially those caused by an electrical failure from excessive heat generation. The objective of this paper is to discuss the future implementation of thermal imaging cameras as a supplement to the industry-standard testing equipment and to perform an accurate preventative and predictive maintenance of the aircraft electrical system. The performances, using the industry-standard testing equipment and procedure, were compared with the performances using the thermal imaging camera additional to the current standard testing equipment. The researchers used an avionics troubleshooting mock-up to simulate a typical aircraft maintenance situation. Later, they demonstrated the theory on a small selection of aircrafts available at Purdue University's School of Aviation and Transportation Technology. The comparison results showed that the improved process decreased the troubleshooting time by 40%, thereby proving the usefulness of implementing thermal imaging techniques to the industry. Also, technicians in the field will be able to perform the improved process to reduce aircraft maintenance time without compensating for both the reliability of decision-making or the safety of the personnel.

Research Mentors: Thomas K. Eismin, Aviation and Transportation Technology; Sergey Dubikovsky, Aviation and Transportation Technology

Start Time: 9:30am :: **Room:** Stewart 214-B :: Life Sciences

College of Pharmacy

Developing Cryoprotective Nanoparticles (CNP) for DMSO-free Cryopreservation of Natural Killer Cells for Cancer Immunotherapy

Author:

Hei Yun (Stella) Jung

Abstract:

Through several years of research, NK-cell based cancer immunotherapy has shown clinically promising results in the treatment of various incurable cancers. Natural killer (NK) cells inhibit tumor activities by participating in the innate immune response. Thus, they are strong immune effectors for cancer immunotherapy as they promote anti-tumor effects in patients. However, the clinical use of NK cells requires a freezing process called cryopreservation in order to administer the cells into the patients. Cryopreservation utilizes low temperatures to sustain the living cells, without disrupting their cellular activities. Today, dimethylsulfoxide (DMSO) is widely used as the primary cryoprotectant for immune cells in cancer immunotherapy. However, DMSO has several drawbacks such as a high potential to cause severe toxicity at body temperature, which raises several questions about its clinical safety. Therefore, replacing DMSO is highly desirable to avoid serious clinical side effects in patients. Substituting for DMSO is extremely challenging, however, because non-DMSO cryoprotectants poorly permeate into the cell membrane, resulting in low intracellular penetration efficiency and poor cryoprotection. My goal is to develop a new cryoprotective nanoparticle carrier that can effectively deliver new non-DMSO cryoprotectants by internalizing them during cryopreservation without causing toxicity to NK cells. The nanoparticle incorporates biocompatible chitosan-based components along with new cryoprotectants, which maintains superior post-thaw function of NK cells. I aim to implement the nanoparticle-based cryopreservation approach to improve cellular delivery and membrane penetration efficiency of new classes of cryoprotectants in order to ensure superior patient safety during the administration of NK cell cancer immunotherapies.

Research Mentor: Sandro Matosevic, Industrial and Physical Pharmacy

Start Time: 9:30am :: **Room:** Stewart 214-C :: Social Sciences/Humanities

College of Science

Impact of Active Learning on Future Student Performance

Author:

Andy Gao

Abstract:

Active learning is becoming a widespread practice in higher education. While there is a growing body of literature that describes the effectiveness of active learning during a single semester, the research regarding the long-term effects of active learning on future success has been sparse. The majority of the literature explores active learning effects on student performance throughout one course. This research investigates whether active learning in one course will affect students in a way that allows them to perform better in subsequent courses. In particular, this research traces the impact of select courses redesigned through Instruction Matters: Purdue Academic Course Transformation (IMPACT), a course development program at Purdue University that aims to achieve a greater student-centered learning environment by incorporating active learning as well as other student-centered practices, by examining their effects on student performance in subsequent courses not redesigned through the program. The method consists of comparing student grades in the subsequent courses based on whether the previous course that they took had been redesigned through the IMPACT program while controlling for SAT scores and previous GPA of the students. A two-sample t-test will be utilized to determine if there is a significant difference in final grades between the subsequent classes. The results from this research may inform the optimal placement of active learning courses within curricula, and therefore, support the effective use of active learning in higher education.

Research Mentor: Clarence Maybee, Libraries

Start Time: 9:50am :: **Room:** Stewart 214-A :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Botanical Air FIltration and Purdue Biowall Research

Authors:

Joseph Overdorf

Emily Rada

Sailesh Kandula

Jordan Petty

Grace Bickel

Aaron Manio

James Rieser

Jun Ho Kim

Bryce Woodhead

Abstract:

Breathing is one of the most basic necessities for a human or animal to lead a healthy and productive lifestyle. Based on this logic we would expect our buildings to provide us with clean and filtered air. Indoor air is six times more polluted than outside. Americans spend more than 90% of their time indoors. To gain energy efficiency through Heating Ventilation Air Conditioning (HVAC) systems in buildings, indoor air is recirculated. Decaying and forgotten air filters leave inhabitants vulnerable to breathing contaminated air. Poor Indoor Air Quality causes respiratory issues, prolonged sickness, headaches, and earned its own designation, Sick Building Syndrome (SBS). A reliable method of filtering recirculated indoor air urged this research into Botanical Air Filtration. Based off more than 30 years of NASA research into phytoremediation, the Purdue Biowall uses plants and the rhizosphere around its roots to filter the indoor air supply of a full functioning net-zero energy residential home. Oriented into a vertical plant wall, the Biowall is an integral part of the buildings HVAC system. It takes advantage of an Building Automation System (BAS) to provide lighting, irrigation, and record data. Along with filtering air, the Biowall and arrangement of plants in it, brings beauty to the home and connects people back to nature.

At the determination of previous graduate research, project evolution requires specialties from multi-disciplines. The Spring 2018 Biowall undergraduate research team is tasked with moving the project forward. Prof. William Hutzel of the College of Polytechnic created the vehicle for eight undergraduate students from four disciplines to participate in this research, where undergraduate researchers meet once a week to set goals and spend the rest of the week fulfilling them.

Each member of this multi-discipline group brings their own specialty to the project and holds an area of responsibility. Research conducted includes plant growth and propagation, automated system optimization, mechanical design, fluid analysis, digital project outreach, data analysis, as well as the physical maintaining of the Biowall Prototype. Work that is done with the next iteration Biowall, and the drive towards commercialization in mind. A healthy environment starts in your home. The contribution by the Biowall undergraduate research team aids to drive this technology towards commercialization, as well as provides research experience for undergrads. In advancing this technology for all, a contribution to the overall health and happiness of a buildings inhabitants is made.

Research Mentor: William Hutzel, Mechanical Engineering Technology

Start Time: 9:50am :: **Room:** Stewart 214-B :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

Marketing Analytics And Recruitment Practices

Author:

Joshua Chan

Abstract:

This study focuses on understanding how various institutions can incorporate data analytics into recruitment practices in order to convert more admitted students to matriculating students that would ultimately accept their offers. Questions that often arise among higher education administrators are: Which social media platform should we engage our students in? Is email an effective way for us to reach out to students? What are the events that we should devote more promotion budget to in in order to make sure our resources are well spent? While students are trying to get into their desired colleges, institutions are trying to recruit the right students in order to remain competitive in the education market. We developed a solution that integrates clustering and predictive modeling that allows an institution to identify its target segment and truly understand the underlying needs of those potential students. Furthermore, institutions will also discover the marketing approaches that have a significant impact on student enrollment, rather than spending time and resources on campaigns that are ineffective.

Research Mentors: Matthew A. Lanham, Management; James Reeder, Management

Start Time: 9:50am :: **Room:** Stewart 214-C :: Social Sciences/Humanities

College of Liberal Arts

High Expectations and High School Choice

Author:

Bridget Curry

Abstract:

Increasing educational choice is being promoted in some US contexts where traditional schools are most impacted by systemic inequalities and labelled as “failing.” Greater educational agency among students and ownership over education in these settings deserves anthropological attention. In my ethnographic case study, I focus on an urban school of choice program featuring student-centered and project-driven learning. My research questions how and why students, parents, and teachers chose to be a part of this program, as well as how their participation shapes their meaning-making of education. This research contributes to an understanding of how education and choice impacts students.

Research Mentor: Linda Renzulli, Sociology

Start Time: 10:05am :: **Room:** Stewart 214-A :: Life Sciences

College of Agriculture

Effects of Biostimulant on Productivity and Quality of Lettuce and Tomato

Author:

Gaotian Zhu

Abstract:

Historically, plant-derived biostimulants have been considered as a subgroup of growth regulators and bioregulators, and the use of plant biostimulants is proposed as an innovative and revolutionary approach to improve crop quality and yield. Greenhouse production system is typically known as a high input system where high levels of fertilizers were used to grow crops. In this study, a type of biostimulant, legume-derived protein hydrolysate, was used to improve crop quality and yield, while reducing fertilizer inputs for crop production. A series of experiments were implemented in the greenhouse to evaluate the effects of biostimulant on romaine lettuce 'Sara' and dwarf tomato 'Micro-tom' on plant performance, which includes leaf/stem/root length, leaf number and root diameter, photosynthetic gas exchange, chlorophyll content, and crop yield. Treatments consisted of two levels of biostimulant (0 and 3 g/L biostimulant), which were combined with either nitrogen (N) treatments (low, medium, and high) or electrical conductivity (EC) treatments (low, medium, and high) with commercial fertilizer (4.5N-14P-34K). A solution of 50 mL containing biostimulant was applied to romaine lettuce and micro-tom as soil drenching once every week during production period. The results showed that leaf area and head fresh weight of romaine lettuce were increased by 11 % and 15 %, respectively, when 3 g/L biostimulant was combined with low nitrogen or low EC treatment. While the micro-tom experiment is currently ongoing, we observed similar results as romaine lettuce: the tomato plants applied with biostimulants have already shown better performance, particularly under low nitrogen and low EC treatments. Based on our study, it is concluded that biostimulant improves productivity and quality of both romaine lettuce and tomato under low fertilizer conditions. This suggests that biostimulant application may contribute to the reduction of fertilizer inputs in greenhouse production systems.

Research Mentor: Hye-Ji Kim, Horticulture and Landscape Architecture

Start Time: 10:05am :: **Room:** Stewart 214-B :: Physical Sciences

College of Engineering

Thin Film Adhesion Measurements through Wrinkle to Delamination Transitions

Author:

Allison Chau

Abstract:

Polymer thin film applications are becoming increasingly common, and the need for a quantitative adhesion measurement technique is critical. Taking advantage of well-characterized surface buckling instabilities, this paper will explore the wrinkle to delamination transition that occurs in glassy polymer thin films attached to compliant substrates under lateral compressive strain. By carefully measuring the wrinkle wavelength and subsequent strain at which delamination occurs, the film modulus and adhesion of the film to the substrate can be determined, respectively. Exploiting this transition allows the calculation of the critical strain energy release rate (G_c), a quantitative measurement of adhesion. Polystyrene (PS) and polydimethylsiloxane (PDMS) were utilized in this experiment as the thin film and substrate, respectively. The PS film thickness and PDMS modulus were varied systematically to define the parameter space over which the wrinkle to delamination transition was observed. An average adhesion value of G_c = 0.022 ± 0.02 J/m^2 was found for the PS-PDMS interface, very close to the predicted value of G_c = 0.02 ± 0.02 J/m^2.

Research Mentor: Chelsea Davis, Materials Engineering

Start Time: 10:05am :: **Room:** Stewart 214-C :: Life Sciences

College of Science

Polluted Parasites: The Effects of an Endocrine disruptor, Bisphenol A, on a Trematode Parasite

Author:

Elizabeth Reinhart

Abstract:

The influx of plastic materials into the environment has had many negative impacts. One issue of ecological concern is the accumulation of plastics in water, wherein their breakdown results in the leaching of added chemicals into surrounding waters. One common chemical, Bisphenol A (BPA), can imitate estrogen, binding to activation sites, and disrupting the endocrine system. BPA has been shown to induce precocious puberty and other reproductive disorders, however its impact on other organismal interactions, including host-parasite disease dynamics, is largely unknown. To elucidate the impact of BPA on disease transmission and intensity, we exposed the aquatic snail, Biomphalaria glabrata, infected with a human trematode parasite, Schistosoma mansoni, to two concentrations of BPA: control (well water), low (0.05 µg/L) and high (5.0 µg/L). The number of parasites released from each snail, and the period in which parasites remained active were measured to record transmission. Additionally, we infected mice to determine the impact of BPA within the definitive host. Results suggest that parasite life history is impacted by BPA, but the influences at one life cycle stage does not always correlate to similar trends in subsequent stages. The differences in cercarial output could be due to a change in snail physiology which then influences the ability of the parasite to reproduce.

Research Mentor: Dennis J. Minchella, Biological Sciences

Start Time: 10:30am :: **Room:** Stewart 214-A :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Development of Novel ELP-Based Transcriptional Regulators for Improved Biomanufacturing

Author:

Juya Jeon

Abstract:

Microbes can be used to produce valuable drugs, chemicals, and biofuels; however, their potential has not been fully realized due to low production yields. These yields can be improved through use of biosynthetic techniques to improve efficiency. Dr. Solomon’s lab is focused on improving biomanufacturing processes by developing novel, transcriptional regulators that work to improve cellular health and overall production. These regulators are composed of elastin-like proteins fused to orthogonal sigma factors (ELP-SF). Elastin-like polypeptides (ELPs) make ideal sensors since they exhibit a sharp, inverse phase transition to indicators of cell health such as pH and ionic strength, and external stimuli such as temperature. Their fusion to orthogonal, or non-native, sigma factors allows for precise control of gene expression without interfering with the native processes already present within the cell. The goal of my project was to first clone the necessary constructs and then test their effectiveness on controlling gene expression in response to temperature. I worked to fuse ELP to Tet repressor protein (TetR) and to clone blue fluorescent protein under a Tet inducible promoter. The ELP fusion to TetR has been successfully made and sequence confirmed. Future work will involve finishing the Ptet-BFP construct and testing the system above and below the transition temperature of ELP to determine its response.

Research Mentor: Kevin Solomon, Agricultural & BIological Engineering

Start Time: 10:30am :: **Room:** Stewart 214-B :: Social Sciences/Humanities

College of Liberal Arts

Anthropologists as Cultural Mediators: Improving Access to Human Rights for U.S. Asylum Seekers

Author:

Baylee Bunce

Abstract:

Anthropologists, both academic and professional, continue to lend their theoretical lenses and research methods to human rights issues, including asylum policy and procedures. Despite open debates about the compatibility of universal human rights ideals and more locally-oriented cultural relativism, anthropology remains well-suited to mediating the cultural landscape between the global and the local in asylum cases. While many anthropologists have done this through serving as expert witnesses on cases, the potential exists to expand the impact further to bring asylum policy closer to human rights ideals. After an overview of U.S. asylum policy and procedures, a discussion of several asylum cases related to the broad protection ground of “fear on account of membership in a particular social group” will illustrate current problems that might benefit from anthropological intervention. These cases will be pulled from several databases, including Refworld (UNHCR), the U.S. Board of Immigration Appeals, and the Center for Gender and Refugee Studies (UC Hastings). Anthropologists and other culturally-minded advocates can promote cultural literacy training to bring asylum policy closer to international human rights ideals. Anthropologists’ local knowledge and understanding has been and continues to be vital for improving asylum seekers’ access to human rights in the U.S.

Research Mentor: Ellen Gruenbaum, Anthropology

Start Time: 10:30am :: **Room:** Stewart 214-C :: Social Sciences/Humanities

Polytechnic Institute

The Less Known Generation Alpha

Author:

Sakhi Aggrawal

Abstract:

The social interactions, contemporary life style, changing technolgy and their economic effects have its consequence on the way organizations develop the structure, company-wide operations, retain and motivate employees. Hence, organizations need to know about the type of people they are hiring. The 'next generation', also called the 'alpha generation' will enter workforce soon and form its major part in about a decade. However, very little is known about them yet. This paper explores the various aspects of organizational behavior that this generation might institute and tries to predict the best strategies to have them in workforce effectively. In person interviews, surveys and focus group methodology are employed for qualitative and quantitative data collection. This study reveals interesting aspects about this new generation and compares it to Generation X, Y and Z. It is recommended that organizations start developing methods for the future workforce.

Research Mentor: Beverly J Davis, Technology Leadership & Innovation

Start Time: 10:30am :: **Room:** Stewart 214-D :: Social Sciences/Humanities

College of Science

Patient-Physician Communication on Tapering Opioid Medication Dosage

Authors:

Kiara Hughes

Audrey Caprio

Abstract:

Opioid misuse can lead to a barrage of medical issues and even death. Even though literature has shown that long-term use of opioids is ineffective in chronic pain management, many providers continue to prescribe these medications at alarming rates. Along with an increase in use, providers and patients alike find conversations regarding pain and pain management strategies “strenuous,” “hostile,” and “a major source of frustration.” Improving communication by breaking down these barriers is essential in the prevention of opioid misuse. To conduct the study of patient-physician communication, Dr. Shields (Purdue) and Dr. Mathias (IUPUI) recruited 36 patients from Eskenazi Hospital outpatient clinics to complete pre-observation surveys and record three sequential visits with their primary care provider. After transcription by the research team, undergraduate research assistants rated transcripts on tapering (reducing or eliminating) opioid use. Physician’s discussions were rated on a 5-point scale of how much they discussed the need to taper opioid use, and patients were rated on the same scale on how much they talked about their need for maintaining or increasing opioid dosages. Physicians discussing tapering and patients requesting the same or more opioids were highly correlated 0.85 ($p < .001$). This indicated that when physicians suggest tapering, patients might become alarmed and protective of their need for opioids. When patients mention maintenance or an increase in opioids, physicians respond with concerns about opioids and promote tapering of dosages. Future studies will examine interventions to increase tapering conversations.

Research Mentor: Cleveland Shields, Human Development and Family Studies

Start Time: 10:50am :: **Room:** Stewart 214-A :: Life Sciences

College of Pharmacy

In Vitro Characterization of Delta Opioid Receptor Pharmacology

Author:

Kendall Mores

Abstract:

Despite that alcohol use disorder (AUD) is the most common substance use disorder in the United States, very few efficacious pharmacologic treatments are available to treat AUD. Recent findings in our lab have indicated that the delta opioid receptor (DOR) may be an interesting target to treat AUD, and thus our goal is to develop DOR specific drugs to treat AUD. The goal of this project is to further investigate three aspects of DOR pharmacology in order to understand and efficiently perform translational drug discovery at DOR for the treatment of AUD. We currently know that drugs targeting the DOR, a G-protein coupled receptor, signal primarily though G-protein and/or beta-arrestin (for which two isoforms exist) pathways and can display a 'bias' for one pathway over the other. However, it is unclear if this bias occurs equally across species. I have characterized the pharmacology over several DOR agonists at the mouse, rat and human DOR. Secondly, endogenous peptides acting at DOR are quickly metabolized, making it difficult to study bias of these compounds. I have characterized a metabolically stable peptide at DOR. Thirdly, it is our hypothesis that DOR signaling involving the beta-arrestin 1 isoform may be beneficial. I have started the process of screening a drug library to identify beta-arrestin1-biased DOR agonists. . I have used different cellular assays to study DOR pharmacology. My research will hopefully move the lab closer to developing a DOR agonist that will have efficacy in humans to treat AUD.

Research Mentor: Richard van Rijn, Medicinal Chemistry and Molecular Pharmacology

Start Time: 10:50am :: **Room:** Stewart 214-B :: Social Sciences/Humanities

Krannert School of Management

Alleged Antitrust Violations in Collegiate Athletics

Author:

Joshua Groh

Abstract:

The previous four decades have witnessed numerous suits brought against the National Collegiate Athletics Association. Plaintiffs have included student athletes, coaches, broadcasters, tournament organizers, and more, all allegedly impacted by the NCAA's enforcement of eligibility and similar regulations. All cases discussed in this piece alleged violations of the Sherman Antitrust Act, America's first "trust-busting" statute to eliminate unreasonable restraints on trade, often taking the form of monopolies and trusts. While numerous plaintiffs have alleged violations of the Sherman Act, only few have been awarded relief after an extensive process fought every step of the way by the NCAA. After taking the first step of defining activities as commercial to pave way for application of the Sherman Act, several cases have certified a class action and argued for the application of one of the three primary methods of determining antitrust violations: per se, quick-look, and the rule of reason. Read on to find a case-specific analysis of each step in the litigation process of alleged violations of the Sherman Antitrust Act.

Research Mentor:

Start Time: 10:50am :: **Room:** Stewart 214-C :: Social Sciences/Humanities

College of Science

Sex Differences in Reward Seeking and Safety Behaviors in a Fear-Safety-Reward Discrimination Learning Paradigm

Authors:

Makenzie Norris

Rainy Herakovich

Abstract:

Posttraumatic stress disorder (PTSD) is often characterized by a patient's inability to differentiate a safety signal from a fear signal. Interestingly, in the event that both male and female experience a traumatic event, females are more likely to consequently exhibit PTSD symptoms. In a discriminative conditioning paradigm that uses fear, reward and safety associated cues, male rats significantly reduce their fear levels to the fear cue if in the presence of the safety cue (fear+safety cue) whereas female rats do not. In addition to appearing more fear responsive, female rats also appear to be more reward responsive in that they spend more time reward seeking during the reward cue. In an effort to physiologically explain these behavioral differences, we are currently mapping for differences in neuronal activity between males and females by staining for cFOS after reactivating the fear, safety or reward associated memory. Our areas of interest in this study include the basolateral (BLA) amygdala. We hypothesize that females will express more cFOS positive neurons in the BLA than males for all reactivation groups, indicating hyperactivity in the female amygdala during this task. Data confirming this hypothesis could potentially explain, at least partially, the higher diagnosis of PTSD in women, as well as contribute to the development of sex-specific treatment techniques for PTSD and related anxiety disorders.

Research Mentor: Susan Sangha, Psychological Sciences

Start Time: 10:50am :: **Room:** Stewart 214-D :: Innovative Technology/Entrepreneurship/Design

College of Liberal Arts

Breeching Security: Identifying the Security Gaps Created by Technological Advancement

Authors:

Zach Tipton

James Eric Dietz

Anthony Hustedt

Abstract:

The continual wave of technological advancements has decreased burdens and expanded human capabilities. Innovative utilization of new technologies has become a routine expectancy, but often the potential repercussions of these advancements, in the hands of those with malicious intentions, are often unrecognized and overlooked. This research will seek to identify potential risks stemming from advancements in Unmanned Aerial Vehicles (UAVs) or drone technology. By assessing the capability to penetrate existing security process with UAVs broken down into component parts, security planners and personnel can reassess their current practices and identify new measures needed to counter the as yet unidentified security risks.

Research Mentor:

Start Time: 11:05am :: **Room:** Stewart 214-A :: Social Sciences/Humanities

College of Health and Human Sciences

Understanding Condom and Pharmacy Vending Machine Attitudes and Behaviors in Italy

Author:

Gabrielle Wise

Abstract:

Over the last 30 years, unplanned births and abortions in Italy have significantly declined, distinguishing Italy from other Western countries. Italy's success may be attributed to the implementation of Condom Vending Machines (CVMs) and Pharmacy Vending Machines (PVMs)—both of which contribute to minimizing embarrassment in contraceptive purchases. These machines increase access to personal care products while combatting negative attitudes toward their purchase.

This study explored consumer attitudes and behaviors toward CVMs and PVMs including user experience, purchase embarrassment, and cultural implications.

Data were collected via in-depth individual interviews and a web-based survey among reproductive-aged women in Florence, Italy. A grounded theory approach and a constant comparative method were used for qualitative theme development.

Participants discussed how the vending machines' convenient locations and lack of cashier interaction promoted feelings of anonymity, decreasing purchase embarrassment. Preference for purchasing condoms from these outlets remained even though some did not feel vending machines were a discrete purchase method. Vending machine service hours (24/7) facilitated the common condom purchasing time in Italy (after dark), allowing access to protective products even after pharmacies close for the evening. Despite the benefits of vending machines in increasing anonymity and decreasing embarrassment, gender and age disparities remain in their use, reflecting traditional sociocultural norms of Italy.

Findings suggest CVMs and PVMs are moderately successful in decreasing the overall level of embarrassment associated with condom purchases. Results can be transferable to inform implementation of similar purchasing outlets to increase accessibility, prevent unplanned pregnancies, reduce the embarrassability barrier, and lessen the stigma associated with these vending machines. Gender norms were also shown to have a negative effect on the ratio of female to male purchases from CVMs and PVMs. These findings suggest focused campaign efforts on increasing condom purchase comfort among young, female consumers may be an effective future direction. Overall findings support extant consumer health, purchase embarrassment, and social-identity literature.

Research Mentor: Andrea DeMaria, Consumer Science

Start Time: 11:05am :: **Room:** Stewart 214-B :: Social Sciences/Humanities

College of Engineering

Pathways into Engineering: A Multi-Institution Comparison

Authors:

Anna Francis

Pedro Martinez

Dan Irby

Wil Stuckey

Nathan Eckhart

Abstract:

Pathways into Engineering: A Multi-Institution Comparison

Every engineering college creates policies for the admission and academic progression of engineering undergraduates, policies that are responsive to the institution's environments and goals. However, each college has its own set of variables that are exclusive to that college, which is why it is important to study educational policies not only over time, but also across institutions. Observing the institutional policies relative to each institution could give insight on possible trends occurring across various engineering institutions. This project provides context for student and institutional outcomes through a study of the 2017-18 undergraduate catalogs from seven institutions.

The catalogs were examined, with particular attention paid to academic progress and admission policies into the engineering program. Also emphasized was the path to engineering that undergraduates could take, such as the inclusion of both required and optional first year engineering programs, alternate pre-engineering programs, and transfer options.

Some common differences between the institutions included how they admitted transfer students, how they admitted incoming freshman, Up-and-Out Polices, and some higher-level core courses; as well as prerequisites and general education requirements. Some commonalities in engineering policies included GPA requirements, certain common required courses, and progress requirements.

The seven institutions had a significant variation in policies such as admissions, while policies such as GPA and required classes remained similar. This indicates that policies regarding the admission stages of engineering vary significantly across institutions, while policies concerning admitted students vary considerably less. Findings from this study will inform future data analysis of a multi-institutional database of student academic records.

Research Mentor: Nichole Ramirez, Engineering Education

Start Time: 11:05am :: **Room:** Stewart 214-C :: Life Sciences

College of Health and Human Sciences

Motor Preparation For Expected but Undefined Movements

Author:

Mitchell Tillman

Abstract:

During motor performance, stability must be emphasized to successfully accomplish a task at hand. In contrast, dexterity is the skill that allows for rapid switching between tasks. Current clinical assessments of manual dexterity typically measure the time required to complete pick-and-place tasks. These tests can only provide information regarding gain or loss of dexterous ability. To provide a more refined understanding of the processes involved in dexterous task transitions, we analyze the variability of subjects' performance using the Uncontrolled Manifold (UCM) analysis. This allows examination of the performance error and the compensatory strategies evident in the subjects' performance.

Our experimental paradigm consists of subjects seated at a computer screen pressing with the four fingers of their dominant hand on force sensors. Participants track a force target with the sum of their four finger forces. They perform a constant force production task with a 'Certain' control condition where subjects produce only constant total force. The dexterous conditions consist of the same constant force production, with the expectation that soon the required force value would change. We have previously shown that healthy young adults respond to this expectation by reducing the variability and the stability of their current state without accumulating more errors.

Older adults also responded by lowering the stability of their current state, however, in contrast to younger adults, they increased variability and became less accurate in their performance. We conclude that younger adults adopt a movement preparation strategy that allows for optimal transition, while older adults show more errors during preparation because they adopt a less efficient strategy, or try and fail to adopt the strategy employed by the young adults. We have found that motor preparation for an expected movement occurs via two distinct age-related mechanisms.

Research Mentor: Satyajit Ambike, Health and Kinesiology

Start Time: 11:05am :: **Room:** Stewart 214-D :: Life Sciences

College of Agriculture

Effects of L-Glutamine Supplementation on Meat Quality of Porcine Muscles from Pigs Exposed to Transportation / Weaning Stress and Climate Stress

Author:

Krizia Lepiz Conejo

Abstract:

Porcine exposed to transient heat stress and transporting stress at weaning can experience physiological and metabolic alterations that negatively impact growth performance. Recent studies have shown that L-Glutamine supplementation in replacement of antibiotics in weaned/transported piglets diet could be a nutraceutical mitigation strategy. However, few studies have addressed the effect of different mitigation strategies on (future) meat quality attributes. Therefore the objective of this study is to evaluate the effect of L glutamine supplementation in replacement of antibiotics on pork quality attributes that exposed to transportation/wean stress at different seasons.

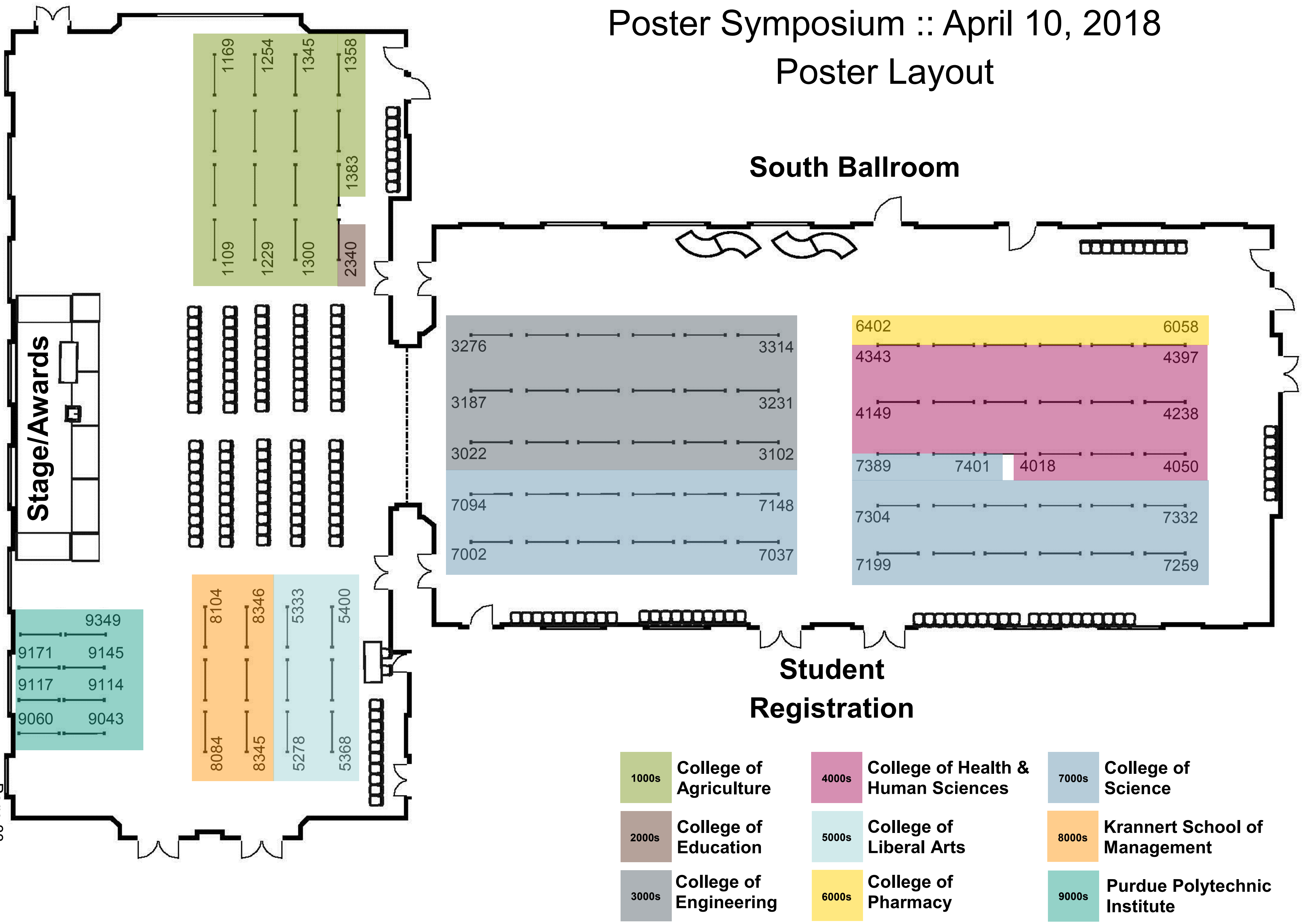
Piglets were weaned at and transported at two different temperature conditions: thermo-challenging vs. thermo-neutral. After each transportation, pigs were randomly assigned to fed with three different diets (non-antibiotic (10 pens), antibiotic (10 pens) and 2% L-glutamine (10 pens)) for 14 days. Basal diets were fed to all until market weight was reached. Upon harvest, Left and right longissimus dorsi and psoas major muscles were collected after s at 1 day and 7 days postmortem. Color, proximate component, and water-holding capacity (WHC) were measured in all muscles. There was a significant seasonal impact on the redness ($P<0.05$). There was a significance in treatment effect on drip loss ($P<0.05$). Seasonal difference also significantly impacted meat tenderness ($P<0.05$). Season did not have a significant impact on moisture content ($P>0.05$). Muscle type impacted ash content, as well as combining seasonal and treatment impact ($P<0.05$). Results suggest that L-Glutamine supplemented piglets have better or equivalent impacts on improving meat quality attributes of heat, weaning, and transportation stress compared to those treated with antibiotics.

Research Mentor: Yuan H. Brad Kim, Animal Sciences

Undergraduate Research Conference

Poster Symposium :: April 10, 2018

Poster Layout



Undergraduate Research Conference
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4341 *Megan Pentecost*
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4050 *Leeah Reidenbach*
Mentor: Jennifer Freeman

4267 *Liron Saletsky, Xiaofang Zheng*
Mentor: Richard Schweickert

4177 *William Schrock*
Mentor: Stewart Chang Alexander

4178 *Griffin Selch*
Mentor: Bruno Roseguini

4024 *Courtney Sheffield, Shraddha Rane, Eric Foss*
Mentor: Jason Harris

4298 *Faith Stirm*
Mentor: Keith Stantz

4100 *Kelsey Stolz, Joyce Lin, Melody Kung*
Mentor: David Purpura

4397 *Lucas Turner, Leeah Reidenbach*
Mentor: Jennifer Freeman

4303 *Sanjna Vinze, Nana Gletsu-Miller*
Mentor: Nana Gletsu-Miller

4215 *Emma Wallens*
Mentor: Linda Nie

4238 *Rachel Yuska*
Mentor: Carlos Perez-Torres

College of Liberal Arts

5334 *Samaah Al-Najjar*
Mentor: Harold K. Cooper

5394 *Sunny Asaf*
Mentor: Amanda Veile

5285 *Brenda Culver* ◊
Mentor: Catherine Dossin

5186 *Diyuan Deng*
Mentor: Christopher Cayari

5202 *Sheyenne Fishero*
Mentor: Jessica Sturm

5288 *Katelyn Graham, Drew Dienhart*
Mentor: Carol Cunningham-Sigman

5399 *Hannah Hawkins*
Mentor: Zoe Nyssa

5398 *Muxuan Hua*
Mentor: Catherine Dossin

5357 *Yaxuan Jiao*
Mentor: Collin Raymond

5184 *Cheng Mun Loke, Juan Pablo Ramírez, Bruno Sanchez-Ortiz, Chuande Ye* ‡
Mentor: Torsten Reimer

5375 *Jessica McDaniel* ◊
Mentor: Catherine Dossin

5400 *Jorden McKibben*
Mentor: Brian Kelly

5278 *Saad Mukhtar* ‡ ◊
Mentor: Rayvon Fouche

5350 *Brenae Newhard* ‡
Mentor: Angelica Duran

5333 *L. R. Nikolai*
Mentor: Ronnie B. Wilbur

5079 *Isabelle Ortt, Kaitlyn Sanders* ‡
Mentor: Michele Buzon

5205 *John Rapes*
Mentor: Erik Otarola-Castillo

5284 *Lucinda Ray*
Mentor: Jessica Sturm

5151 *Meron Tamene, Daniella Gonzalez, Pablo Balcazar, Eesha Patel*
Mentor: Natasha Duncan

5361 *Frankie Tao* ‡
Mentor: Kathleen Hickey

5327 *Addie Walters*
Mentor: Stacy Lindshield

5368 *Natalie Young* ‡
Mentor: H. Kory Cooper

5365 *Lu Yu*

5362 *Ziqin Yuan* ‡
Mentors: J. Eric Dietz & James Lerums

College of Pharmacy

6351 *Avni Bhalgat*
Mentor: Michael Wendt

6396 *Christopher Blackwell*
Mentor: Vincent Jo Davisson

6142 *Martasia Carter* ‡
Mentor: Andrea DeMaria

6130 *Julia Czarnik* ‡
Mentor: Joanna Hodges

6095 *Amanda Graboski*
Mentor: Daniel Flaherty

6058 *Sarah Hood, Anthony Giazzon*
Mentor: Michael D Murray

6106 *Nathaniel Macatangay*
Mentor: Darci Trader

6211 *Holly Maize*
Mentor: Stephen Byrn

6216 *Arbaaz Mukadam, Grace Mulia, MeeJung Ko*
Mentor: Richard M. van Rijn

6402 *Stephen Connor Purdy*
Mentor: Michael Wendt

6252 *Anqi Shao*
Mentor: Vincent Jo Davisson

College of Science

7296 *Jose Adorno-Cancel*
Mentor: John Wilker

7099 *Pranav Ram Anappindi*
Mentor: Dan Goldwasser

7387 *Sahej Bains*
Mentor: Christine Hrycyna

7010 *Arjun Banerjee, Lisa Campbell, Guna Kondapaneni*
Mentor: Buster Dunsmore

7031 *Nishit Banka*
Mentor: Christopher Uyeda

7274 *Tamara Batarseh*
Mentor: Chae Hyun Yum

7015 *Chufan Cai*
Mentor: Qing Deng

7136 *Zoe Carlson-Stadler, Nicole Schartz, Amy Brewster*

7271 *Morgan Carrithers, Zhi Yu, Zihan Gao, Zonghao Zhang*
Mentor: Kari L. Clase

7261 *Catherine Carroll, Helen Flynn, Gabrielle Shapiro, Kasey Martineau*
Mentor: Kari L. Clase

7030 *Katherine Ceglio*
Mentor: Mandy Rispoli

7175 *Mackenzie Chapman*
Mentor: Catherine Searle

7372 *Yujie Chen* ‡
Mentor: Jianxi Su

7017 *Cara Christensen*
Mentor: Jeffrey Lucas

7203 *Ya-Wen Chu*
Mentor: Lan Zhao

7253 *Rachel Collicott*
Mentor: Emily Dykhuizen

7270 *Nickoulas Cooper-Garcia*
Mentor: Jeffrey Lucas

7034 *Taylor Dal Bon*
Mentor: Edward Fox

7336 *Michael Dalrymple, Joshua Woodard* **‡**
Mentor: Nastasha Johnson

7026 *Elisabeth Demarco*
Mentor: Estuardo Robles

7385 *Stephanie DeVoe, Bradley Readnour*

7321 *Oscar Dillman*
Mentor: Erica Carlson

7255 *Theresa Emeli*
Mentor: Daoguo Zhou

7006 *Mara Fattah, Jessica Page*
Mentor: Riyi Shi

7128 *Jack Fekete*
Mentor: Kenneth Ridgway

7143 *Chrishan Fernando*
Mentor: Elizabeth Tran

7176 *Rodrigo Ferreira*
Mentor: Ignacio Camarillo

7221 *Benjamin Flueckgier*
Mentor: Kavita Shah

7039 *Helen Flynn*
Mentor: David Thompson

7323 *Luke Francisco*
Mentor: Elliot Friedman

7236 *Autumn Frerk*
Mentor: Darci J. Trader

7153 *Hareesh Gali* **‡**
Mentor: Daisuke Kihara

7042 *Clare Gallagher* **‡**
Mentor: David Thompson

7286 *Adrianne Glaser*
Mentor: Seema Mattoo

7204 *Adam Guerin, Srividya Iyer-Biswas* **‡**
Mentor: Srividya Iyer-Biswas

7074 *Charles Guinn*
Mentor: Mike Manfra

7233 *Joshua Heishman*
Mentor: Reuben Goforth

7342 *Ashlyn Heniff*
Mentor: Samarth Mathur

7105 *Taylor Hornung*
Mentor: Brandon Keehn

7040 *Savannah Hottle*
Mentor: Kristine Marceau

7265 *Kiara Hughes, Audrey Caprio*
Mentor: Cleveland Shields

7159 *Juliana Ilmain*
Mentor: Catherine Searle

7369 *Francis Jagiella*
Mentor: Olga Dmitrieva

7157 *Chinyere Kemet*
Mentor: Tiffany Lyle

7032 *Caitlin Kennedy*
Mentor: David Gleich

7332 *Sebastian Kenny*
Mentors: Saadia Chaudhry & Jianguo Mei

7257 *Archana Kikla, Kok Zhi Lee, Arren Liu, Kevin Solomon* **‡**
Mentor: Kevin Solomon

7389 *Haebin Kim*
Mentor: Ruoyu Zhang

7337 *Thomas Knowles*
Mentor: Dennis Minchella

7316 *Sarah Komanapalli*
Mentor: Catherine Hill

7072 *Hana Kubo, Sean Humphrey, Sarunya Kitdumrongthum, Humna Hasan, Feng Tian, Sarah Allen, Andrea Kasinski*
Mentor: Andrea L. Kasinski

7174 *Kevin Lee*
Mentor: Shihuang Kuang

7197 *JaeJoong Lee, Lingjun Chen, Andy Gao* **‡**
Mentor: Vaneet Aggarwal

7335 *Hye Su Lee*
Mentor: Hye-Ji Kim

7393 *Seunghee Lee*
Mentor: Li Qinglin

7326 *Jiawei Li*
Mentor: Tonglei Li

7101 *Kun Lin*
Mentor: Ed Fox

7061 *Arren Liu, Kok Zhi Lee, Kevin Solomon* **‡**
Mentor: Kevin V. Solomon

7165 *Amanda Ludwig*
Mentor: Tiffany Lyle

7147 *Helena Lysandrou* ‡
Mentor: Meng Deng

7098 *Namaluba Malawo, Gabriela Nunez-Mir* ‡
Mentor: Songlin Fei

7062 *Prateek Malik*
Mentor: Aaron Hoffman

7055 *Dylan Martin* ‡
Mentor: Vetria L Byrd

7395 *Joshua Mazur*
Mentor: David Thompson

7320 *William Mbongo*
Mentor: Angeline Lyon

7259 *Mikaela Meyer* ‡
Mentor: David Johnson

7183 *Ramizah Mohd Sabri*
Mentor: Qing Deng

7005 *Kristan Morgan*
Mentor: Olivia Salmon

7294 *Roshini Mudunuru, Christina Dantam*
Mentor: David Johnson

7246 *Kiersten Nelson* ‡
Mentor: Gordon McNickle

7401 *Jillian Ness*
Mentor: William Cramer

7093 *Tyler Netherly, Elizabeth Bell, Madison Trout* ‡
Mentor: Dennis Buckmaster

7318 *Barnabas Obeng-Gyasi* ‡
Mentor: Hyowon Lee

7228 *Allison O'Brien*
Mentor: Jason Hoverman

7339 *Alex Piroozi*
Mentor: Christine Hrycyna

7148 *David Prather*
Mentor: Catherine Searle

7262 *Neal Ramseier, Rahul Hadap, Elena Konrath, Nicholas Young* ‡
Mentor: Jeffery J Nielsen

7386 *Caleigh Roleck*
Mentor: Stanton Gelvin

7091 *Sasmita Rout*
Mentor: Philip Low

7096 *Morgan Schafer*
Mentor: Richard J. Kuhn

7313 *Evan Shank, Ethan Hillman, Adrian Ortiz-Velez*
Mentor: Kevin Solomon

7073 *Mollie Shinkle*
Mentor: David H. Thompson

7037 *Hannah Smith*
Mentor: Maria Sepulveda

7133 *Alexander Stanley, Savannah Mick*
Mentor: Kimberly Kinzig

7190 *Ashwin Sunderraj, Stevie Norcross* ‡
Mentor: Mathew Tantama

7094 *Hana Maldivita Tambrin*
Mentor: Mark C. Hall

7193 *Dawn Tilley*
Mentor: Gaurav Chopra

7317 *Shelby Tucker*
Mentor: Dorothy Teegarden

7287 *Ena Tully* ‡
Mentor: Richard Kuhn

7002 *Jack VanSchaik*
Mentor: Steven Bell

7324 *Sarah Varney*
Mentor: Mathew Tantama

7283 *Kendra Wang*
Mentor: Alexander A. Chubykin

7347 *Lauren Washington*
Mentor: Vetria Byrd

7304 *Ben Watson*
Mentor: Seema Mattoo

7312 *Hunter Wieczorek*
Mentor: Richard Kuhn

7041 *Elliott Williams* ‡
Mentor: Barrett Caldwell

7282 *Katie Wong*
Mentor: Dorothy Teegarden

7377 *Eder Xhako*
Mentor: Stanton Gelvin

7199 *Hannah Yee*
Mentor: Marty Frisbee

7150 *Amber Young*
Mentor: George McCabe

Krannert School of Management

8198 *Jessica Bennett*
Mentor: Susan Watts

8021 *Margaret Berkemeyer*
Mentor: Ilana Stonebraker

8139 *Megan Hawkins*
Mentor: Melissa Evens

8163 *Briana Jenkins*
Mentor: Chad Allred

8097 *Andrew Lentz*
Mentor: Matthew A. Lanham

8004 *Andrew Marshall*
Mentor: Ralph Siebert

8089 *Madison McDonough, Lawrence Baryoh, Danielle Bresich, Libby Gonzalez*
Mentor: Matthew A. Lanham

8085 *Katarina McGuckin, Josh Chan, Norah Alwalan, Andrew Moolenaar, Daniel Yang*
Mentor: Matthew A. Lanham

8083 *Joshua McKenney, Yuqi Jiang, Junyan Shao*
Mentor: Matthew A. Lanham

8192 *Mason McLary*
Mentor: Amy Lynn Budd

8084 *Nathan Mehringer, Jeremy Anderson, Eric Wilens, Will Coffey, Katie Shatkus*
Mentor: Matthew A. Lanham

8104 *Qi Meng*
Mentor: Melissa Evens

8086 *Junan Pan, Shengwen Huang, Hyerin Kim, Xuanye Guo, Wanying Zhou, Theerakorn Prasutchai*
Mentor: Matthew A. Lanham

8080 *Jayana Patel, Ersin Nurkic Kacapor, Matthew Bottorff, Tyler Richards, Graham Cason, Naveen Ellappan*
Mentor: Matthew A. Lanham

8082 *Michael Roggenburg, Simon Jones, Chris Root, Theerakorn Prasutchai, Zhengho Ye, Zhuoheng Xie*
Mentor: Matthew A. Lanham

8132 *Michael Roggenburg, Guanzhu Mou, Juan Pablo Bustamante-Paez*
Mentor: Matthew A. Lanham

8346 *Isaac Tang*
Mentor: Melissa Evens

8081 *Tony Ye, Andrew Lee, Yixuan Shi, Yidan Gao*
Mentor: Matthew A. Lanham

8210 *Ruoxuan Zhao*
Mentor: Melissa Evens

8345 *Tiffany Zheng*
Mentor: Melissa Evens

Purdue Polytechnic Institute

9349 *Monique Barnes* ‡
Mentor: Kereshmeh Afsari

9114 *Benjamin Carpenter*

9209 *Andrew Deeter*
Mentor: Vetria Byrd

9019 *Marlee DeSplinter* ‡
Mentor: Scott Bartholomew

9167 *Jackalyn Dodson*
Mentor: Vetria Byrd

9116 *Oluwadara Fasipe*
Mentor: Vetria Byrd

9119 *Bin Han* ‡
Mentor: Vetria Byrd

9043 *Anna Hardy*
Mentor: David Whittinghill

9172 *Gowri Hassan*
Mentor: Ida Ngambeki

9049 *Evan Hockridge*
Mentor: Guofan Shao

9212 *Alfredo Karduss* ‡
Mentor: Mesut Akdere

9113 *Ferdinand Macatangay*
Mentor: Vetria Byrd

9007 *Emily Maneke*
Mentor: Kereshmeh Afsari

9115 *Edith Mauro*
Mentor: Vetria Byrd

9219 *Tyler McDonald*
Mentor: Qingyou Han

9160 *Kanishka Misra* ‡
Mentor: Julia Rayz

9118 *Hunter Moore*
Mentor: Vetria Byrd

9117 *Pablo Moore*
Mentor: Vetria Byrd

9035 *Caleb Morin*
Mentor: Mark French

9110 *Rylie Nichol*
Mentor: Vetria Byrd

9145 *Jose Nieves, Nathaniel Hill, Christian Venzlauskas, Joshua Campbell*
Mentors: Sergey Dubikovsky, J. Michael Davis

9120 *Epifanio Sadural*
Mentor: Vetria Byrd

9171 *Kyle Schnetzler*
Mentor: Kathryn Seigfried-Spellar

9070 *Zachary Schreiber*
Mentor: Jason Ostanek

9134 *Will Seltenright, Daryk Brekke, James Simon, Weihang Zhong*
Mentors: Sergey Dubikovsky, J. Michael Davis

9036 *Megan Shaffer, Juliana Baluh, Nicholas Steffen, Joseph Sawicki*
Mentors: Sergey Dubikovsky, J Michael Davis

9060 *Adrianne Swanson, Maxwell Webber, Joseph Masset*
Mentors: Sergey Dubikovsky, J. Mark Thom

9048 *Ian Williams*
Mentor: Vetria Byrd

9112 *Qiuhan Zhang*
Mentor: Vetria Byrd

Legend:

‡ - Interdisciplinary Project

◊ - Utilized Archival Sources in Project

Poster Number: 1373 :: Life Sciences

College of Agriculture

Identifying New *Drosophila melanogaster* Cdc7 Regulatory Subunits

Author:

Benjamin Anderson

Abstract:

Cell Division Cycle 7 (Cdc7) is a serine/threonine kinase that is required for the initiation of DNA replication, because it activates minichromosomal maintenance complex 2-7 (Mcm2-7) helicase. To prevent Cdc7 function at incorrect stages during the cell cycle, it must be bound to Dumbbell-Former 4 (Dbf4) to function. Cdc7 and Dbf4 are well conserved across many eukaryotic species, such as humans, Xenopus, yeast, and Drosophila melanogaster, but this study focuses on D. melanogaster Cdc7 and its Dbf4 like regulator Chiffon. Recent studies have suggested that Chiffon may not be the sole regulator of Cdc7 and that a second regulatory protein or proteins might exist, and we hope to identify them. Human Dbf4 was discovered because it shared similarities to yeast Dbf4, thus by identifying D. melanogaster Cdc7 regulators it is possible that new human Cdc7 regulators could be identified. Cancer is caused by improper cell cycling, so perhaps by identifying Cdc7 regulators new targets for cancer medicines could be found. To find the new subunits a Yeast 2-Hybrid Assay will be used. The goal of this semester was to prepare for the full-scale assay by running test assays, test screening, and PCR to test the procedure. Once the full-scale assay is complete, the selected colonies will be screened, isolated, retested to confirm interaction, and then isolated again and sequenced. Sequences will be identified using BLAST and proteins found here would be candidates for Cdc7 regulatory subunits.

Research Mentor: Vikki Weake, Biochemistry

Poster Number: 1383 :: Life Sciences

College of Agriculture

Transgenic Plants Expressing the Cyanogenic Glucoside Dhurrin to Manage Nematodes

Author:

Alex Angel

Abstract:

Dhurrinase is a β-Glucosidase that hydrolyzes the cyanogenic glucoside Dhurrin in the root endodermis of Sorghum spp. A chimeric gene containing the open reading frame for the expression of dhurrinase was isolated from a construct containing all of the genes responsible for the production and hydrolysis of cyanogenic glucosides. The entry vector TOPO can be used to transfer dhurrinase into transfer vector pB2GW7. Transformed dH5oc competent Escherichia coli may then be utilized to produce the pB2GW7:dhurrinase construct, in excess. The plant pathogen, Agrobacterium tumafaciens may then be transformed with pB2GW7 and help to facilitate the transformation of Arabidopsis thaliana via floral dip. The goal of this experiment is to assess whether inclusion of the gene encoding dhurrinase is necessary to release p-hydroxymanelonitrile from dhurrin in Arabidopsis. To test this, the formation of p-hydroxymandelonitrile from supplied dhurrin will be compared in Arabidopsis seedlings overexpressing dhurrinase to that produced by wild-type plants. If Arabidopsis contains endogenous β-glucosidases that can efficiently perform the cleavage, we expect to see as much p-hydroxymandelonitrile produced in wild type as in transgenics. If more p-hydroxymandelonitrile is produced in transgenics, then this will indicate that the dhurrinase gene should be included in future strategies to metabolically engineer dhurrin production. This work is expected to guide approaches for harnessing dhurrin as a novel natural product-based pesticide for controlling soil nematodes, and may lead to a safer replacement of the environmentally and physiologically deleterious methyl bromide.

Research Mentors: Joshua Widhalm, Horticulture and Landscape Architecture; Peter Goldsbrough, Botany and Plant Pathology

Poster Number: 1292 :: Life Sciences

College of Agriculture

Is Bigger Always Better?: Assessing the Effect of Cage Space on Mouse Welfare

Author:

Katherine Bachert

Abstract:

The Guide provides recommendations for the amount of cage space needed for mice. A few studies have looked at space needs for 3-8 mice, however, no studies have been conducted for large-scale production. We hypothesized that mice in larger cages would show more positive and less negative behaviors. Groups of 30, 35, and 40 mice were housed at densities either recommended by Guide (different space/mouse based on body weight; 38-96 cm2/mouse) or current industry stocking densities (19-25 cm2/mouse). C57BL/6 and CD1 mice were placed in adjustable sized cages and observed from 4-7 weeks of age. Each week mice were weighed and the cage size adjusted for the cage average body weight. Positive (play, nesting, and affiliative) and negative behaviors (stereotypy and aggression) were recorded by 1/0 sampling method in 2-minute intervals every 40 minutes for 24 hours twice a week. Data were analyzed as a GLM with $\alpha=0.05$. More negative behaviors, both stereotypy and aggression, were observed in Guide sized cages than industry sized cages. Group size did not affect negative behaviors. More positive behaviors were also seen in Guide sized cages compared to industry sized cages. Group size was significant in positive behaviors; as cage size increased so did the percent of positive behaviors. It is concluded that Guide allowed the group of mice to perform more positive and negative behaviors compared to the industry because it gave mice more opportunities to display behaviors due to more space.

Research Mentor: Brianna Gaskill, Animal Sciences

Poster Number: 1144 :: Life Sciences

College of Agriculture

Productivity and quality comparisons between vegetables grown in organic hydroponics and conventional hydroponics systems

Author:

Jeffrey Bates

Abstract:

The world population is predicted to rise by one billion people by 2030, meaning that using land and resources efficiently to grow crops is more crucial now than ever. Hydroponic systems provide higher efficiency than conventional field production and are capable of being constructed indoors, making them a common method of greenhouse cultivation. Applying conventional chemical fertilizers to these systems results in runoff that degrades the ecosystem and is toxic to humans and wildlife. To minimize these concerns, organic hydroponic fertilizers may be a more desirable option for their environmental sustainability; however, their effects on plant productivity require further research. The objective of this study was to compare plant growth and productivity of basil, lettuce, and tomato and system efficiency between organic hydroponics and conventional hydroponics. Seedlings were transplanted into pots filled with soilless media and placed in Purdue University Horticulture Plant Growth Facility. During the production period, plants were treated with three different fertilizer schemes: organic hydroponic fertilizer (OHF), OHF plus a micronutrients supplement, and chemical fertilizer (CF), combined with coconut coir substrate. Plant growth parameters including the number of leaves, flowers, fruits, stem height, and leaf chlorophyll content were measured. At harvest, all the parameters were measured again, and the fresh weight of each plant organ was recorded. All plant materials were then dried and water content was calculated. The results showed that plants grown with organic fertilizer had higher biomass accumulation than the ones grown with chemical fertilizer, with fresh weights increased between 10-30%. While the plants weighed more, they had a higher water content in leaves, shoots, and roots. Plant height, leaf number, and fruit number were not improved with organic fertilizer. However, flowering showed a slight increase in two organic fertilizer treatments. The traditional chemical fertilizer yielded smaller plants; however, they contained less water per unit gram of fresh weight, potentially leading to a higher accumulation of nutrients and increasing the risk of nitrate exposure to humans. In summary, hydroponic growers can increase the yield of their crops by applying organic fertilizer in place of conventional chemical fertilizer, and reduce the health risks synthetic fertilizers pose to humans.

Research Mentor: Hye-Ji Kim, Horticulture and Landscape Architecture

Poster Number: 1307 :: Life Sciences

College of Agriculture

Structural and functional characterization of the iron-hijacking receptor TbpB from N. gonorrhoeae

Author:

Evan Billings

Abstract:

In the Neiserria family of bacteria, there are two pathogenic species, N. gonorrhoeae and N. meningitidis that are responsible for causing the diseases gonorrhea and meningitis, respectively. To survive, these bacteria must import iron for metabolic use and have evolved a way to import iron from their host. In humans, iron is transported throughout the body by proteins such as serum transferrin in the blood. Neisseria have evolved specialized proteins on the surface of their membranes that specifically bind to transferrin to import the iron for their own metabolism. The surface proteins that are responsible for this are called transferrin binding protein A (TbpA) and its coreceptor transferrin binding protein B (TbpB). Together they form the transferrin binding complex. In 2012, the structure of this complex in N. meningitidis was determined by our research group. My project focuses on the structural determination of TbpB in N. gonorrhoeae; which is not known. I have expressed these proteins in E. coli and purified them by affinity chromatography, crystallized them using high-output screening methods and am now in the process of determining the crystal structure using the molecular replacement method.

Research Mentor: Nicholas Noinaj, Biological Sciences

Poster Number: 1266 :: Life Sciences

College of Agriculture

Patterns in Leaf Net Primary Productivity in the Boreal Forest

Author:

Paige Bradley

Abstract:

The boreal forest, the world's largest forest, occupies twenty-five million square kilometers, or eleven percent of the terrestrial globe (Nelson, 2007), and contains approximately 20300 species (Ruckstuhl, 2007). The forest sequesters and produces carbon based on rates of decomposition and photosynthesis. Net primary productivity (NPP), a production measurement, is relevant to any plant system and can be affected by resource competition and spatial dominance of one plant over another. NPP responses to environmental factors are evaluated by a combination of remote climate sensing and on-the-ground measurements. To estimate NPP in the boreal forest, sixty litter traps distributed over a one km long transect were collected annually for three years, sorted by species, dried, and weighed to determine biomass built by photosynthesis and associated processes. The boreal forest is notoriously slow-producing, so long-term studies must be conducted in order to understand the driving factors of productivity. In this study, we show that nitrogen in soil predicts productivity. Root system imagery and soil analyses may provide a more holistic view of the ecological processes of the forest. Boreal forest productivity as linked to both biotic and abiotic factors of the ecosystem indicate NPP trends result from global climate and nutrient trends.

Research Mentor: Gordon G. McNickle, Botany and Plant Pathology

Poster Number: 1169 :: Life Sciences

College of Agriculture

Reverse Genetic Probing for a Functional Cytosolic Shikimate Pathway in Plants

Authors:

Gabrielle Buck

Joseph Lynch

Abstract:

The shikimate pathway produces the aromatic amino acids—phenylalanine, tyrosine, and tryptophan—essential to human diets and involved in many plant, fungi, and microbe specialized functions. Therefore, it is commonly targeted in its known location in plastids (such as chloroplasts) for technologies including antibiotics, herbicides, and genetic engineering. There is biochemical evidence, however, of a cytosolic shikimate pathway. This experiment's goals are two-fold: 1) determine the presence of the cytosolic shikimate pathway by overexpressing a mutated, exclusively cytosolic 3-deoxy-D-arabino-heptulosonate-7-phosphate (DAHP) synthase, the first shikimate pathway enzyme and 2) characterize the genes encoding enzymes of the pathway. At present, we have transformed and regenerated 68 transgenic petunias—selected by antibiotic resistance—and are verifying the presence of the desired gene. We will discern the effect of the modified DAHP synthase by measuring the change in the production rate of volatile organic compounds (VOCs) derived from phenylalanine. If a complete cytosolic shikimate pathway exists, we expect an increase in the VOC production rate. Two putative cytosolic shikimate enzymes have been identified: 3-dehydroquinate synthase (DHQS) and 2-dehydroquinate dehydratase/shikimate dehydrogenase (DHD-SHD). Suppression of these demonstrated that DHQS plays a role in production of VOCs, consistent with a role in the shikimate pathway. By visualizing fluorescently-tagged variants, we determined DHD-SHD is localized in the cytosol, as expected; however, DHQS is localized in plastids and is therefore unlikely to directly contribute to cytosolic shikimate pathway flux. Further analysis is required to determine these enzymes' precise roles with respect to the putative cytosolic shikimate pathway.

Research Mentor: Natalia Dudareva, Biochemistry

Poster Number: 1217 :: Life Sciences

College of Agriculture

The role of the microbiome in restoring piglets health following weaning and transport stress.

Author:

Ruth Centeno

Abstract:

In the swine industry, weaned piglets are subject to stress caused by heat, transport, and weaning. This stress can lead to decreased animal growth and feed efficiency, as well as increased illness followed by therapeutic antibiotic use. The use of prophylactic antibiotics in the piglet diet has helped to reduce the negative side-effects of stress in weaned piglets. However, the industry is seeking new substitutes for antibiotics due to pressures to reduce antibiotic use. L-glutamine shows promise as a substitute for prophylactic antibiotics given to weaned piglets to increase their disease resistance, growth performance and feed efficiency. The goal of this research is to determine if the microbiome can help explain the mechanism by which L-glutamine and prophylactic antibiotics lessen the negative outcomes caused by transport, weaning and heat stress. For this experiment, piglets were sorted in 30 groups of 8 piglets per pen. Three dietary treatments were supplied after transport: a) prophylactic antibiotic as control, b) no antibiotics and c) nutraceutical (L-glutamine) for a total of 14 days per treatment per pen. For the molecular analysis, 1 piglet from each pen was harvested at day 13 and 33 after transport and ileal contents were collected. Total DNA was extracted from the ileal contents, followed by amplification of the bacterial taxonomic marker – the 16S rRNA gene – by PCR. Amplicons will be sequenced with Illumina MiSeq and analyzed using the Mothur bioinformatics software. PCR and sequencing are currently underway. With the sequencing data we will be able to identify changes in bacterial populations and microbiome composition between piglets receiving prophylactic antibiotics in contrast with those recieving L-glutamine and the role microbiome composition plays in increasing feed efficiency and growth performance.

Research Mentor: Timothy Johnson, Animal Sciences

Poster Number: 1322 :: Life Sciences

College of Agriculture

Effect of Seasonal and Transportation/Weaning Stress on Meat Quality and Protein Degradation of Pig Muscles

Authors:

Yufan Chao

Danyi Ma

Alan Duttlinger

Brian Richert

Jay Johnson

Abstract:

Transporting weaned pigs is a common production management practice. However, potential negative impacts of complex stressors, such as transportation/weaning stress coupled with heat stress on physiological activities and growth performance of pigs have been reported. While the most current published research focuses on the animal productivity and carcass characteristics, little to no information is available how these multiple stressors during the early phase of pig handling affect the final meat quality attributes. Therefore, the objective of this study was to determine the effect of seasonal and transportation/weaning stress during the early phase of pig production on meat quality and postmortem proteolysis of porcine muscles. Two groups of pigs were weaned and transported in two different seasons: thermal-challenged summer vs thermal-neutral spring. After reaching market weight, 20 pigs (n=10 from each group) were slaughtered. Both sides of the longissimus dorsi (LD) and psoas major (PM) muscles were separated at 1d and 7d postmortem, respectively. Pork muscles from pigs transported in summer season exhibited a decrease in tenderness and water-holding capacity as indicated by elevated shear force values, display loss, thaw loss, and cook loss ($P<0.05$). Heat stress increased muscle pH, probably due to decreased glycogen content accumulation. Display loss was decreased in postmortem muscles from heat-stressed pigs comparing to that of the non-heat stressed pigs ($P<0.05$). Postmortem aging significantly increased tenderness ($P<0.05$) as well as troponin-T degradation ($P<0.05$). The PM muscle showed greater tenderness and degradation of troponin-T compared to the LD muscle regardless of transport season. The current results from this study indicate that heat stress during early life accompanied with transportation stress at weaning could negatively affect meat quality characteristics, as shown by decreases in meat tenderness, water-holding capacity and oxidative stability.

Research Mentor: Yuan H. Brad Kim, Animal Sciences

Poster Number: 1126 :: Physical Sciences

College of Agriculture

Soil aggregate stability in first year cover crop treatments

Author:

Christine Charles

Abstract:

Soil health is the capacity of soil to act as a living ecosystem that sustains life. There are various methods to improve soil health, one of which is growing cover crops. Cover crops are planted between cash crop growing seasons to incorporate attributes of natural ecosystems, such as year round cover for the soil. Cover crops can influence soil health in numerous ways depending on species. Thus, quantifying and understanding the influence of different species on soil health is vital to effective management. This project compared how three cover crop treatments influenced the soil aggregate stability of a field after one season of cover crop use. Increasing aggregate stability increases water infiltration and reduces erosion by strengthening soil particles. The oat and mixed cover crop treatment were hypothesized to have higher aggregate mean weight diameters than the no cover treatment. In the fall of 2017, soil samples and aboveground cover crop biomass samples were collected from the treatment plots at the Purdue Agronomy Center for Research and Education. Aboveground biomass was dried, weighed, and compared by treatment. The soil was analyzed by treatment using the wet aggregate stability method, where samples are immersed in water and physically disturbed to test the strength of soil aggregates. The data showed that soil aggregate mean weight diameters were not statistically different among treatments. Results from the first year of cover crop growth suggest that more years of growth are required before significant soil improvements will be measurable.

Research Mentor: Eileen Kladivko, Agronomy

Poster Number: 1195 :: Life Sciences

College of Agriculture

Can baseline heart rate variability be used to characterize the swine fever response?

Author:

Jessica Chen

Abstract:

Studies have shown evidence that the vagal nerve (parasympathetic-activity) plays a role in fever transmission. As heart rate variability (HRV) can be used to indirectly measure autonomic activity, the objective of this study was to evaluate the potential of two baseline HRV measures to characterize fever responses, creating a predictor of an animal’s immune response to illness. Twenty pigs were acclimated to heart rate monitors for three days before undergoing heart rate variability measurement on day 4. On day 5, pigs were exposed to bacterial lipopolysaccharides, inducing an immune response. Body temperatures were collected at 0, 60, 120, 480, and 1440 minutes post-injection. After HRV analysis, piglets were divided into a high (n=10) or low (n=10) groups based on high frequency spectral output (HF) and the root mean square of successive differences (RMSSD), respectively. These groups were then compared with regard to (a) the magnitude of body temperature change (MAG), (b) time to maximum body temperature (MAX), and (c) time to return to baseline body temperature (BASE). The low HF group tended to have a larger change in MAG compared to the high HF group (P=0.08) but not with MAX or BASE (both P>0.5). There were no differences between groups based on RMSSD with regard to MAG, MAX, or BASE (all P>0.1). In summary, MAG tended to be different between groups classified by HF. No other relationships were found. An increase in test subjects is needed for conclusive results.

Research Mentor: Chris Byrd, Animal Sciences

Poster Number: 1295 :: Life Sciences

College of Agriculture

Examination of the capacity of bacteriophages to reduce Listeria monocytogenes contamination on non-food contact surfaces

Authors:

Aishwarya Chitnis

Abstract:

Listeria monocytogenes (LM) is the etiological agent of listeriosis, and as a foodborne pathogen, it is responsible for 240 deaths each year in the United States alone. The bacterium is ubiquitous in nature and endemic in some food processing facilities. Bacteriophages are viruses specific to bacteria with the potential to control LM contamination when used as an antibacterial. Here we examined the ability of bacteriophages to reduce LM on non-food contact surfaces (NFCS) using stainless steel coupons (1cm X 1 cm) as a facsimile of a common surface typically found in food processing facilities. Phage treatment of coupons co-inoculated with LM reduced significantly reduced ($P < 0.05$) LM concentrations to (1.5 log CFU/mL) compared to untreated coupons (5.3 log CFU/mL). These experiments were repeated under conditions that more closely resembled what might be seen in food processing settings (e.g., co-contamination with unrelated bacteria, the presence of various types of organic matter, etc.). Phage treatment remained effective at reducing LM contamination when coupons were also inoculated with wastewater (phage treated: below detection level; untreated: 5.1 log CFU/mL; $P < 0.05$). Likewise, phage treatment remained effective at reducing LM contamination when coupons were also inoculated with animal fat (phage treated: 1.9 log CFU/mL; untreated: 3.8 log CFU/mL; $P < 0.05$). Blood, however, reduced phage efficacy with no differences in LM concentrations on phage-treated vs. untreated coupons. These data indicate that phage treatment may be effective at lowering LM contamination of NFCS even under conditions that may be found in food processing facilities.

Research Mentor: Paul Ebner, Animal Sciences

Poster Number: 1329 :: Life Sciences

College of Agriculture

Characterization of a Mouse Model to Study SCN2A Mutations Related to Autism

Author:

Emily Coleman

Abstract:

The SCN2A gene encodes the voltage-gated sodium channel Nav1.2. Loss-of-function mutations of this gene in humans is suggested to contribute to autism, a neurodevelopmental disorder characterized by persistent deficits in social interaction and restrictive, repetitive patterns of behavior interest, and activities. Total knockout of SCN2A does not allow survival to weaning age in mice. It is postulated that conditional knockout of SCN2A will allow survival to and beyond weaning age, allowing the development and study of a mouse model for SCN2A mutations related to autism. To obtain a colony of mutant mice (homozygous for the conditional knockout mutation), transgenic mice are being bred strategically. At weaning age, tissue samples are obtained by ear punch or tail clip. DNA is isolated from tissue samples, amplified using PCR, and analyzed using gel electrophoresis to determine genotype. Once genotypes of the transgenic mice are known, behavioral studies can be performed to analyze the social interaction and restrictive, repetitive behavior patterns in mice of different genotypes. Using EthoVision software and carefully designed social chambers, mice can be analyzed to observe differences in social and repetitive behaviors between wild-type, heterozygous, and mutant mice.

Research Mentor: Yang Yang, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 1069 :: Social Sciences/Humanities

College of Agriculture

United States Food Shopping Preferences

Author:

Caroline Crosslin

Abstract:

The American grocery shopper is complex. American consumers and their preferences are always changing and evolving. The objective of this research is to 1) summarize consumers' prioritization of their food spending in 8 categories (vegetables, fruits, honey, meat, seafood, baked goods, water and other beverages, and "other" category) and 2) analyze the relationship between stated preferences and demographics (gender, age, income, household makeup, having a vegan or vegetarian in the household). Data was collected though a nationally representative survey of residents of the United States (n=1200) through Lightspeed GMI. The findings of this study indicated that shopping frequency was significantly different across genders (at a .05 level) for vegetables, fruits, honey, and baked good. Age and income were significant for five of the eight shopping frequency categories. Having a child was significant for three of the eight shopping frequency categories studied. Out of the eight categories of food, six displayed significance if you have a vegan or vegetarian in your household.

Research Mentor: Nicole Widmar, Agricultural Economics

Poster Number: 1245 :: Life Sciences

College of Agriculture

Genomic Characterization of S-Cluster Phage Vasu Nzinga

Authors:

Kevin Fitzgerald

Anqi Shao

Trevor Shoaf

Archana Kikla

Abstract:

A bacteriophage is a virus that infects and replicates inside a bacterium. Mycobacteria are bacteria that cause infections such as tuberculosis (Mycobacterium tuberculosis) and leprosy (Mycobacterium leprae) (1). Mycobacteriophages are bacteriophages that use Mycobacteria as their host to replicate (4). They can be used to diagnose different types of Mycobacteria because each Mycobacteriophage usually infects a couple bacteria strains at most. The 1031 particle bacteriophage population has been evolving for possibly 4 billion years with the population turning over every 5 days. The population contains new genes, functions, and structures that have not yet been studied (5). Although bacteriophages were quintessential in the making of several significant microbiological discoveries, research into phage genetics has only truly begun recently in response to the upsurge of antibiotic resistance in bacteria (2,3). To remedy this problem, most research done on mycobacteriophages serves to either characterize novel and potentially useful genetic material or to determine the evolutionary patterns responsible for the incredible genetic diversity intrinsic to bacteriophages. With the aid of several powerful and sophisticated softwares, this research aims to communicate the annotation of the VasuNzinga genome. As one of the few S-cluster phages to be successfully isolated, its annotation has the potential to assist in the discovery of genetic similarities and differences between phages within the S-cluster and overall phage community. Presently, start sites have been selected for all 115 genes annotated by DNA Master in the VasuNzinga genome. Current research focuses on categorizing their likely function into a few broad categories.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 1358 :: Life Sciences

College of Agriculture

Perfluorinated compound (PFAS) mixtures reduce growth and delay development of a larval amphibian

Author:

Megan Gannon

Abstract:

Recent discovery of elevated concentrations of PFAS’s in drinking water sites in the U.S. has heightened awareness of potential adverse effects on health and environmental impacts. In general, acute toxicity of individual PFAS’s is well-studied, and we are rapidly gaining an understanding of sublethal effects. However, effects of PFAS mixtures are largely unexplored despite the fact that organisms are exposed to suites of PFAS’s in nature. To address this gap, we examined effects of individual- and PFAS mixtures on growth and development of American bullfrog (Lithobates catesbeianus) tadpoles. We chose environmentally relevant concentrations (0.1 and 0.2% LC50: 144 and 288 ppb) of the two most prevalent and persistent PFAS’s, PFOS and PFOA, for our assessment. We found that exposure to PFOS-only and mixtures delayed development and reduced growth of tadpoles by >30% at the conclusion of the 74d exposure period with more severe effects in the mixture groups. The severity of delayed development and growth was independent of varying PFAS concentrations used in this study. These results suggest that PFAS mixtures have synergistic sublethal effects on larval amphibians at environmentally relevant concentrations. Thus, PFAS mixtures warrant further investigation in environmental assessments.

Research Mentor: Jason Hoverman, Forestry and Natural Resources

Poster Number: 1291 :: Life Sciences

College of Agriculture

Lighting Preference of Laboratory Rats

Authors:

Ellen Green

Elizabeth Carper

Abstract:

Lighting Preference of Laboratory Rats

Laboratory lighting is brightly lit for humans, however, rats find it aversive. Red-tinting is used in the lab because rats cannot see it and appears opaque. We hypothesized that rats would prefer dimly lit, red cages during the day and will not have a preference at night. Two different kinds of cages (clear and red-tinted) and light intensities (25 and 200 lux) were used. Preference for lighting environment was assessed in a 72h free choice test with 24 pairs of rats. One CD and Long-Evans (LE) rat were housed together at weaning. Four cages were attached by a central tube; 25 lux-clear, 200 lux-clear, 25 lux-red, and 200 lux-red. The rats had the option to go into any of the cages based on their preference. Lights were on a 12h:12h, light:dark, cycle. The rats were video recorded and was later coded by observers blind to treatments. Observers recorded the location of both rats every 15m. Data was analyzed with a GLM. Both types of rats spent the most time during the night in the 200 lux-clear cage. During the day, CD rats spent more time in the 25 lux-clear and 25 lux-red than either of the two 200 lux cages. The LE rats spent the least amount of time in the 200 lux-red cage compared to both clear cages but was not different than 25 lux-red during the day. Overall rats at night showed a preference for intensity but difference in preferences between the rats were seen during the day.

Research Mentor: Brianna Gaskill, Animal Science

Poster Number: 1180 :: Life Sciences

College of Agriculture

Determining the role of the epigenetic factor SET4 in antifungal drug resistance in budding yeast

Authors:

Abigail Gress

Nina Serratorre

Abstract:

Fungal pathogens and their role in the increasing prevalence of systemic infections are of critical concern for human health. Systemic infections are regularly caused by drug resistant pathogens, a phenomenon that results from genetic mutation or overexpression. These changes in gene expression result from the mutation of epigenetic factors. Epigenetic modifications cause changes in gene expression or recruitment of additional factors to the epigenetic site. Classes of epigenetic factors include ATP-dependent chromatin remodelers and histone modifiers such as histone acetyltransferases (HATs) and methyltransferases (HMTs). The SET domain superfamily is a class of epigenetic factors in yeast that include HATs and HMTs. This family includes SET4, a possible HMT that we hypothesize is regulating antifungal drug resistance genes in budding yeast. Set4 is induced under stress conditions, such as hypoxia and drug treatment. Additionally, a SET4 deletion is resistant to antifungal drug treatment. While the interactions of Set4 in the hypoxia stress condition have been studied, it is currently unclear what Set4 targets during antifungal drug treatment. Interestingly, overexpression of SET4 results in hypersensitivity to antifungal drugs. This study utilizes suppressor screens, overexpressed SET4 colonies plated on media containing antifungal drugs, to identify suppressors of the hypersensitive phenotype. The suppressor colonies overcome the hypersensitive phenotype to grow under the antifungal treatment. Re-plating the suppressors showed drug resistance, suggesting that a genetic mutation(s) occurred. The suppressor colonies were finally analyzed for SET4 expression and found to have little to no visible change in Set4 levels from the original overexpressed SET4 strain. This suggests that the suppressor mutations are novel and not due to mutations in SET4 or the constitutive promoter. In the future, genome-wide sequencing will be conducted in order to identify the suppressor mutation(s) and further analysis will determine whether the suppressor proteins have roles in antifungal resistance or a function in the drug resistant mechanism of Set4.

Research Mentor: Scott Briggs, Biochemistry

Poster Number: 1227 :: Life Sciences

College of Agriculture

Requirement of Fatty Acid Oxidation to Attenuate Cardiac Hypertrophy

Author:

Kate Harris

Abstract:

Heart enlargement, or cardiac hypertrophy, is an increasingly prevalent condition in the obese, aging, diabetic, and hypertensive populations. It is characterized by reductions in mitochondrial fatty acid oxidation, yet the role fatty acid oxidation plays in cardiac remodeling remains unclear. We have previously demonstrated that the loss of mouse cardiac carnitine palmitoyltransferase 2 (Cpt2M-/-), an enzyme required for mitochondrial long-chain fatty acid oxidation, causes cardiac hypertrophic remodeling and early lethality. Cpt2M-/- mice are resistant to two therapies previously shown to attenuate hypertrophy: inhibition of mTOR and reversal of protein hypoacetylation, suggesting that improving mitochondrial fatty acid oxidation is key for attenuating cardiac hypertrophy. To determine if restoring mitochondrial oxidative flux with alternative substrates to long-chain fatty acids could improve hypertrophy, control and Cpt2M-/- mice were placed on either control diet or specialized ketogenic diet enriched with octanoate, a medium-chain fatty acid that can bypass CPT2 for mitochondrial oxidation. While ketogenic diets have been shown to improve cardiac hypertrophy, we report here that in the absence of CPT2, ketogenic octanoate-enriched diet failed to improve hypertrophy. We will further describe the molecular and metabolic consequences of the ketogenic octanoate-enriched diet on the heart with and without CPT2. Determining the molecular events that fail to be modified in the Cpt2M-/- heart in response to this therapy will elucidate pathways that link fatty acid oxidation to cardiac remodeling.

Research Mentor: Jessica M. Ellis, Ph.D., Nutrition Science

Poster Number: 1254 :: Life Sciences

College of Agriculture

Characterization of Arabidopsis DMP9/10 Function in Seed Germination

Author(s):

Ryan Hockemeyer

Nikita Bhatnagar

Leonor Boavida

Abstract:

Seeds are the products of sexual reproduction and the most common method of plant propagation. Seed dormancy is a physiological mechanism that allows seeds to sense favorable conditions and initiate germination appropriately. This mechanism allows seeds to separate from the mother plant and disperse before initiating germination, renewing the plant life cycle. The period of seed dormancy varies greatly between species. In some species, seeds may remain dormant for a few days while others may lay dormant for years before beginning germination. Seeds may require a cold period, scarification, or even certain wavelengths of light to initiate germination. The dormancy period and mechanisms of exit from seed dormancy however; are not well understood. The correct hormone balance and cellular signals are necessary for the embryo to leave the dormancy period at an appropriate time. In this study, two novel proteins DMP9 and DMP10, were identified as potential regulators of seed germination in Arabidopsis thaliana. The single mutants display the characteristics of a recessive allele. Single, knockout mutant lines showed no apparent change in vegetative growth, but dmp10 Ho mutants present a delayed seed germination phenotype. In addition, we failed to recover higher order mutants from the progeny of a self-cross of dmp9/dmp10 double heterozygous. Germination rates of dmp9/dmp10 double heterozygous progeny were analyzed soon after seed collection and in different time periods. The germination of these seeds appeared to drastically increase over the course of three months. In conclusion, our results suggest that DMP9 and DMP10 proteins are involved in the regulation of seed dormancy.

Research Mentor: Leonor Boavida, Botany and Plant Pathology

Poster Number: 1367 :: Social Sciences/Humanities

College of Agriculture

Haitian Orphanage Agricultural Education Curriculum

Author:

Brianna Lammers

Abstract:

Haiti is the poorest nation in the Western Hemisphere. The country has been stripped of many of its resources and many families have been forced to give their children to orphanages in hopes that they can live a better life through such entities. My scholarly project focuses specifically on one orphanage school in the small town of Despinos, Haiti. The orphanage houses approximately 75 children and approximately 200 kids attend the free school that the orphanage sponsors. While I was there, I realized the children were curious about the flowers that we were planting and that they really wanted to help water them. The main goal of my scholarly project is to design and compile a 10-day learning module for the students so that they can learn the basics of plants, animals, and basic care for both. The long term goal of my project is to inspire the students to start their own small community garden inside of the orphanage so that they can eat the produce that they grow.

Research Mentor: B. Allen Talbert, Youth Development & Agricultural Education and Curriculum & Instruction

Poster Number: 1240 :: Life Sciences

College of Agriculture

Annotation of Mycobacteria Phage Genes

Authors:

Austin Larson

Anthony Park

Ellie Lang

Abstract:

The purpose of this project is to fully sequence a bacteriophage genome. This will include determining gene start sites as well as determining gene function as well as comparing the genome to other sequenced genomes. In order to do this, a number of programs are to be used in tandem. The NCBI database is used to BLAST and align proteins with known sequences. DNA Master is used to auto-annotate the genome as well as record the annotation done on each gene. Phamerator is also used in order to assess the start/stop positions decided upon and to visualize the genome. GeneMark is used in order to determine coding potential.

Once all of the genes have been annotated and start positions are determined, it can be translated into a protein sequence. This protein sequence will be used to determine the functionality of the gene (what sort of protein it codes for and what evidence there is to determine this gene’s function).

This research will add another sequenced genome for other researchers to use for future sequencing. Ultimately, fully sequencing a genome will open new information available for further research in genetic engineering and gene therapy using bacteriophages.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 1229 :: Innovative Technology/Entrepreneurship/Design

College of Agriculture

Exploring the Longevity of Businesses that have a Disaster Plan in Place Before Encountering a Natural Disaster

Author:

Jared Lovins

Abstract:

For many businesses, having an emergency preparedness plan can make the difference between closing or remaining in business when faced with an emergency. In recent years, disaster planning has become an important topic for many small businesses and research has been finding that more and more small businesses are unprepared for when a disaster hits. Having a disaster plan in place has been shown to have a positive affect on businesses survival immediately following a disaster. However, there is little research on the longevity of the survival of small businesses who had a disaster plan in place prior to a natural disaster. This study explores if businesses that have a disaster plan in place before a disaster, survive longer than businesses that do not. In order to conduct this experiment, I will be using data from interviews of a random sample of 499 businesses who were operating before Hurricane Katrina. This data will be used to determine if businesses that had a disaster plan were more likely to still be operating in 2013, following Hurricane Katrina.

Research Mentor: Maria Marshall, Agricultural Economics

Poster Number: 1272 :: Life Sciences

College of Agriculture

Hydrogen Sulfide Emissions from an Indiana Dairy Lagoon

Author:

Mary Rose Mangan

Abstract:

Hydrogen sulfide (H2S) emissions from Midwestern diary lagoons are episodic. This study evaluates the causes of this in an anaerobic Indiana dairy lagoon with data provided by the National Air Emissions Monitoring Study. In anaerobic dairy lagoons, H2S results from the breakdown of organic matter by sulfate reducing bacteria, and then purple sulfur bacteria converts the H2S into sulfur and new cells. Because H2S is slightly soluble in water, H2S bubbles rise to the lagoon surface. The causes of episodic emissions of H2S include weather conditions, lagoon conditions, and the bacteria populations in the lagoon. This study hypothesizes that synoptic-scale weather conditions – particularly the passage of cold fronts – are the most important factor for emissions. The passage of cold fronts is associated with low barometric pressure, precipitation and high wind speed – all of which can pop a H2S bubble and increase emissions. During the yearlong study, there were 11 days whose emissions were high outliers (emissions greater than 7.02 gd-1Hd-1 [Hd = head of cattle]). 9 of those days were associated with frontal systems, 7 of which were cold fronts. Although there was no direct association between pressure, precipitation events, and wind speed with emissions, the highest emissions occurred prior to a pressure minimum. There was a linear correlation between the emissions and precipitation amount given a half hour time lag (r=0.67). Winds from the south and the southwest tended to have the highest emissions. One possibility for this is that these wind directions typically occur after the passage of a cold front. Moreover, H2S emissions were lower in the summer and the winter than in the spring and the fall, which was possibly due to the presence of a lagoon cover either from ice or a natural crust.

Research Mentor: Richard Grant, Agronomy Department

Poster Number: 1158 :: Social Sciences/Humanities

College of Agriculture

GrowLocal Lafayette: An Urban Community Garden's Impacts on Quality of Life

Authors:

Chelsea Maupin

Abstract:

This research investigates how the urban community garden program GrowLocal Lafayette ("GrowLocal") impacts the community's quality of life. GrowLocal is a binding network of urban community gardens in downtown Lafayette, Indiana. Previous research conducted by Purdue affiliates has shown participant's motivations center on community building and food security. As GrowLocal develops, this research looks more deeply at how GrowLocal impacts some of the many aspects of a community's wellbeing. Data is collected through interviews, focus groups, and surveys with GrowLocal leaders, volunteers, and participants. This research also generates an overview of the program's current progress, challenges, and goals.

Research Mentor: Lindsey Payne, Office of Engagement

Poster Number: 1268 :: Life Sciences

College of Agriculture

Genome Annotation of S-Cluster Mycobacteriophage VasuNzinga

Authors:

Sean McCormick

Michael McCool

Ethan Gaskin

Zachary Berglund

Abstract:

This research began with the isolation, purification, and amplification of a novel bacteriophage from environmental samples. Thereafter, the next portion of this research involved the analysis and annotation of a previously isolated bacteriophage, VasuNzinga. The massive population of the bacteriophage species coupled with their intense genetic diversity has sparked much interest from the scientific community. These microscopic entities could be harboring significant genomic data, hidden in non-annotated DNA sequences. Purdue University, with much help from the Howard Hughes Medical Institute, has taken up the expedition to clear the fog surrounding the bacteriophage genome. VasuNzinga was discovered by Purdue undergraduate researchers in 2014. VasuNzinga specifically offers an unique opportunity to examine the new genome of a phage from the S Cluster which is still a mystery to even the most experienced phage researchers.The goal of this research was twofold. Firstly, to supplement the scientific community's knowledge of bacteriophages through continued genomic discovery using programs such as DNA Master, Phamerator, and GeneMark. Secondly, to allow inexperienced researchers to gain valuable insight into bioinformatic methods of analysis. Using the auto-annotation from the program DNA Master and performing comparative analysis via tools such as GeneMark (tool for measuring coding potential) and Phamerator (used to exam gene sequence conservation amongst members of a pham), informed decisions regarding the existence, location and function of the genes were made.The results of this will broaden the scientific community's knowledge of genomes, allow future researchers to compare against VasuNzinga, and perhaps reveal new genes with new functions.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 1047 :: Life Sciences

College of Agriculture

Effects of PCAI Catheter Design on Semen Quality

Authors:

Morgan McKinney

Tabitha Steckler

Larissa Shirley

Abstract:

The swine industry has adopted a new method of performing artificial insemination (AI) called post-cervical AI or PCAI. This method deposits semen past the cervix, straight into the uterine body of the female during the insemination process. PCAI requires a unique catheter to be used for insemination that has a small diameter inner cannula which penetrates the cervix and enters the uterus. The purpose of this study was to evaluate 3 different PCAI catheter designs produced by Neogen, Inc. and their potential effects on semen quality. The three catheter designs used in this study included single port, dual port, and triple port catheters. Semen was collected from two boars per week for 8 weeks. The semen was diluted in a commercial semen extender to a concentration of 3.75 million cells/mL. Semen samples were then passed through each of the catheters 10 times per week at a pressure of 12lbs and pre and post semen quality was assessed. Semen quality assessments included sperm cell morphology, motility, mobility, membrane integrity and acrosome morphology. Motility and mobility were obtained using a computer assisted semen evaluation system (CASA). Morphology and acrosome morphology were performed using bright-field, phase-contrast microscopy. Sperm cell membrane integrity was assessed using the SQS® machine. Data was evaluated using the MIXED procedures in SAS. Catheter had a tendency to have an effect on lateral head displacement (ALH) (P=0.0649) where the triple port was less than the single port. Catheter had an overall effect on distance average path (DAP) (P=0.0291), curvilinear distance (DCL) (P=0.0059) and distance straight line (DSL) (P=0.0381), where the distance was reduced for the triple port catheter compared to the single port catheter. These results suggest that outside of some minor changes in mobility of the sperm cells, catheter design did not have a significant effect on semen quality.

Research Mentor: Kara Stewart, Animal Sciences

Poster Number: 1208 :: Physical Sciences

College of Agriculture

Chemical Stability of Amorphous Thiamine Mononitrate and Thiamine Chloride Hydrochloride in Controlled pH Environments

Author:

Jenna Miller

Abstract:

Thiamine, vitamin B1, is an essential vitamin, found in the bran of grains and often obtained in the diet through the consumption of products made from whole grain or enriched flours. Two synthetic forms of thiamine are commercially used as food additives: thiamine chloride hydrochloride and thiamine mononitrate. Both natural and synthetic thiamine are susceptible to degradation, with driving factors including light, heat, and product formulation; however, little information is available regarding a direct comparison of the stability of these vitamin forms. Thiamine chloride hydrochloride has been reported to be more stable in acidic conditions and to destabilize at its isoelectric point, pH 5.5, while thiamine mononitrate has been reported to be most stable at pH 4 and unstable above this pH. Thiamine degradation not only compromises the nutritional quality of foods, but also has a great impact on the sensory aspects of foods, particularly aroma. This study directly compared the stability of the two synthetic forms of thiamine under different conditions relevant to the formulation and storage of foods (pH, flour types, temperature, and relative humidity(RH)). Thiamine was added in a 1:9 w/w ratio to wheat flour, wheat starch, wheat gluten, or a wheat starch and gluten (1:1) mixture. To control the pH, 10 mL of a citrate buffer was added to the samples to create either pH 3 or pH 6. The samples were then freeze dried to create amorphous matrices containing the vitamin (to simulate food matrices). The samples were stored at either 25°C and 11% RH, or 40°C and 75% RH. HPLC was used to track vitamin degradation periodically over the storage period of 5 weeks. Both vitamins were significantly ($p<0.05$) more stable at the lower temperature and RH storage condition than the higher temperature and RH condition; however, the vitamin stability in the different pHs did not follow the expected trend. Because salt forms of vitamins dissociate in solution, it was anticipated that no difference in stability would be found between the vitamin forms at the same pH; however, the data provide conflicting results. Further experiments are designed to document differences in degradation products and well as the physical state of the vitamins in the samples; however, it is clear that formulation and storage conditions pose challenges for delivering thiamine in food systems.

Research Mentor: Lisa Mauer, Food Science

Poster Number: 1315 :: Social Sciences/Humanities

College of Agriculture

The Impact of a Roundtable Discussion on Attitudes in Agriculture

Author:

Sabrina Myoda

Abstract:

Controversial agricultural topics have begun to divide those involved in agriculture into increasingly disparate ideological “camps”. In order to effectively educate and collaborate within agriculture, it is necessary that forums for civil debate and education are available. In this experiment, audience members engaged with a panel discussion on the characteristics of conventional and organic agriculture in order to provide such a forum and to better understand how to most effectively educate audiences about controversial topics in agriculture. The specific focus of this study was the impact of panel-type discussions on audience member beliefs and their confidence in their ability to explain agricultural issues.

Audience members were recruited from Purdue’s campus via flyers, word-of-mouth, and email announcements. At the event, subjects were asked to fill out a voluntary written survey given before and after the panel discussion. The panel itself was composed of three Purdue faculty members with considerable depth and breadth of knowledge in their field and with an understanding of the nuances of organic and conventional agriculture.

Based on pre- and post-survey data, it appears that panel discussions can be an effective format for increasing audience members’ understanding of controversial agricultural topics (based on increased levels of confidence in respondents’ ability to define organic and conventional agriculture). Audience members were more likely to favor a combination of conventional and organic methods after the panel, possibly suggesting a greater appreciation of the benefits of both agricultural systems. Advantages and disadvantages of conventional and organic methods identified by audience members did not dramatically change from pre- to post-survey. Overall, 85% of respondents found the discussion at least somewhat helpful in deepening their understanding of conventional and organic agriculture techniques.

Research Mentor: Steve Hallett, Horticulture and Landscape Architecture

Poster Number: 1275 :: Life Sciences

College of Agriculture

Effects of Rubber Versus Concrete Flooring on Dairy Cow Productivity and Well-being

Author:

Jenny Oberhelman

Abstract:

Concrete and rubber flooring are commonly used in US dairy facilities. The objective was to determine effects of rubber versus concrete flooring surfaces for housing on production and health of dairy cows during their first two lactations. Holstein dairy cows (n=43) were randomly assigned by first calving date to concrete (n=23) or rubber (n=20) flooring at the Purdue Dairy Research and Education Center. Cows remained on assigned flooring for first lactation, were housed on bedded pack during dry period, and returned to same housing for second lactation. Production data was assembled from monthly Dairy Herd Information records and evaluated as lactation measures. Effects on productivity were analyzed using PROC MIXED of SAS®. Floor type, calving season, and their interactions were fixed effects, and cow was random, with lactations treated as repeated measures. Chi-Squared tests were used to compare concrete and rubber flooring for routinely recorded health effects. No significant ($P \leq 0.05$) main effects of flooring were observed for 305-day milk, fat, or protein; somatic cell count; or body weight. Number of breedings to successful conception for cows on rubber (n=1.05) tended ($P \leq 0.06$) to be less than concrete (n=1.26) flooring. No significant differences were determined using Chi-Squared tests for incidences of metritis, retained placenta, ketosis, pneumonia, mastitis, left displaced abomasum, lameness, abscesses, foot rot, hairy heel warts, or swollen legs. No significant differences ($P \leq 0.05$) between concrete and rubber flooring's effects on productivity or illnesses resulted in this study. Dairy cows can be successfully managed on either flooring type.

Research Mentor: Michael Schutz, Animal Sciences

Poster Number: 1173 :: Life Sciences

College of Agriculture

Metabolic Impact on Transcription

Author:

Jordan Page

Abstract:

Isocitrate dehydrogenase is an enzyme in the TCA cycle responsible for the oxidative decarboxylation of isocitrate to α-ketoglutarate. Recent studies have demonstrated the prevalence of isocitrate dehydrogenase mutations in the cells of acute myleoid leukemia, prostate cancer, and colon cancer. Research suggests the most common mutation causes a gain of function (or neomorphic activity) where the enzyme instead catalyzes the reduction of α-ketoglutarate to R-2-hydroxyglutarate (R2HG). As a result, cells experience a significant increase in concentration of R2HG, which is known to inhibit the Jumonji domain-containing histone demethylases of the cell. The effects of histone demethylase inhibition are not fully understood; however, our preliminary data show cryptic initiation within a gene body is induced in yeast expressing the neomorphic isocitrate dehydrogenase (IDP1 R148H in yeast). The experiments presented in this poster explore whether cryptic initiation occurs at multiple sites in the genome when IDP1 R148H is expressed to test the prediction that isocitrate dehydrogenase mutations lead to aberrant gene expression at a genome level.

Research Mentor: Ann Kirchmaier, Biochemistry

Poster Number: 1027 :: Life Sciences

College of Agriculture

Probing the Long-distance Signaling in Root Foraging Using Solanum lycopersicum (Tomato)

Author:

Charles Peacock

Abstract:

How do the farming practices in a rural Indiana community affect the water quality and fish population in the Gulf Coast? Despite being hundreds of miles away, the fertilizer put in the fields for grain production can contaminate water bodies in remote communities. Therefore, reducing the fertilizer input in farming practices, through improving plants' ability to forage for nutrients, is vital to the sustainability of modern agriculture. Here, we used a unique "split-root" system on Solanum lycopersicum (tomato, Heinz 1706) to probe the molecular mechanism responsible for the root foraging of nutrients, which is vital to the optimum growth of plants. In this system, the roots of a single plant are split into two separate root systems. One root system is supplied with sufficient nitrogen (N) in the form of NO3- (SpN), while the other is supplied with Cl- (SpCl), forming a heterogeneous N condition. There are two controls: a homogeneous "N-supplied" control (CN) with NO3- supplied to both root systems and a homogeneous "N-starved" control (CCl) with Cl- supplied to both root systems. After growing the plants in the described conditions above, root architecture was analyzed. We found that the root foraging in Heinz 1706 is mostly driven by a systemic nitrogen supply signal (that leads to the differential root growth between SpCl and CCl), other than driven by a systemic nitrogen starvation signal (that leads to the differential root growth between CN and SpN). Currently, we are comparing the systemic nitrogen signaling in two varieties- Heinz 1706 and M82.

Research Mentor: Ying Li, Horticulture and Landscape Architecture

Poster Number: 1289 :: Innovative Technology/Entrepreneurship/Design

College of Agriculture

Effect of Live and Recorded Observations on Shelter Dog's Response to Stanger Approach

Authors:

Andrew Pietraniec

Mikayla Small

Abstract:

Assessments of dog welfare that incorporate behavior must be valid and reliable. The Field Instantaneous Dog Observation (FIDO) tool was used to determine whether observer method (live vs video-recorded) influences dogs' responses to stranger-approach. FIDO categorizes dogs' behavioral responses to approach into three categories: red, indicating fearfulness, green, indicating affiliative or neutral response, and yellow, indicating ambivalence. A male and female observer each scored response to stranger approach of 34 dogs at a shelter in Lafayette, Indiana over two test periods (phase 1, n =1 9, phase 2, n = 15). Observer one approached the dog's pen in a quiet, non-threatening manner, extended a hand, and FIDO-scored the response while the test was video-recorded. After 30 minutes, observer two scored the same dogs using the same methods. Reliability within and between observer scores was calculated. Phase 1 testing showed low to moderate agreement for one observer's intra-rater reliability (IRR1) (52%; Kappa = 0.089) and low to moderate Inter-rater reliability (IRR2) for live and video-recorded scoring (52%, Kappa = 0.33 and 68%; kappa = 0.58 respectively). Observers were then re-trained on scoring. Phase 2 results indicated high IRR1 for both individuals and high IRR2 for both observation types. These findings suggest that level of training has more of an effect on consistency of scoring than the method of observation or observer gender. Small sample sizes and only one male-female scoring pair for evaluating gender effects were limitations. Future studies with more male-female scoring pairs and larger sample sizes are needed.

Research Mentor: Candace Croney, Comparative Pathobiology

Poster Number: 1237 :: Life Sciences

College of Agriculture

Isolation, Characterization, and Comparative Genomic Analysis and Annotation of mycobacteriophage VasuNzinga

Authors:

Chitra Ram

Sanya Gupta

Jacob Riedel

Catherine Nagy

Abstract:

Mycobacteriophage VasuNzinga with host Mycobacterium smegmatis mc²155 was isolated in Fall 2014 from a soil sample on Purdue University's campus in West Lafayette, IN. This mycobacteriophage is only the eighth S cluster phage to ever have been found. It has a lytic life cycle and siphoviridae morphotype. This phage was identified as being uncommon during a large DOGEMS screening run, then subsequently grown from frozen stock and sequenced on November 6, 2017 at the Pittsburgh Bacteriophage Institute via Illumina sequencing (by synthesis). The genome has a GC content of 63.4%, length of 64911 bp and a 3' sticky overhang of 11 bases: GCGCGCAGCGC.

The unusual mycobacteriophage VasuNzinga was selected for genome annotation in Spring 2018. Based on evidence from multiple in silico databases, genes were called using the bioinformatics tools DNAMaster, GeneMark, BLAST and Phamerator and the putative proteins were annotated. Functions of the presumed gene products were allocated after comparison and determining a semblance to previously characterized proteins. Programs BLAST, HHPred and Phamerator were used for a quality control analysis of the final genome annotation file. Most annotated gene functions were associated with structure, replication and protection of the mycobacteriophage genetic material.

It is crucial to consider how this particular genome is similar to previously known S cluster genomes, since can help establish the role of the gene. Additionally, the plasmids, phages and resistance genes of the genome will reveal information about genome nature which will better allow us to recommend future applications and research employing this mycobacteriophage.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 1135 :: Life Sciences

College of Agriculture

Passive Stomatal Responses in Lady Fern

Author:

Joshua Randall

Abstract:

Two theories exist to explain stomatal responses to water status in ferns. The first is that stomata in ferns respond passively to changes in water status. The second claims that hormones like abscisic acid (ABA) actively regulate stomatal responses just like angiosperms. This study tested whether stomatal responses in ferns are regulated by passive hydraulic processes rather than hormones. Using two varieties of Lady Fern Athyrium filix–femina, Mrs. Frizzle and wild-type, which have very different leaf morphologies, a model predicting stomatal behavior that assumes stomatal responses are passive, was developed and tested using stomatal responses to changes in vapor pressure deficit. Stomatal responses were measured using an infrared gas analyzer and the hydraulic properties of the leaves were quantified by the two-point rehydration method and pressure-volume curves. The variety Mrs. Frizzle had a higher leaf capacitance and hydraulic conductance compared to the wild-type. Stomatal responses to VPD in both varieties could be accurately predicted by the hydraulic properties of the leaf alone. No measured change in the levels of the plant hormone abscisic acid were detected when stomata closed following severe dehydration of fronds. These results suggest that fern stomata are passively controlled by leaf water status and not actively by hormones.

Research Mentor: Scott McAdam, Botany and Plant Pathology

Poster Number: 1029 :: Life Sciences

College of Agriculture

Exploring Tickling Dosages: Do Frequency and Duration Matter?

Authors:

Megan Riley

Abstract:

Laboratory rats find initial interactions with humans stressful. Tickling, a human-animal interaction that mimics rough-and-tumble play, can improve rat welfare. Previous protocols for rat-tickling are time-intensive. Our purpose was to identify a time-efficient and effective dosage of rat tickling. We hypothesized that a total of five minutes or less of tickling will improve rat affect and handling.

We sampled 72 rats of both sexes, housed in pairs. Each cage was randomly assigned a tickling duration (15, 30, or 60 seconds) and frequency (1, 3, or 5 days). After the final day of tickling, rats received an intraperitoneal injection preceded by a tickling session. Ultrasonic vocalizations were recorded live, and behavior was assessed during anticipatory and reactionary approach tests. Rat behavior in their home cage was assessed for one hour before and after tickling.

Regardless of duration, rats tickled for at least 3 days produced a higher rate of positive vocalizations during tickling than rats only tickled for 1 day. During the approach test after injection, the rats reared more. Additionally, they played more before tickling and were less inactive in their cages before and after testing.

Based on the data, the minimum tickling dosage to improve positive affect in laboratory rats is 15 seconds per day for 3 days, and an additional tickling session the day of an aversive procedure. This results in one minute of time investment. These results suggest that rat tickling can be a time-efficient and effective method of habituating rats to handling.

Research Mentor: Megan LaFollette, Animal Sciences

Poster Number: 1352 :: Life Sciences

College of Agriculture

High Carotenoid Orange Corn for Poultry Health

Author:

Ashley Ring

Abstract:

Yolk color is a characteristic that consumers highly value in the market for eggs. Beyond consumer preference, carotenoids, which are precursors to vitamin A, must be obtained through dietary means and are essential to human health. The objective of this study is to determine if different corn diets (white, yellow and orange) will affect the pigmentation of the yolk color, carotenoid deposition, production levels and overall egg quality. The study will include 360 birds divided into 3 treatments (White, Yellow and Orange diets) with 6 replicates per treatment (20 birds per replicate.) Yolk pigmentation will be analyzed using two different methods, the DSM egg yolk color fan and a colorimeter. Egg quality assessments will be performed to analyze shell strength, shell thickness, and freshness via Haugh Unit assessment. Egg quality measures can determine if there are dietary impacts. Egg production will be monitored by gathering eggs daily and reporting hen-day percentages and total eggs per hen-housed. Laying hen well-being will be monitored using a standardized welfare quality assessment at the start and conclusion of the project. The welfare quality assessment will monitor various aspects of the laying hen including the keel bone, feathering, and foot condition. We expect yolk color to range from rich orange pigmented yolks to washed-out yellow yolks from the orange and white corn diets respectively. Minimal differences are expected in overall egg quality, well-being measures, and production levels for the study. Future work includes analyzing ceca for microbial analysis and blood serum for immune marker analysis.

Research Mentor: Darrin M. Karcher, Animal Sciences

Poster Number: 1241 :: Life Sciences

College of Agriculture

Prediction of the Gene Calls and Functions of VasuNzinga (Genes 42-60)

Authors:

Julia Russo

Holly Spiritoso

Mika Reuhs

Jack Hamlin

Abstract:

Bacteriophage, viruses which infect bacteria, are the most abundant organisms in the biosphere. The goal of this work was to annotate the genome of the mycobacteriophage VasuNzinga, to aid the research of the HHMI SEA-Phages initiative. Previously, VasuNzinga was collected as an environmental sample which was purified and amplified to extract its DNA for annotation and analysis. The extracted DNA was sequenced at a Purdue University facility and was identified as “uncommon” during a DOGEMS screening (phagesDB, 2018). Preliminary annotation was completed by gene prediction software. Then, the gene calls were manually refined using evidence from programs such as DNA Master, Phamerator, and GeneMark. Phamerator and DNA Master are comparative analysis tools which utilize databases, such as Glimmer, of DNA sequences from other phages to identify the most likely call for each gene. GeneMark produces a graphical analysis of coding potential in each section of the genome, which served as a reference for analyzing each gene call. Once the calls for each gene were determined based on the guiding principles provided by SEAPhages, analysis was completed to determine the function of each gene’s associated protein in the genome. During this work, it was decided to omit Gene 58 because of the lack of alignment to other genomes and the resulting gap will require further investigation. The next steps in this research would involve investigation of the associated protein structures and chemical properties, predicted operon dsequences, gene ontologies, evolutionary relationships, and metabolic pathways (Stothard & Wishart, 2006).

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 1109 :: Life Sciences

College of Agriculture

Red Clover Inclusion Impact on Cover Crop Biomass and Potential Soil N Cycling within Row-Crop Agricultural Systems

Author:

Stephen Schwartz

Abstract:

Cover crops are increasing in popularity among Midwest farmers because of both potential on-farm (soil health) and off-farm benefits (reduced nutrient losses). Specifically, there is interest in using cover crop mixtures (cocktails) to maximize these ecosystem services on an annual basis. Additionally, there is growing interest in mixing winter-kill cover crop species with over-wintering legumes species (red clover) to improve the potential of soil N cycling. However, there is a dearth of knowledge examining how individual cover crops species perform in a mixture. Therefore, the objective of this study is to examine the performance of red clover in increasingly complex cover crop mixtures. To investigate this objective two research sites (NEPAC and DPAC) were established. At each site a complete random block design was used to set up 5 cover crop treatments replicated 6 times each. The treatments included a no cover crop check, 100% Red Clover, 70% Red Clover with 30% Daikon Radish, 30% Red Clover with 70% Daikon Radish, and 10% Red Clover with 10% Rapeseed, 20% Daikon Radish and 60% Oats. Cover crops were drilled after wheat harvest in early summer. Tissue samples were collected in the fall and spring, separated, dried, and ground. Ground samples were then analyzed for N content to determine cover crop N uptake and biomass. The results of this study will help guide Indiana corn and soybean grain growers in determining the most appropriate mixtures to maximize potential N cycling. This is essential to providing short-term benefits that will encourage cover crop adoption.

Research Mentor: Shalamar Armstrong, Agronomy

Poster Number: 1122 :: Physical Sciences

College of Agriculture

Moisture-mediated interactions in complex ingredient blends: Case studies of seasoning blends

Author:

Abigail Sommer

Abstract:

Ingredient blends which contain crystalline and amorphous substances are common throughout the food industry and often exhibit unwanted clumping during storage. Crystalline and amorphous ingredients are known to respond differently to increases in relative humidity (RH) and temperature. The purpose of this study was to characterize blends of amorphous spices/herbs and crystalline ingredients, co-formulated and subjected to varying temperature and RH conditions. Crystalline ingredients and spice/herb powders were studied individually and in complex blends. All ingredients and blends were analyzed using powder X-ray diffraction. The effects of increasing temperature on the water activity of individual ingredients were determined using controlled-temperature water activity analysis. Graphs were prepared by plotting the effects of increasing temperature on both the water activity of amorphous spices/herbs and the deliquescence points of crystalline ingredients to determine the crossover temperatures at which the water activity of an amorphous ingredient exceeded the deliquescence point of the crystalline ingredient. When the initial moisture content of the spice or herb was increased, the crossover points occurred at lower temperatures. Increasing the number of crystalline ingredients in a blend lowered the mutual deliquescence point, similarly lowering the crossover temperature. Spice blends placed in closed systems and exposed to increasing temperatures, resulted in deliquescence of the crystalline ingredient, leading to clumping or compaction of the ingredient blend. This study provides not only valuable data to support informed decisions for formulation strategies enhancing ingredient blend quality, but also a road map for conducting experiments to explore the complex phenomena of mutual deliquescence and amorphous ingredient behaviors.

Research Mentor: Lisa Mauer, Food Science

Poster Number: 1044 :: Innovative Technology/Entrepreneurship/Design

College of Agriculture

Impact of Educational Simulation Games on Increasing Interest in Poultry Management

Author:

Samantha Tinney

Abstract:

Indiana ranks second in the U.S. for table egg production. There is a large demand in the table egg industry for well-qualified workers and a considerable amount of jobs are available in Indiana. However, the number of candidates qualified to fill these positions is insufficient to meet the industry's continually growing need. It is important to introduce college students to poultry management opportunities to increase the number of students pursuing careers in the industry. The objective of this study is to increase undergraduate interest in pursuing poultry industry careers and educate students on poultry management. This will be accomplished by the creation of a laying hen game which simulates decisions made to increase welfare and production in a modern hen house. The simulation game will consist of modules in which students learn about different attributes of hen management, industry technology, and housing design. Students will interact with multiple parameters to optimize egg production given different scenarios, allowing them to demonstrate comprehension of the material. A pre-questionnaire will be given to 88 students enrolled in Introduction to Animal Agriculture in Spring 2018 to determine student knowledge of poultry management prior to presentation of the learning material. A post-questionnaire will be administered after the game to determine student interest in pursuing poultry careers as well as poultry management knowledge gains. We predict that the use of a simulation game as an instructional tool will increase student retention of information as well as student interest in poultry management.

Research Mentor: Elizabeth Karcher, Animal Sciences

Poster Number: 1234 :: Life Sciences

College of Agriculture

Supplementing Beef Steers with Ruminal Bypass Arginine Improves Oxidative Stability of Aged Beef Loins

Authors:

Jacob Tuell

Hyun-Wook Kim

Juliana Guedes

Jin-Kyu Seo

Jon Schoonmaker

Abstract:

Supplementation of ruminal bypass amino acids, such as arginine (Arg) and lysine (Lys), in beef cattle rations has been suggested to improve growth performance, feed efficiency and carcass composition. However, its impacts on meat quality characteristics have not been fully investigated. Postmortem aging is widely practiced in the beef industry to improve eating quality characteristics, but extended aging period has been shown to negatively affect oxidative stability. This study was conducted to evaluate the effects of ruminal bypass Arg and Lys supplementation on meat quality and oxidative stability of beef loins (M. longissimus lumborum) under two durations of postmortem aging (14 and 28 days). Forty cattle fed four different diets for 180 days (control - basal diet; additional supplementation treatments - Arg, 10 g/day metabolizable Arg; Lys, 10 g/day metabolizable Lys; and ArgLys, 10 g/day metabolizable Arg and 10 g/day metabolizable Lys) were harvested. At 1-day postmortem, paired loins were separated, vacuum-packaged and assigned to 14 and 28 days aging at 2 °C. An increase in aging period improved instrumental tenderness values ($P < 0.05$) but negatively impacted color stability over display ($P < 0.05$). However, Arg supplementation reduced surface discoloration, maintaining higher a* values (redness) and lower hue angle (discoloration) values compared to other treatments ($P < 0.05$). An increase in total reducing activity and decrease in lipid oxidation was observed for the ArgLys treatment ($P < 0.05$). No significant supplementation impacts on pH, water-holding capacity, and shear force were found ($P > 0.05$). These findings suggest that Arg supplementation could be an effective strategy to minimize oxidative quality defects of beef loins with extended aging storage.

Research Mentor: Yuan H. Brad Kim, Animal Sciences

Poster Number: 1207 :: Life Sciences

College of Agriculture

Circadian Disruption in Transition Period Cows

Author:

Camille Vann

Abstract:

This project is focused on the transition period in dairy cows, which is the last three weeks of pregnancy and the first three weeks of lactation. During this period, cows are susceptible to metabolic diseases due to being unable to maintain homeostasis. The purpose of this research project is to monitor the circadian system during this period while under different environmental conditions. The circadian system generates circadian rhythms to coordinate internal physiology and synchronizes it with their external environment so that the animal can maintain homeostasis. We hypothesize that when the circadian system is disrupted the result will be an increase in the risk of metabolic diseases. Our objective is to measure the impact of disrupting the circadian system on physiological and behavioral circadian rhythms and to analyze the association with development of disease in dairy cattle. The circadian system will be disrupted by exposing cows to a chronic jet lag paradigm. This will be a light-dark cycle shifted every three days to mimic flying from the East Coast to Europe every three days. Behaviors that will be monitored are rest-activity, core body temperature and feed intake. Feed intake will be measured by feed refusals, rest activity will be obtained through pedometers and core body temperature will be obtained through a continuous intravaginal I-Button recorder implant. Blood samples will also be taken to measure blood glucose and ketone levels to monitor if there will be any development of ketosis during this period. Overall by using this phase shift light-dark cycle treatment we will be able to investigate the role of the circadian system in regulation of homeostasis in transition period cows. This will enable development of future studies aimed at understanding how management factors and the environment interact with the circadian system to affect animal welfare and productivity.

Research Mentor: Theresa Casey, Animal Sciences

Poster Number: 1009 :: Life Sciences

College of Agriculture

Grain Nutrient Concentration Changes Over 70 Years of Maize Hybrid Improvement

Author:

Garrett Verhagen

Abstract:

Plant breeding and management improvements in maize (Zea mays L.) production have each contributed roughly 50% to increased grain yields since the introduction of hybrids in the 1930s. Over the past 70 years, breeders have improved abiotic stress tolerance and enhanced maize responses to intensive management. Concentrations of macronutrients such as N, P, and K have generally increased in whole plants at maturity as proportional nutrient uptakes from fertilizers have increased. However, there is a lack of research establishing the relationships of modern maize hybrids to micronutrient concentrations such as copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), and zinc (Zn) in grain or stover. If relationships exist, it would fundamentally change the way breeders and managers approach future crop productivity. To answer the question: "Are higher yielding modern hybrids mining more micronutrients from the soil compared to their older counterparts?" we took grain samples from a 2017 field study of 7 maize hybrids from every decade since 1940. These hybrids were grown side-by-side at low versus high N-rate management techniques in West-Central Indiana. We analyzed grain samples for both macro- and micro-nutrient concentrations and subjected the results to statistical analyses to explore relationships of individual nutrients over time as well as macro-micronutrient interactions. The study's outcome will provide valuable information to farmers looking to replenish their soils and improve crop quality for livestock feeding purposes. The results should also assist both public and commercial plant breeders in developing new hybrids with superior nutritional quality as well as yield.

Research Mentor: Tony Vyn, Agronomy

Poster Number: 1354 :: Life Sciences

College of Agriculture

Role of Xyloglucan in the Structural Integrity of the Plant Cell Wall

Authors:

Bryce Westman

Evan Sowinski

Abstract:

Plant cell walls are structural scaffolds of cellulose microfibrils interlocked with cross-linking glycans (hemicelluloses) embedded in an independent but co-extensive pectin matrix. Xyloglucan (XyG) are the major cross-linking glycans in the primary cell wall of most angiosperms. These polymers are repeating units of cellotetraose consecutively subtended with three xylosyl residues; variants of this structure include additional combinations of subtending sugars, galactose and fucose. Xyloglucans are synthesized in the Golgi apparatus by coordinate action of a glucan synthase and xyloglucan xylosyltransferases (XXTs) that add xylose residues to the glucan backbone. Mutants of Arabidopsis thaliana lacking two genes encoding these xylosyl transferases, xxt1 and xxt2, have no detectable XyG in their cell walls. Growth and development of this mutant is remarkably normal, but etiolated hypocotyls are reported to exhibit loss of tensile strength. We have re-examined the growth and stress-strain behavior of the xxt1/xxt2 mutants compared to two other mutants with altered XyG side-group structure. In contrast to published observations, we found that the xxt1/xxt2 mutants had slightly higher tensile strengths compared to wild type, but had considerably reduced elasticity before breakage. These results indicate that XyGs add elasticity in addition to cross-linking support for strong but brittle cellulose. Currently, we are using scanning electron microscopy (SEM) to determine how these alterations in physical properties manifest themselves in hypocotyl morphology and epidermal cell shape. Methylation (linkage) analysis is also employed to determine what, if any, alternative polysaccharides might be enhanced to compensate for the lack of XyG.

Research Mentor: Nicholas Carpita, Botany and Plant Pathology

Poster Number: 1239 :: Life Sciences

College of Agriculture

Drug Repurposing in Neurodegeneration

Author:

Gabrielle Williams

Abstract:

Alzheimer's disease (AD) is a neurodegenerative disorder characterized by the accumulation of toxic amyloid beta (Aβ) plaques leading to the progressive loss of neurons. Previous studies have found increased nitric oxide (NO) production in the brain microenvironment during AD. It has also been shown that microglia, the resident macrophages of the CNS lose their capacity to phagocytose Aβ peptides during the disease. Currently, there are no therapeutic treatments or cure for AD. We hypothesize that a drug treatment with synergistic effects on enhancing microglial phagocytic capacity, reducing neurotoxicity as well as reducing microglial NO production would successfully mitigate the symptoms of AD. By utilizing a computational machine learning approach developed by our group, we have identified several compounds to target the mechanism of phagocytosis, neurotoxicity, and NO production. Human microglial clone 3 (HMC3) cells and primary rat cortical mixed neuronal cultures are used as in vitro models of AD. The NO secretion by IFN-γ-activated HMC3 cells is measured using Griess assay, microglial phagocytosis of Aβ peptides evaluated on the IncuCyte S3 platform, and neurotoxicity assessed using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay. Our preliminary data suggests that nuclear hormone receptor modulators, non-steroidal anti-inflammatory drugs, and compounds used for treatment of diabetes, rheumatoid arthritis, etc are neuroprotective as well as affect microglial NO secretion. Further studies are ongoing to find active compounds with increased accuracy. In conclusion, we propose that targeting multiple disease mechanisms has merit compared to the traditional single-target drug discovery approach for treating this devastating disease.

Research Mentor: Gaurav Chopra, Chemistry

Poster Number: 1366 :: Innovative Technology/Entrepreneurship/Design

College of Agriculture

Archaeogenomics of Old World Cotton

Authors:

Hallie Wright

Nicole Adkins

Amanda Gozner

Abstract:

With the advent of modern technologies, researchers are more readily and cost-effectively able to observe plant evolution through genome sequencing. However, charred seed specimens- dubbed the “holy grail” of biomolecular research- have had limited success due to challenges that come with aDNA sequencing. Thus, domestication and evolution of some of these plants are poorly understood. A collection of Old World cotton seeds from the Kara-tepe excavation site in Uzbekistan dated to ca. 300-500 AD were collected and underwent archaeogenomic sequencing processes. The objectives of this study were to: (1) understand how modern archaeogenomic and computational methods can be use to determine the sequences of aDNA from Old World cotton seeds, and (2) if successful in sequencing, determine the variety of the Old World cotton seeds. These findings will provide novel insights not only in identifying the specific variety of Old World cotton found at this site but will also be indicative of social change and economic stability within the human society of which these seeds were found.

Research Mentor: Elizabeth Brite, Honors College

Poster Number: 1300 :: Physical Sciences

College of Agriculture

Comparison of the Historical Soil Classification in the Public Land Survey System to Current Soil and Terrain Maps

Author:

Erica Wyss

Abstract:

The Public Land Survey System (PLSS) was developed under Thomas Jefferson with the creation of the Land Ordinance of 1785. Under the PLSS, states were divided into 6 x 6 square-mile townships, and the townships were further divided into 36 one-square mile sections. Surveyors were required to note a variety of natural features, including “the quality of the soil.” The purpose of our study was to compare the land classification in the PLSS with current soil maps to gain insights as to how concepts of soils have changed over the past 200 years. Our study area is Township 23 North, Range 5 West, 2nd Principle Meridian, which was surveyed in 1822. The area is bisected by the Wabash River and includes part of Purdue University, West Lafayette campus. The original field notes and plat were downloaded from the Tippecanoe County Surveyors Office website. We georeferenced the plat map from the original survey to the modern-day PLSS grid available from IndianaMap.org using ArcGIS Pro version 2.0. We read the narrative descriptions given in the original survey notes, extracted the land classifications and added them to our GIS dataset. The land was characterized as first rate, second rate, or third rate, and then also by the any notable geographic characteristics such as whether the land was under prairie or forest, and whether it was flat, rolling, or broken. We then compared the PLSS soil rating to modern soil maps available on the SoilExplorer.net website.

Research Mentor: Darrell G. Schulze, Agronomy

Poster Number: 1194 :: Life Sciences

College of Agriculture

Listeria monocytogenes virulence genes are upregulated in multispecies biofilm with Staphylococcus aureus

Authors:

Luping Xu

Abstract:

Listeria monocytogenes is a foodborne pathogen causing a life-threatening infection. The common coexisting pathogen found with Listeria spp. is Staphylococcus, especially on dairy farms. Staphylococcus aureus is responsible for mastitis in cow and could contaminate milk by producing heat-resistant toxins. Although the molecular mechanism of pathogenicity of both pathogens is well understood, the knowledge about the pathogens interaction in a multispecies biofilm and their pathogenic attributes during biofilm formation are poorly understood. Therefore, the objective of this study is to understand the change of Listeria virulence factors during a multispecies biofilm formation with S. aureus. Two strong biofilm-forming S. aureus strains were selected for co-culture experiment with L. monocytogenes. The results showed that the viable cell counts of L. monocytogenes, a weak biofilm former, in mixed biofilm with S. aureus significantly increased compared to its monoculture biofilm, suggesting the biofilm formation of L. monocytogenes probably was stimulated by S. aureus or they can colonize in the extracellular polymeric substances produced by S. aureus. Meanwhile, the cell counts of S. aureus, a strong biofilm former, decreased significantly in mixed biofilm compared to the monoculture biofilm. In order to compare the virulence potential of L. monocytogenes from mono- or mixed-culture biofilm, the expression of main virulence factors (LAP, InlA, and InlB) responsible for infecting human intestinal epithelial cells was examined using Western blot. It turned out that all the factors were upgraded in the mixed culture biofilm. Overall, these results suggest a complex interaction dynamics exist in the biofilm formed by the two pathogens, and L. monocytogenes from mixed biofilm may have the stronger capability of infecting into human intestinal cells and cause infection.

Research Mentor: Xingjian Bai, Food Science

Poster Number: 1028 :: Life Sciences

College of Agriculture

In Vitro Maturation of Porcine Oocytes in Different Media

Authors:

Madison Zartman

Natalie Ehmke

Zoltan Machaty

Abstract:

A great number of assisted reproductive technologies require oocytes matured in vitro. Such oocytes can be used not only for research purposes but also, for the production of offspring in breeding programs. Maturation is a physiological event, which in the laboratory involves the incubation of immature oocytes (that are arrested at prophase of their first meiotic division) in specifically formulated culture media. During the process, they resume meiosis and reach second metaphase, the stage when they can be fertilized. In the present study, we evaluated whether three cytokines added to a chemically-defined maturation medium used routinely in our laboratory can improve the efficiency of in vitro maturation of pig oocytes. Immature pig oocytes were collected from ovaries of prepubertal gilts (a generous donation from Indiana Packers Corporation, Delphi, IN) and placed, in groups of 50, into two different kinds of media for maturation. Half of the oocytes were matured in aTCM-199-based medium; the other half of the oocytes were cultured in the same medium supplemented with fibroblast growth factor 2 (FGF2, 40 ng/mL), leukemia inhibitory factor (LIF; 20 ng/mL), and insulin-like growth factor 1 (IGF1; 20 ng/mL). Following 44 hours of incubation at 39oC under 5% CO2 in air with 100% humidity, the oocytes were denuded of the surrounding cumulus cells by vigorous vortexing in the presence of 1 mg/ml hyaluronidase. They were then examined under a microscope and the number as well as percentage of oocytes with an extruded first polar body (a sign of nuclear maturation) was recorded. The experiment was done in 11 replications; the data were analyzed by chi-square analysis. We found that in the traditional maturation medium, 67.2% of the oocytes (388 out of 577) reached the second metaphase stage and extruded their first polar bodies. On the other hand, 83.3% of the oocytes (581 out of 697) in the cytokine-supplemented medium completed nuclear maturation successfully; the difference between the two groups is statistically significant ($p<0.05$). Our results support earlier findings, which suggested that supplementation of the maturation medium with cytokines is beneficial for porcine oocytes and should be used to improve the efficiency of assisted reproductive technologies.

Research Mentor: Zoltan Machaty, Animal Sciences

Poster Number: 1012 :: Mathematical/Computational Sciences

College of Agriculture

Improving the Accuracy of the Long-Term Hydrologic Impact Assessment (L-THIA) Model

Author:

Anqi Zhang

Abstract:

Urbanization increases runoff by changing land use types from less impervious to impervious covers. To mitigate the stormwater issue from these impervious surfaces, Low-Impact Development (LID) practices are applied and runoff assessment models are used to evaluate expected runoff and the impact of these practices. Improving the accuracy of a runoff assessment model, the Long-Term Hydrologic Impact Assessment (L-THIA) model, can help us to better evaluate the potential uses of LID practices, as well as to identify appropriate runoff and water quality mitigation methods. Several versions of the model have been built over time, and inconsistencies have been introduced between the models. To improve the accuracy and consistency of the model, the equations and parameters (primarily curve numbers (CNs) in the case of this model) were reviewed and documented. Two methods were pursued to conduct this work. First, CNs used in the current L-THIA model and related papers were identified and summarized. Second, the spreadsheet and code of this model were reviewed to improve the logic in the L-THIA model. A new Curve Number spreadsheet was built to summarize the CNs with clear descriptions. The values of the CNs remained the same in the model. Improved logic in combining curve numbers was added to the model, while ambiguous code in the model was fixed. In conclusion, the accuracy and consistency of the L-THIA model were improved by validating the curve numbers and better defining the code logic. Further tests are needed to examine the updated version of the L-THIA model.

Research Mentor: Bernard Engel, Agricultural & Biological Engineering

Poster Number: 1155 :: Life Sciences

College of Agriculture

Atmospheric Cold Plasma Caused Structure Alternation and Chemical Modification of Bovine Serum Albumin

Authors:

Chumin Zhang

Lei Xu

Bernard Tao

Abstract:

The objective of this study was to investigate the types and degrees of protein modification under diverse atmospheric cold plasma conditions, which will subsequently apply into food industries about enzyme inactivation, bioactive protein protection, and artificial protein modification. The 50 mg/mL bovine serum albumin solutions were prepared in 10 mM phosphate-buffered saline and Milli-Q water as solvents. The bovine serum albumin powders were prepared by freeze dry. The atmospheric cold plasma conditions include post treatment in modified air, atmospheric cold plasma treatment periods and direct or indirect atmospheric cold plasma treatment. To study the secondary structure alternations, the treated samples were characterized by Circular Dichroism (CD). Chemical modifications of bovine serum albumin were studied using Fourier Transform Infrared Spectroscopy (FTIR). Aromatic amino acids (Phenylalanine and Tyrosine) were characterized by FT- Raman. The alpha helix of BSA protein decreased by the maximum number 27% and beta sheet, beta turn and random structures were changed based on processing conditions. Based on data of FTIR and FT-Raman, the environment of S=O, NH3+, Phenylalanine and Tyrosine were changed and the degree of alternations depended on specific processing conditions.

This indicates that atmospheric cold plasma has effect on bovine serum albumin, and the specific processing conditions owns various degree of influences.

Research Mentor: Bernard Tao, Agricultural & Biological Engineering and Food Science

Poster Number: 2340 :: Social Sciences/Humanities

College of Education

Language and Number: Students' Interpretations of "Less Low"

Author:

Maya Cameron

Abstract:

When making comparisons with objects, young children have an easier time interpreting positive terms (e.g., higher, more) as opposed to negative terms (e.g., lower, less). However, when asked to compare positive and negative numbers, children will often rely on absolute value. Yet, when comparing several negative temperatures, second and fifth graders were better able to determine which was least cold (a compound negative term) than when comparing positive temperatures. In this project, we explored second and fifth graders interpretations of the comparison language “less low” with and without the support of positive and negative numbers before and after an intervention focused on interpreting language such as “less negative.” The problems we focused on in this analysis involved pictures of two cats on a staircase. The cats were placed on different steps in each problem (both low, both high, or split high and low on the staircase). We asked them to identify which cat was less low in each picture. The correct answer was the higher of the two cats because that is the less low of the two. Of the pictures, the first three involved unlabeled stairs and the last three had positive and negative number labels under the stairs (as in a number line). Some students changed their pattern of responses when they encountered the numbered staircase. We discuss their pretest and posttest responses and the meaning they gave to the term "less low." The interviews of the students revealed interesting usage of language.

Research Mentors: Laura Bofferding, Curriculum and Instruction; Mahtob Aqazade, Curriculum and Instruction

Poster Number: 3264 :: Physical Sciences

College of Engineering

Effects of Viscoelasticity and Temperature on the Operation of Delay Based Vibration Absorber

Author:

Abhishek Ajmani

Abstract:

Every structure vibrates when struck by an external force. The extent of the vibrations not only depends on the type, magnitude, and the frequency of exciting force, but also depends on the structural characteristics. For most systems, even little vibrations can be unpleasant (for instance, a skyscraper swaying in the wind). This research is based on a novel device known as the delayed resonator (vibration absorber) which can be attached to absorb the vibrations from a vibrating structure. Firstly, a mathematical model is developed that represents the system's dynamics as well as the structures' viscoelasticity (exhibiting both viscous and elastic properties). The model is then analyzed to study the control parameters that would engender stability. The research will further show how the stability regions heavily depend upon temperature since in the real world, the system is exposed to different temperature gradients. These stability analyses will provide the optimal set of control parameters for the delayed resonator to operate most efficiently, and various experiments will be conducted in the lab to validate the theoretical results. The resulting stability charts can then be used to tune the delayed resonator, which would enable it, unlike conventional vibration absorbers, to completely eliminate a broad range of vibrations in real time. The results will have the practical implications of improving the safety of a given structure.

Research Mentor: James Gibert, Mechanical Engineering

Poster Number: 3311 :: Mathematical/Computational Sciences

College of Engineering

Lockheed Martin Company (LMC) Integrated Air and Missile Defense Modeling

Author:

Yahia Aly

Abstract:

A significant issue in developing missile simulations is the great variability between model and realistic implementations. Furthermore, there is a great deal of interactions between different aspects of the system. The objective is to develop a flexible, scalable model to optimize IAMD architectures. IAMDs are integration of all sensors and weapons with a missile command in a missile theater. We also aim to identify optimal configuration systems for a representative, medium-range IAMD scenario. This is achieved by creating medium-fidelity models for constituent systems in DAF and characterizing the design and performance space, and developing metrics to identify the high-performing architectures. The research has been successful in developing medium fidelity models to simulate sensors and inter-relation between different missile systems.

Research Mentor: Dan Delaurentis, Aeronautics and Astronautics

Poster Number: 3242:: Life Sciences

College of Engineering

Discovery and Sequencing of Mycobacteriophage

Authors:

Jamie Arabshahi

Ashley Otero

Janice Chan

Elena Haskins

Abstract:

As a part of the HHMI Sea Phage Project, environmental samples of mycobacteriophage are being taken worldwide to sequence their genomes and learn more about their capability for medical therapy in substitution of antibiotics. One of the bacteria mycobacteriophage target and infect, is mycobacterium tuberculosis, which infects 10.4 million and kills roughly 1.7 million people per year. In addition, it has developed deadly strains of antibiotic resistance. To find bacteriophage, soil samples are collected from the environment, and the bacteriophage are purified and amplified before being added to the Sea Phage Database. To estimate genes, programs such as DNA Master, Phamerator, Starterator, BLAST, and GeneMark use information such as coding potential, similarity to other genomes, and ribosome binding sites. Using the information of how mycobacteriophage target mycobacterium could lead to new treatment methods for bacterial based infections.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 3279 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Do the Frame-of-Reference and Video-Based Training have Effect on the Quality of Peer Ratings in Teams?

Author:

Natalia Bak

Abstract:

The ability to work in teams is crucial for engineers and often being considered during the hiring process. Many U.S. undergraduate programs introduce team-based courses to help students prepare for their future careers.

Teamwork skills in our study are defined as the dimensions of teamwork measured by the CATME Peer Evaluation system, currently in use by over 8,000 instructors, across multiple disciplines, in over 2,000 institutions worldwide. The CATME teamwork dimensions are defined in 5 categories:

• Having relevant knowledge, skills or attributes (KSAs) refers to the base knowledge of individual team members

• Contributing to the team’s work is being able to add value to your team’s work/project

• Interacting with teammates refers to the way individuals communicate within their teams

• Keeping the team on track is similar to being a timekeeper

• Expecting quality is taking expectations to the next level and working collaboratively to produce the best possible team outcomes

The CATME (Comprehensive Assessment of Team-Member Effectiveness) application guides students in rating their peers on teamwork performances. The aim of this research analysis is to measure the difference in the quality of their peer ratings and determine whether proven training methods – Frame of Reference Training and Video Training modules improve the rating behavior of first-year engineering students. Data used for the analysis will incorporate students in teams from introduction to engineering courses, using data from evaluations before and after an intervention. The analysis efforts are a work-in-progress to which multiple students have contributed to. We expect that both the training methods will improve the dispersion of ratings across the CATME teamwork dimensions and the convergence of ratings between self and peers over multiple ratings.

Research Mentor: Daniel Ferguson, Engineering Education

Poster Number: 3244 :: Mathematical/Computational Sciences

College of Engineering

Parametric Sensitivity Analysis of a Coastal Louisiana Flood Risk Model

Authors:

Jackson Ball

Mikaela Meyer

Baylee Bunce

Abstract:

Many factors introduce uncertainty into any effort to quantify the risk posed by rare events such as coastal storm surge. Although several of these uncertainties are unavoidable, others could be reduced through data collection or by addressing them with different statistical methods. This study aimed to identify the major drivers of uncertainty in flood risk estimates produced by an existing model of current and future flood depths in Louisiana. The model has been used for Louisiana’s coastal master planning process, but policy makers do not know what factors introduce the most uncertainty into risk estimates, or the sensitivity of flood depth predictions to these parameters. Using the one-at-a-time method for sensitivity analysis, five different variables were tested to determine the degree to which each affects the estimated flood depths. The tested parameters were variability in the rate at which levee overtopping occurs, the frequency and mean intensity of storms, noise in LiDAR measurements of ground elevations, and the standard error of predictions of surge and wave data. Default values were selected as base cases for each variable and run through the model, then a range of values for each variable was tested while holding the rest at their base levels. The range tested for each variable was decided upon by using either reasonable assumptions or research-based predictions about future conditions. The confidence intervals of 100-year flood depths for each possible combination of parameter values will be compared to assess how the model responds to the various uncertainties. Identifying the contribution of each parameter to uncertainty will help identify potential improvements to the model, such as immediate data collection needs.

Research Mentor: David Johnson, Industrial Engineering

Poster Number: 3243 :: Social Sciences/Humanities

College of Engineering

Comprehending Mathematical and Design Thinking Usage Across Differing Educational Backgrounds

Author:

Zachary Beyer

Abstract:

Within the ever-changing landscape of engineering, engineers who are not only able to deal with uncertainty, but excel at complex and unknown challenges will only become more vital. At the heart of this adaptability lie mathematical and design thinking. While both are essential processes for an engineer, these concepts are rarely taught concurrently in classrooms. Discovering how students utilize both types of thinking could help educators find ways to better students' understanding of engineering concepts, allowing students to apply them in practice more naturally.

While previous research explored the differences between the design processes of practicing engineers and engineering students, this study sought to discover how students internalize and use both mathematical and design thinking based on their educational background. Students in engineering (n=18), mathematical (n=12), and design (n=9) majors were asked to work independently on a design task. Throughout the design task, the participants used a think aloud protocol, allowing for their thought processes to be captured for later reference. Video data was used to collect these thought processes, allowing for a unique analysis that sought to discover the interplay between mathematical and design thinking. As a result of this analysis, educators have the possibility of being better equipped to teach these complex processes to students, allowing students to better engage in these crucial thought processes. Some preliminary findings indicate that the engineering group is the most varied, with some students exhibiting processes that are heavily favored towards mathematical or design thinking. The variability within engineering students needs to be further analyzed in order to solidify these findings.

Research Mentor: Monica Cardella, Engineering Education

Poster Number: 3371 :: Physical Sciences

College of Engineering

Characterization of Near-Congruent Copper-Manganese Alloys with Carbon Additions

Authors:

Matthew Binkley

Samuel Inman

Abstract:

Leaded brasses have been utilized in many applications ranging from water piping to solid lubricated bearings. The copper-manganese (CuMn) alloy based around the congruent point of the phase diagram may have properties that allow this alloy to replace leaded brasses in various applications to reduce the amount of lead introduced to the environment. Microstructure development in casting of CuMn alloys based on the congruent point at 34.6 wt pct Mn and 1146 K (873 °C) with added carbon was investigated. The alloys were prepared by induction melting of Cu wire and electrolytic Mn in a silicon-carbide crucible in open air. Carbon was introduced into the system by floating graphite blocks of varying sizes on the molten alloy. Under conventional casting conditions, the effect of carbon on the microstructure formed during solidification was investigated. The formation of Mn7C3 particles was investigated, as well as potential pure graphite inclusions. The ratio and sizes of the various carbon impurities were observed to understand the full impact of the different phases created. Microstructure development of the alloy was analyzed based on available thermochemical data. Hardness and tensile testing allow for characterization of the effect of C on the base alloy system.

Research Mentor: Kevin Trumble, Materials Engineering

Poster Number: 3045 :: Social Sciences/Humanities

College of Engineering

On the Banks of the Wabash with Paul Dresser

Author:

Lillian Bishop

Abstract:

The Wabash River is Indiana's bridge to the past, and few things make that more apparent than the study of how Indiana's state song, "On the Banks of the Wabash, Far Away", came to be. Written by Terre Haute native Paul Dresser, the song from the Tin Pan Alley school of music became a cultural phenomenon, perfectly encapsulating the nostalgic feelings of Americans at the time. An analysis and categorization of Tin Pan Alley's greatest hits with the help of primary sources allows us to take a deeper look into Dresser's life, as well as the lives of other Tin Pan Alley songwriters like him, to ultimately reveal the origins of this American nostalgia. Dresser's celebrity was cemented when his song became the state song of Indiana in 1913, but the real celebrity was the Wabash River, which was granted a legacy as Indiana's iconic and beloved river.

Despite a controversial history steeped with accusations of plagiarism from Dresser's own brother, "On the Banks of the Wabash" has helped to give the Wabash River a positive connotation in the eyes of Hoosiers everywhere. A second controversy involving copywrite infringement from the better-known song, "(Back Home Again In) Indiana", a piece of music made famous by the Indianapolis 500 and Purdue's own All American Marching Band, uncovers how Dresser's song lives on in a different form. The implications of the public's positive perception of the Wabash cannot be overstated; as the years go by, the banks of the Wabash River are filling with memorials to Dresser, and speak volumes to his impact on the state. Modern news sources provide valuable insight regarding Dresser's impact on civic perception of the Wabash River, as well as efforts to restore the river to its former state.

Research Mentor: Lisa Welp-Smith, Earth, Atmospheric, and Planetary Sciences

Poster Number: 3297 :: Social Sciences/Humanities

College of Engineering

Evaluating Recycling Within Greek and Cooperative Houses

Authors:

Dylan Buechler

Andrew Huang

Michelle Bischoff

Clare Schroeder

Diana DiPretoro

Christopher Arnold

Hillary Vbra

Michal Chrapek

Kobe Richardson

Abstract:

Previous iterations of Purdue's Campus Master Plans have not included sustainable development within the Purdue Greek and Cooperative Life Community, which neglects sustainable development goals for approximately 6000 undergraduates at Purdue. This study is focused on establishing baselines for successful sustainable development programs in the Fraternity, Sorority, and Cooperative Life Houses. One of the key metrics being investigated is the adoption rate and perception of recycling programs within shared community spaces. We hypothesize that convenience (e.g., distance to recycling drop off points) and economic perceptions are the primary drivers impacting individual sustainable practices and broader implementation within Fraternity, Sorority, and Cooperative Life housing. This study will gather information on the successful implementation of existing programs and identify challenges and barriers to those without recycling initiatives. An educational targeted campaign will be implemented within houses. Electronic surveys will be conducted to identify and assess: (1) factors that influence diversion rates; (2) perceived barriers and challenges to implementing recycling programs, and (3) the impact of the educational campaign (i.e., to gauge changing attitudes). In focusing on Fraternity, Sorority, and Cooperative Life students, we hope to utilize this information to implement long-term sustainable practices that will encompass the entirety of Purdue's undergraduate community.

Research Mentor: Michael Mashtare Jr., Agronomy and Environmental & Ecological Engineering

Poster Number: 3235 :: Physical Sciences

College of Engineering

Investigation of Thermal Interface Material Ingress into Silicon Vias

Authors:

Mallory Capestrain

Natalie Burgos

Christine Neudeck

Karyn Hobson

Abstract:

Silicon photonic chips that are being utilized by Juniper Networks have a thermal interface material (TIM) applied to their (non-active) backsides to aid in heat dissipation. However, the non-active side contains circular and rectangular trenches. There is concern that the ceramic-loaded polymer TIM ingresses into the backside trenches and will affect device operation and lifetime. In this project, TIM was applied to silicon chips provided by Juniper Networks, compressed to mimic the actual device assembly, subjected to accelerated testing, and then measured for possible ingress. The two accelerated testing techniques used for the chip assembly were thermal cycling and high temperature storage. During high temperature storage testing, two clamps were placed into the furnace at 150°C. One clamp containing four chips, was removed every 500 hours. After their removal from the furnace, any potential TIM ingress into the circular trenches was determined using an optical profilometer. For thermal cycling five clamps with four chips each will be placed into the furnace and cycle through a temperature range from 0-118°C for 500 cycles. One clamp was removed every 100 cycles for optical profilometry to see if the TIM had ingressed into the circular vias. TIM ingressed through the silicon vias after both high temperature storage and thermal cycling.

Research Mentor: Carol Handwerker, Materials Engineering

Poster Number: 3188 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Foraging Optimization using Deep Reinforcement Learning

Author:

Wentao Chen

Abstract:

The widespread usage of intelligent devices that autonomously forages objects in our daily life, such as robots and mechanical arms, leads to the demand of actively operating the intelligent devices in order to optimize the working efficiency of the device and avoid crashing. Today there are unprecedented high volume of data available for this optimization process. In this research, we explore the benefit of regulating intelligent devices using Deep Reinforcement Learning, a hybrid algorithm that uses reinforcement learning and deep learning (neural network). Deep Q-network and policy gradients are the strategies experimented with online data available from the device monitoring system. The Deep Q – network establishes a reward table (Q table) using neural network and generates the optimal solution that yields the best reward, which is the minimal loss of energy (and time) in this research. The results will be validated in terms of execution time and prediction accuracy. This model of deep reinforcement learning can be applied to smart device management and is helpful for energy conservation and safety improvement.

Research Mentor: Guang Lin, Mechanical Engineering and Mathematics

Poster Number: 3196 :: Life Sciences

College of Engineering

Resistance of Yale ES2 and abnormal trichome of Arabidopsis

Author:

Cecilia Chiu

Abstract:

The purpose of this research is to identify the relation of abnormal trichomes and the resistance of Yele ES2. Trichomes of Arabidopsis are unicellular epidermal cells, which provide protection for the plant from UV light and water loss. Yale Endosidin2 (Yale ES2) is a small molecule to block the trafficking proteins in plants that are recycled between the plasma membrane and endosomes. Researchers conducted experiments through sowing Arabidopsis seeds on petri dish containing Murashige and Skoog medium with the concentration of 5 micromoles per liter Yale ES2. The results from the experiments indicated that Arabidopsis seeds grown on media containing Yale ES2 had shorter and fewer root hairs. A number of Arabidopsis seedlings which displayed resistance in Yale ES2 were found to have abnormal trichomes on their leaves. The abnormal trichomes on Arabidopsis seedlings appeared to have branches that were curled and fewer in number when compared to the normal trichomes that grew straight and always with three branches. Further experimentation on the relation between abnormal trichomes and resistance to Yale ES2 are currently underway.

Research Mentor: Chunhua Zhang, Plant Pathology

Poster Number: 3102 :: Physical Sciences

College of Engineering

Fracture Mechanics in Nonwoven Fibers

Author:

Sean Conaway

Abstract:

This study focuses on failure in nonwoven fiber materials subjected to uniaxial tension. Nonwoven fiber materials are typified by non-affine clusters of fibers bonded to each other via a resin or thermal fusion bond, similar to how amorphous polymers are bonded. We hypothesize that for such materials the tearing process under an applied mechanical load is distinctly different from that in a homogeneous sheet material. Experiments conducted in this study consider Center-Crack-Tension (CCT) and Double-Edge-Notch-Tension (DENT) coupons of varying sizes extracted from single layered fiberglass tissue. Digital Image Correlation software was used to relate the overall applied displacement to localized displacements in the material. Results indicate that by introducing a crack prior to loading, the material will become stiffer and withstand a higher load before failure. This is in contrast to conventional homogeneous solids. Through the Digital Image Correlation, a pattern of fiber alignment is observed, propagating diagonally from the crack tip. The failure analysis of the samples revealed that all samples failed due to the bond between fibers breaking rather than individual fibers fracturing. So far, specimens with only small crack sizes have been tested; larger crack sizes with varying geometry will be tested in the future to determine if any size effect exists that increases or decreases the effectiveness of the cracks in strengthening or toughening the nonwoven fiber material.

Research Mentor: Thomas Siegmund, Mechanical Engineering

Poster Number: 3108 :: Mathematical/Computational Sciences

College of Engineering

Variational Methods Applied to Crossed Field Devices

Author:

Adam Darr

Abstract:

Cylindrical magnetrons are well known crossed-field devices for magnetrons and amplifiers (CFA). Recent studies showing that recirculating cylindrical magnetrons yield higher currents, faster heat dissipation, and more favorable magnetic field scaling have motivated the design and development of recirculating planar crossed field amplifiers (RPCFAs). This growing interest in CFA simulation and design motivates the extension of previous one-dimensional models for crossed field flow. These models showed that electron trajectories universally collapsed to a Brillouin flow with slight perturbations, including external resistance and magnetic field misalignment. This paper will explore the application of variational calculus, which has previously been applied to generalize the Child-Langmuir law, to the characterizing the physics of turbulence in the crossed-field geometry. We will further present preliminary calculations applying this technique to non-uniform electrodes, such as those exhibiting surface roughness. Relevance to experiments and potential extensions of this approach to external perturbations and multiple dimensions will be discussed.

Research Mentor: Allen Garner, Nuclear Engineering

Poster Number: 3302 :: Physical Sciences

College of Engineering

Mechanical and Chemical Analysis of Cured in Place Pipe for Water Infrastructure

Author:

Kayli DeCocker

Abstract:

Cured-in-place pipe (CIPP) is a trenchless technology used to repair old and deteriorating underground pipes by installing and curing a fabric, resin-impregnated liner. Steam, hot water, and ultraviolet (UV) radiation are common ways used to cure the liner. Previous studies have found styrene and other various compounds in the condensed steam or water from CIPP installations sites. Our objective for this study was to analyze the thermo-mechanical performance of CIPP lining as a function of curing conditions. The uncured CIPP material contains styrene monomer, an anticipated human carcinogen, along with other organic compounds which have been identified using nuclear magnetic resonance (NMR) analysis. Thermal properties of the liner were characterized by using differential scanning calorimetry (DSC). Physical properties such as porosity, density, and potential degradation under water/solvent conditioning were also investigated. Significant differences between the inner and outer layers of the lining were observed indicating that thermal history of the material directly impacts final material properties.

Research Mentor: John Howarter, Materials Engineering

Poster Number: 3277:: Physical Sciences

College of Engineering

Reconstruction and Segmentation of X-ray Computed Tomography Data for the Investigation of Fatigue Crack Growth

Author:

Rachel Delmontagne

Abstract:

Aluminum alloys are common in aerospace applications, in which fatigue is a primary failure mechanism. Constituent particles in aluminum alloys affect the materials' fatigue damage. Hence, it is important to understand the relationship between these constituent particles and cracking in order to contribute to the safety and longevity of systems. X-ray synchrotron computed tomography, a nondestructive method that uses imaging technology to scan a test specimen, was used to obtain data sets of in situ fatigue crack propagation in aluminum alloy 7050-T7541 samples. The purpose of this research is to reconstruct tomography datasets of AA7050-T7541 to allow for analysis of the interaction between the crack front and the constituent particles at the mesoscale. This research involved reconstruction of the tomographic data, thresholding, and segmentation on the full 3D characterizations in order to perform the necessary data mining to enable further analysis of fatigue crack growth. By creating an accurate and repeatable process for reconstructing the data and processing the results, further investigation can be done to analyze the crack deflections due to the constituent particles in the material.

Research Mentor: Michael D. Sangid, Aeronautics and Astronautics

Poster Number: 3056 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Analysis of the Relationship Between Aircraft Departure Delays and Regional Weather Patterns

Author:

Sydney Dolan

Abstract:

The purpose of this research is to analyze the relationship between flight departure delays and weather patterns in order to develop a greater understanding of the factors behind flight delays. The factors analyzed include type of weather pattern, airport, carrier, and day. Due to the large quantity of data, the data set chosen for this study was all flights from the top 35 U.S. airports in January 2017. Data for this study was taken from the Department of Transportation, and the National Oceanic and Atmospheric Administration. The study developed a probability model to calculate the likelihood of delay for the airport based on a given day. Additionally, the study analyzed the rates of delay between airports, to test the hypothesis that increased delays from one airport will result in more delays at other airports. The results of this analysis can be used to help the FAA understand some of the factors that affect flight delays, which can help them accommodate more flights without sacrificing passenger safety.

Research Mentor: Dengfeng Sun, Aeronautics and Astronautics

Poster Number: 3222:: Physical Sciences

College of Engineering

Enhanced n-type behavior in Black Phosphorus (BP) FETs

Authors:

Yuqin Duan

Adam Charnas

Peide Ye

Abstract:

Black phosphorus (BP) is a 2D semiconducting material with native p-type doping due to phosphorus oxidation states near its valence band edge. With a high carrier mobility up to 10000 cm2/V and a ~0.3 eV direct band gap, BP acts as a good channel material for p-MOSFETs. However, how to dope BP becoming n-type remains a challenge. To address this issue, an Al2O3 layer is applied on top of BP by Atomic Layer Deposition (ALD). Due to the positive fix charges in the Al2O3 layer, the BP channel is n-type doped and BP FETs with ALD Al2O3 show enhanced n-branch in ambipolar characteristics.

Poster Number: 3131 :: Life Sciences

College of Engineering

Abuse Deterrent Formulation of Opioids

Authors:

Chiebuka Egwuonwu

Daniel Smith

Abstract:

The goal of the abuser is to alter the opioid dosage from such that it provides a plasma concentration that is sufficient to induce euphoria. The abuse-deterrent dosage form is designed to minimize the feeling of euphoria when taken as prescribed by a patient, i.e. when using the medication as intended. However, a prescription drug abuser would try to modify the dosage form in a manner to increase the plasma concentration to a level that would induce euphoria. They can achieve this by increasing the rate of drug uptake. For example, they could crush a controlled release tablet, which would induce dose dumping when swallowed. They could change the route of administration. For example the abuser could crush a tablet and then try and inject or snort the contents of the crushed tablet. Thus, abuse deterrent formulations are investigated to identify the failure modes. This knowledge will lead to second-generation formulations that are even more difficult to abuse than those currently on the market.

Research Mentor: Stephen Byrn, Industrial and Physical Pharmacy

Poster Number: 3225 :: Physical Sciences

College of Engineering

Intermetallic Growth in Transient Liquid Phase Bonding

Author:

Salma El-Azab

Abstract:

Transient Liquid Phase Bonding (TLPB) is a method for joining metal interfaces that utilizes the formation of intermetallic compounds (IMCs) through the reaction of a low melting temperature phase with a high melting temperature phase. The resulting IMC's in Cu-Sn and Ag-Sn are known to have higher melting temperatures than the initial low-melting temperature component, Sn. Due to its high re-melt temperature, TLPB may be used as an alternative to high-Pb, lead-containing solders, sintered Ag, or Ag pastes in electronics applications. It has been observed that TLPB occurs rapidly when silver-copper eutectic reacts with Sn-rich alloys. To characterize the growth rates of IMCs for silver-copper TLPB, copper-rich silver-copper substrates were reacted with liquid SAC305 (96.5% tin, 3% silver, and .5% copper) at three different temperatures (260 °C, 300 °C, and 340 °C) and at four different time intervals per temperature (20 minutes, 30 minutes, 40 minutes, and 1 hour). Polished cross-sections of the reaction couples were investigated using optical and SEM imaging. Cu6Sn5, Cu3Sn, and Ag3Sn were found to have formed at the interface. The relative areas of each phase were measured to assess the rate of IMC formation.

Research Mentor: Carol Handwerker, Materials Engineering

Poster Number: 3200 :: Physical Sciences

College of Engineering

Three-Dimensional Analysis of Fission Gas Bubbles in Irradiated U-Mo Fuel

Author:

Alejandro Figueroa

Abstract:

The goal of the Reduced Enrichment for Research Reactors program led by the US Department of Energy is to reduce the use of high enriched uranium in research and test reactors to low enriched uranium (LEU) for civilian applications worldwide, therefore increasing safety and reducing diversion. The post irradiation characterization of LEU candidate fuels is used to understand the microstructure development of a fuel during irradiation. This will allow for a more accurate assessment of the LEU fuel candidate. High energy X-ray synchrotron micro-computed tomography was used to determine the three-dimensional (3-D) morphology of the U-Mo fuel, Zr diffusion barrier, and the U-Mo/Zr interaction layer. Fission gas bubble build up was assessed in the three regions. Morphology size, and quantity of the fission gas bubbles were determined using 3-D microstructure analysis techniques. An understanding of the fission gas bubble behavior in the fuel is essential to the qualification of the material due to the potential of inter-connected fission gas porosity to decrease the structural stability of the fuel. The formation and expansion of fission gas bubbles in the fuel can cause a variety of issues in the fuel such as fuel swelling, cracking, and escape of fission gasses to the coolant. By conducting synchrotron µCT of the irradiated U-Mo fuel plate, a better understanding of the 3-D behavior of the fuel in a reactor can be assessed.

Research Mentor: Maria Okuniewski, Materials Engineering

Poster Number: 3152 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

The variation in the properties of 3D-printed polymer materials.

Author(s):

Kumansh Furia

Abstract:

This research assesses the variation in the properties of 3D-printed polymer materials. The objective of this effort is to evaluate the effects of cross sectional dimensions on mechanical strength and hardness of PLA, HIPS, and ABS specimens. The specimens correspond to the required flat dog bone dimensions specified by ASTM D638-14 TYPE I. The hardness tests complied with Shore Durometer of ASTM D2240-15e1 using the type A and type D scales. Thickness and width measurements at three consistent locations on each of the specimens were used to calculate three cross sectional areas per specimen. The ultimate strength was determined based on the ratio of maximum tensile load to the cross-sectional area at each of the three spots. This gave a range of values for the ultimate mechanical strength of each material. Hardness data was compared to thickness at each measurement location. Variability conclusions drawn from patterns deduced from the correlation of Ultimate strength with cross-sectional area and Shore Durometer Hardness with thickness for each specimen of each material will be presented.

Research Mentor: Nancy L Denton, Mechanical Engineering Technology

Poster Number: 3306 :: Life Sciences

College of Engineering

Pulsed Electric Field Treatment of Microalgae for Enhanced Lipid Production

Authors:

Caleb Geissler

Mary Mulligan

Zane Zmola

Abstract:

Providing clean and sustainable sources of fuels and chemicals to bridge the growing gap between energy consumption and the depletion of fossil fuel reserves remains a major challenge. Biofuels have great potential for the transportation sector, as demonstrated by the implementation of bio-ethanol in various regions of the world. In comparison with cellulosic biomass, algal cells accumulate lipids that can be used to produce biodiesel fuel with higher energy density than bio-ethanol. Additionally, algae can grow on non-arable lands, so they do not compete with the food supply.

Currently, biodiesel fuel from algae is more expensive than standard gasoline, with lipid extraction, usually accomplished with solvents, driving the cost. More lipids can be extracted by applying pulsed electric fields (PEFs) to the algae before solvent extraction, which can reduce the overall cost.

We assessed the impact of applying 10, 50, 100, 200, and 300 60ns, 60 kV/cm pulses on lipid yield. Nanosecond PEFs increased lipid yield for 10, 50, and 100 pulses, with a 19.2% increase in lipid yield for 100 pulses, while 200 and 300 pulses decreased lipid extraction. These results will be compared to microsecond PEFs with equivalent total energy. Further optimization of PEF treatment parameters could benefit industrial biodiesel production.

Research Mentor: Allen Garner, Nuclear Engineering

Poster Number: 3338 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Assessment of Complex Systems Through Network Integration

Author:

Sarafina Gonzalez

Abstract:

The purpose of this project is to explore how different methods of assessing a complex system can tell you different, unique qualities of a network. A complex system can be anything from the brain to a map of highways and their traffic, but this study specifically explores a system of common nouns and adjectives used in the book David Copperfield. The main method used to evaluate the complex network is integration which explores shortest-path length, shortest-path edges, and search information. Through these methods, we are able to infer qualities of the authors writing style.

Research Mentor: Joaquin Goni, Idustrial Egineering

Poster Number: 3250 :: Life Sciences

College of Engineering

Phage Discovery and Genome Characterization

Authors:

Jenna Greene

Chin Fang Lin

Violet Kuchta

Ha Rim Ku

Abstract:

There are approximately 1031 bacteriophages on Earth. With this vast number comes unanswered questions regarding phage proteins and gene functions. The answers to these questions have the potential to progress medical, agricultural, and pharmaceutical research. Research over two semesters focused on isolating bacteriophage and analyzing the bacteriophage genome. Soil samples were collected in order to detect, isolate, and amplify novel bacteriophages from the environment. Bacteriophage DNA was then extracted and the genome was added to the Actinobacteriophage Database for sequencing. The genome of VasuNzinga, an S Cluster mycobacteriophage, was further investigated. Databases and engines such as DNA Master, GeneMark, Starterator, Phamerator, HHPred, NCBI, and PhagesDB were utilized in order to do this. Among these resources, the BLASTP results obtained from DNAMaster provided the strongest evidence in making calls about each gene’s start site. BLASTP analyzes how each potential reading frame matches genetic sequences and protein production tendencies in similar sequences. The matrix scores of the potential start sites and the potential lengths of each gene, also provided by DNAMaster were considered when making a gene call. Combining the data outputs of all the resources allowed for informed decision making about the genome and its functions. So far, the functions of the genes are unknown or hypothesized, so comparing with known functions of similar genes is the most efficient way to determine gene function in ongoing work. Outside the scope of mycobacteriophages, known genomes of other species can be compared to VasuNzinga, providing further information about protein functions of interest.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 3305 :: Social Sciences/Humanities

College of Engineering

Expanding Diversity: International Perspectives of African American Engineering

Author:

Hyeonkyeong Gwon

Abstract:

As a part of a larger study, the experiences of African American Engineering Students at a large predominately white institution (PWI) have been gathered through one-on-one interviews and focus groups of students. This research will be the opportunity for the people to raise awareness of African American engineering student, and to have wider view of diversity issues. I became involved this research when I was asked to code interview transcripts. In the interviews, African American participants shared their values, historical context, experience within their immediate environment, and coping strategies. From coding these transcripts, I learned that the representation of domestic minorities is very low and that these students experience microaggressions on campus. This paper will reflect what I have learned through doing this research including: the importance of raising awareness of an individual's culture and situation. Diversity in engineering can lead to multifaceted solutions, and diversity can only be achieved when we fully understand individual's culture and situations.

Research Mentor: Morgan Hynes, Engineering Education

Poster Number: 3182 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Interactive Model of Hypertension's Effects on the Heart

Author:

Abigail Hancock

Abstract:

The purpose of this project is to educate people on the dangers of hypertension, or high blood pressure, focusing on the importance of them living a healthy lifestyle and taking prescribed medications to keep their blood pressure under control. This will be accomplished through an assessment of the effectiveness of a novel blood pressure education model in instructing individuals on hypertension and its impact on health.

The model is designed to include both physical and visual stimuli. A hand pump is squeezed to propel fluid through tubes with two settings, one simulating pressure felt by a healthy heart and the second, an unhealthy heart unaided by prescribed assistance. Lights were programmed to glow in reaction to the pressure using an arduino kit.

Education will be conducted through Group High Blood Pressure classes as well as one-on-one meetings between patients and providers at the Jane Pauley Clinic in Indianapolis, IN. Participants will take a pre-survey and then receive an education regarding hypertension, effects of the disease, and preventative measures, accompanied by the model demonstration. At the end of the session, participants take the post-survey to test the effectiveness of the high blood pressure model in helping them understand the impact of high blood pressure on their bodies.

Statistical results from earlier methods of testing for retention of hypertension information indicate a much higher percentage of participants retained specific knowledge regarding hypertension when educated with the model than those who were not exposed to the model. This provides evidence that this novel education model helps patients understand high blood pressure, which we plan to solidify with this next round of survey data. In addition to a survey targeted to test the effectiveness and usability of the model, a survey of demographic data will be linked to those responses in an attempt to draw more educated conclusions about how the model aids understanding.

Research Mentor: Denny Yu, Industrial Engineering

Poster Number: 3390 :: Life Sciences

College of Engineering

Analysis of Corn Grits through a Capillary Rheometer and Rapid Visco-Analyzer

Authors:

Daniel Hauersperger

Alyssa Christoffer

Troy Tonner

Abstract:

Food and its rheological properties are necessary to produce many of the products we have today. The ability to determine the effects of different conditions on a material's flow behavior aide in the modeling of processes and output models. The flow behavior of corn meal was measured using a capillary rheometer and a rapid visco-analyzer. The corn meal was sampled at different moisture contents (32.5%, 35%, and 37.5% wet basis) and oil contents (5%, 10%, and 15%). The capillary rheometer was also tested at different temperatures (100°C, 110°C, and 120°C). The capillary rheometer has two dies of the same radius and two different lengths. The rheometer varies shear rate and records pressure needed and translates this information into shear stress. The rapid visco-analyzer used the extruded corn from the capillary and measures the pasting properties with a bob and spindle and varying shear rate and records torque as an output. The increase in temperatures and moisture contents showed a decrease in shear viscosity with the shear thinning behavior staying similar for all treatments. This data will be used to understand the effects of the variable compositions and the possible effects on extrusion rheology. The further understanding of extrusion rheology will aid in modeling of extruders using corn.

Research Mentor: Martin R. Okos, Agricultural & Biological Engineering

Poster Number: 3226 :: Physical Sciences

College of Engineering

Influence of Surface Composition on Powder Flowability of Lactose-based Materials

Author:

Tony Hoch

Abstract:

Flowability of powders is an integral part of processing for many industries including pharmaceuticals and food. Currently, powders experience sticking and cohesion to each other and adhesion to processing equipment. Industries waste valuable time and resources fixing problems associated and created with powder cohesion-adhesion issues. The ability to reduce powder cohesion and increase powder flowability will greatly improve industry processing ease and overall production yield and efficiency. The influence of material properties such as particle size, water content and water activity, surface composition, surface interactions and particle geometry on cohesion forces and powder flow are relevant for industrial applications. This study explores the experimental aspects of cohesive powders during handling and flow.

The specific focus is given to the role of surface composition, water, particle size, and geometry on powder flowability measured by different powder rheometers. The specific aims of this research were a) to separate lactose-based powders by sieving to determine particle size ranges of each sample; b) to determine water activity and moisture content; and, c) to assess powder flow using FT4 and Anton Paar powder rheometers. The material used for this part of the study was powdered milk, one batch contained fat (Nestle Nido) and the second batch was non-fat milk powder (Kroger Brand Dry Milk). Statistical analysis was completed to investigate the significance of each parameter on the flowability of lactose-based powders. Accordingly, evaluate and understand the nature of cohesion strength in order to give recommendations for improving flowability of powders during the processing of single and multi-component mixtures.

Research Mentor: Teresa Carvajal, Agricultural & Biological Engineering

Poster Number: 3276 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Characterizing and Measuring Blockchains

Author:

Ben Huang

Abstract:

The increased popularity of Bitcoin has focused attention on its underlying technology, blockchain. Fundamentally, blockchain is a data structure that supports a continuously growing list of record blocks. When combined with cryptographic methods and appropriate protocols, the records can be anonymized and transactions more securely verified. The potential of such a technology may be vast, and as such has attracted the attention of many industry, government and academic groups. While there is a significant push to apply blockchain to potentially improve various applications, there has been little focus on ascertaining to main questions: (1) when could blockchain be used. That is, what problem characteristics are best suited to allow blockchain to be useful? (2) when should blockchain be used. That is, when blockchain is an option, how does one measure what the benefits or drawbacks of implementing it are?

In order to address the above questions this project will perform an extensive literature review and critical analysis of blockchain, existing applications where it is being used (primarily cryptocurrency) and examine areas where it has been in investigation (e.g., supply chains, contracts). The goal is to write a critical paper on the above two questions that will be useful to the relevant communities. The investigation will include the factors such as cost efficiency, necessity and maneuverability of blockchain, and will likely have an aspect of the blockchain data structure and another aspect specific to the problem domain.

Research Mentor: Mario Ventresca, Industrial Engineering

Poster Number: 3077 :: Physical Sciences

College of Engineering

Rheological Deformation of Creamy Filling of Oreo™ Cookies

Author:

Mayank Jain

Abstract:

The goal of this project was to open an Oreo™ cookie using newly developed rheometry and data analysis techniques to make sure that the cream distribution after cohesive failure was even on both surfaces. This involves studying the mechanical behavior of the sugar and soy-lecithin based creamy filling of the cookies and the dependency of its cohesive failure on the applied deformation parameters which are shear rate and normal force. This was carried out in three steps. The objective of step 1 was to understand if the normal force actually played a part in this failure and if it did, then establishing its upper and lower limits for failure. The objective for step 2 was to find the normal force within the range developed in step 1 that would give even cohesive failure of the creamy filling consistently. The objective of step 3 was to find the shear rate associated with this normal force. The normal force and shear rate that gave the closest results to the desired 50%-50% split was 2.5N and $3.5s^{-1}$. The average weight percentage distribution under these conditions was 49% on the top cookie and 51% on the bottom cookie with a standard deviation of 3.9%. Additional tests were done over time to determine reproducibility of the test results.

Research Mentor: Kendra Erk, Materials Engineering

Poster Number: 3249 :: Physical Sciences

College of Engineering

The Effect of Bubble Length and Velocity on Liquid Film Thickness in Microchannel Slug Flow

Authors:

Prathik Kaundinya

Todd Kingston

Abstract:

Two-phase flows in microchannels have various industrial applications, ranging from cooling of electronics to high-throughput screening in the pharmaceutical industry. These flows are largely affected by the flow regime and operating conditions. Of particular interest is the slug flow regime, which is characterized by elongated bubbles circumferentially surrounded by a thin liquid film and partitioned by liquid slugs. Significant effort has been directed toward quantifying the liquid film thickness under a range of flow conditions because it largely dictates the thermal performance in applications involving heat transfer. However, prior investigations used low-accuracy measurement techniques which did not yield the dependence of the liquid film thickness on the operating conditions. Other investigations approximated the slug flow regime by using a single elongated bubble drawn into a microchannel, thus resembling the annular flow regime. In this study, high-fidelity measurements of the liquid film thickness are used to investigate the effect of bubble length and velocity in the slug flow regime.

In the experimental setup, slug flow with varying bubble length and velocity characteristics is created by independently controlling the injection of air and water from a pressurized reservoir into a microfluidic T-junction and allowing the two-phase mixture to flow into a downstream borosilicate glass microchannel. A laser confocal displacement meter is used to provide a high-fidelity measurement of the liquid film thickness. A high-speed camera is used to provide flow visualization and quantify the bubble length and velocity. Using the obtained data, a correlation between film thickness and bubble length and velocity is developed.

Research Mentor: Justin A. Weibel, Mechanical Engineering

Poster Number: 3214 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Investigation of Lithium-Ion Battery Electrode Response to Direct Dynamic Cycling

Authors:

William Kellerhals

Bing Li

Abstract:

The applications of lithium-ion batteries (LIBs) continue to increase in industry for portable devices, energy storage systems, and electric vehicles. Efficient and systematic measuring of the relationship between dynamic loading and temperature fluctuation, that occurs during the work life of the battery, presents an opportunity for improvement in electrochemical performance and safety. We utilized $LiCoO_2$ cathodes and Raman spectroscopy imaging to analyze the effects of dynamic impact and vibration on lithium-ion battery performance. Conducting charge analysis tests resulted in a distinct trend, observed via Raman shift, between the battery charge capacity and number of impact cycles. Charging performance of LIB, with vibration input, was analyzed with nanomechanical Raman spectroscopy for the monitoring of battery health. Methods such as infrared imaging and external battery regulating systems are flawed due to delayed response time and an inability to provide accurate internal analysis. Battery embedded thermal analysis methods, such as micro resistance temperature detectors (RTD), coupled with in-situ nanomechanical Raman analysis, can provide highly accurate and real-time data on the electrode's thermal and structural conditions. The data collected would allow for a high-resolution, in-situ analysis of the battery's thermal behavior. We expect to develop a sensor system capable of providing real-time analysis of the electrode's thermal activity, which can be pre-embedded in the battery. This will pave the way for a larger system that will grant operators immediate control over risks regarding lithium-ion batteries as well as battery life optimization.

Research Mentor: Vikas Tomar, Aeronautics and Astronautics

Poster Number: 3273 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Development of Road Diet Case Search Tool for the State of Indiana

Author:

Sumedh Khair

Abstract:

The Sustainable Transport Systems Research Group (STSRG) is a research group within the Lyles School of Civil Engineering which undertakes research projects for the Indiana Department of Transportation (INDOT) through the Joint Transportation Research Program (JTRP). Research tasks are performed for INDOT that aim to highlight any economic advantages of different transportation engineering practices.

One of the project that I was involved in as an Undergraduate Research Assistant was “Economic Development Impact of Corridor Improvements”. In order to make urban infrastructure safer, livable and business friendly, Road Diet (Roadway Reconfiguration) strategies are implemented. The US Department of Transportation defines Road Diets as “removing vehicle lanes from a roadway and reallocating the extra space for other uses or travelling modes, such as parking, sidewalks, bicycle lanes, transit use, turn lanes, medians or pedestrian refuge island.”

STSRG designed an informative-interactive tool for searching Road Diets case studies that have been successfully implemented across the United States. Case studies were categorized according to their lane conversion type, context classification, Average Annual Daily Traffic (AADT) handled and land use. All these case studies also included statistics about improvements in safety in terms of reduced crashes and any economic development indicators in the area where Road Diet was implemented.

The purpose of developing this informative tool was to present INDOT with a case searching tool that could provide a comprehensive list of all road diets implemented in the country so that they can quickly assess the best practices and access the lessons learned. Understanding the impacts of Road Diets would encourage INDOT’s planners and decision makers to successfully implement more Road Diet projects in the state of Indiana.

Research Mentor: Nadia Gkritza, Civil Engineering and Agricultural & Biological Engineering

Poster Number: 3038 :: Physical Sciences

College of Engineering

3D-Printed Microswimmers with Nanostructures for Color Tracking

Author:

Cara Koepele

Abstract:

Two-Photon Polymerization (TPP) is a fabrication technique based on the localized linking of photosensitive materials resulting from femtosecond – a quadrillionth of a second – exposure to a laser. Such materials are based on building blocks named monomers that combine under certain stimuli (i.e. light) to form chains or complex networks. Utilization of TPP as a method for micro-3D printing has expanded the field of microrobotics, which presents medical solutions for minimizing procedure invasiveness as well as increasing treatment and diagnosis accuracy. One of the challenges in achieving desired accuracies is designing trackable features onto a microrobot. With the capabilities of TPP, we propose the construction of patterns on microrobot surfaces, mimicking color-expressing nanostructures present on beetles and butterflies. In this study, a tracking point is defined by these patterns on top of a surface on a helical microswimmer. A side-by-side comparison of various patterns determined which responds favorably to visible light. Microswimmers are decorated with the structures that elicit bright and stable reflections, and the whole design is printed and properly functionalized with magnetic nanomembranes to respond to the magnetic field. The helix moves using an external rotating magnetic field and the color expressing features of the microswimmer are visible. Many microrobotic tracking systems are vision-based, thus, this patterning technique has the potential to mark multiple microrobots for differentiation and controlled autonomous manipulation for improvement of microrobot control.

Research Mentor: David Cappelleri, Mechanical Engineering

Poster Number: 3141 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Applications for Robotics in Construction: A Novel Design for a Robotic System to Assist in the Construction of Residential Homes

Author:

Christopher Lacny

Abstract:

Over the past fifty years, the construction industry has lagged behind other manufacturing sectors in its adaption of robotics and other automated manufacturing technologies. Given the present shortage of labor in the industry, technical solutions that increase the productivity of labor in construction could have incredible value. This project attempts to identify the unique needs of the construction industry relative to other manufacturing sectors, and outlines a novel design for a general purpose robotic arm developed to automate several labor-intensive tasks related to the framing of residential homes. The device is designed to operate alongside human workers to enable large increases in productivity and safety, leveraging computer vision and advanced control algorithms to respond to the dynamic environment of a construction site. Theoretical design details of this device are discussed, as well as the performance of a small-scale prototype developed to assess the device's feasibility. Future steps for the development of the device are discussed, building upon the strong performance of the prototype.

Research Mentor: Jiansong Zhang, Construction Management Technology

Poster Number: 3299 :: Physical Sciences

College of Engineering

The Response of Schwann Cells to Weak DC Electric Fields

Author:

Alexander Lai

Abstract:

Schwann cells are glial cells that serve the vital role of supporting neurons in the peripheral nervous system. While their primary function is to provide insulation (myelin) for axons, they also help regenerate injured axons by digesting severed axons and providing scaffolding to guide the regeneration process. This specific role of Schwann cells makes them highly important cellular targets following nerve injury. Although some efforts have been made to encourage Schwann cell migration after nerve damage, the use of electric fields to control cell responses remain unexplored; therefore, this experiment serves to characterize the behavior of Schwann cells to weak direct current (DC) electric fields. Rat Schwann cells were seeded onto IBIDI culture slides and exposed to varying DC electric field strengths of 0 to 500 mV/mm for up to 6 hours. Preliminary responses to alternating DC electric fields were also observed. Pictures of the cells in their culture slides were taken after 0, 3, and 6 hours with images analyzed using ImageJ. Results showed that Schwann cells changed their orientation perpendicular to the electric field after they were exposed to electric field strengths of 75 mV/mm or higher. At a 500 mV/mm field strength, Schwann cells also migrated toward the cathode. When exposed to alternating DC electric fields, the cells are also changed their orientation perpendicularly, but only at field strengths of 500 mV/mm. Although the mechanism behind this change needs further research, this shift in morphology may provide a framework for directed control/acceleration of axon regeneration using electric fields.

Research Mentor: Jianming Li, Basic Medical Sciences

Poster Number: 3168 :: Physical Sciences

College of Engineering

Boron Segregation in Advanced High Strength Steels

Author:

Aaron Lichlyter

Abstract:

There is a current push in the automotive industry to increase the fuel economy of passenger vehicles through the use of advanced high strength steels. Small addition of boron in these steels improve the metal's hardenability by retarding ferrite nucleation at the austenite grain boundaries. Even in small amounts, boron makes the steel difficult to commercially produce. These difficulties are predicted to stem from a metatectic reaction in the binary iron-boron system. This metatectic reaction sees delta-iron transform to gamma-iron plus liquid during cooling. The reaction is predicted to occur at boron compositions above 0.0025 wt%. However, previous experimental work has shown casting defects to occur at boron levels as low as 0.0004 wt%. This leads to the conclusion that boron segregation is a major influence in the occurrence of casting defects. In this study, various heat treatments are utilized to induce segregation of boron to grain boundaries. The experimental results are then compared to their predicted phase diagrams.

Research Mentor: Kara Luitjohan, Materials Engineering

Poster Number: 3156 :: Physical Sciences

College of Engineering

Prediction of Drug Release from 3D Integrated Pharmaceuticals

Author:

Evan Liechty

Abstract:

Current drug therapy employs a one-size-fits-all approach that leads to potential efficacy issues and side effects due to the inherent variability among individual patients. Patient-centric pharmaceuticals represent an emerging technology that will allow for multiple versions of a given product to be tailored to specific segments of the population. A new technology, 3D Integrated Pharmaceuticals (3D IP), allows for pharmaceutical oral dosage forms to be assembled from prefabricated components consisting of polymeric functional films. The final dosage form is created by assembly of the necessary functional films. This approach could lead to an oral dosage form containing films for specific purposes including quick release, controlled release, solubility enhancing, and taste masking.

The purpose of the current work was to develop and characterize 3D IPs for controlled release of active pharmaceutical ingredients (API) and to develop a model to predict release kinetics. The 3D IP development was divided into two stages. The first stage was the optimization and characterization of the pre-fabricated components to ensure quality and final performance characteristics. This stage involves preparing and casting films, cutting film samples into wafers, quantifying the API content, and carrying out a USP release test. The second stage included investigating dosage performance in an in vitro release test by varying the number of films in the assembly. The drug release profiles and mathematical analysis provided information on whether the mass transfer was Fickian diffusion, anomalous transport, or first order release. A working equation to predict drug release from 3D IPs was derived as a result of this work.

Research Mentor: Rodolfo Pinal, Industrial and Physical Pharmacy

Poster Number: 3166 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Structured Light 3D Imaging System with Dual Projectors

Author:

Beatrice Lim

Abstract:

This research project aims to further extend the capabilities of the 3D imaging structured light method by utilizing two projectors. Such limitations of a typical structured light setup are issues of occlusion where the process of 3D reconstruction is affected by optical effects such as shadow on the object's surface. With the usage of two projectors projecting structured patterns from two different directions, two sets of 3D data can be obtained with each providing different areas of higher accuracy. By analysing the angles for a given point measured by two projector-camera pairs and developing algorithms to merge data seamlessly, higher quality 3D measurement can be obtained.

The methods used to achieve the objective of this research were:

Calibrated the structured light system following a proposed framework to accurately estimate the parameters to describe the relationship between the image and world coordinates

Developed an angle calculation algorithm by extracting surface normal vectors for each measured point from the 3D surface geometry

Fuse 3D data into a single 3D surface based on the angle calculation to select higher quality data from two projectors

Research Mentor: Song Zhang, Mechanical Engineering

Poster Number: 3309 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Liquid Water Micropropulsion System for Small Satellites

Authors:

Margaret Linker

Steven Pugia

Matthew Fuehne

Noah Franks

Ryan Clay

Ben Davis

Abstract:

As CubeSat missions become more complex and ubiquitous, the demand for compact, low-power micropropulsion systems has increased. Film Evaporating MEMS Tunable Array (FEMTA) is a novel thruster that employs thermally controlled micro-capillaries to generate micronewton thrust with liquid ultra-pure water as propellant. Preliminary testing of FEMTA has yielded thrust-to-power ratios of 230 micronewtons per watt at mass flow rates of 80 micrograms per second making FEMTA a low-power, low-mass micropropulsion solution. Presented here is a study to demonstrate controllable single-axis rotation of a 1U CubeSat prototype with FEMTA propulsion. The CubeSat was tested at Purdue High Vacuum Lab (PHVL) at an evacuated pressure of 30 – 50 microtorr. On-board inertial measurement sensors monitored angular position of the CubeSat during FEMTA operation and total satellite power consumption is < 1 watt. A numerical study was performed in COMSOL to characterize FEMTA thermal properties and to quantify the impact of changing FEMTA key dimensional features. A concept zero gravity propellant feed system for FEMTA thrusters was also developed in tandem. The feed system exploits vaporization of an alcohol mixture under low pressure to motivate a polyethylene membrane within the propellant tank.

Research Mentor: Alina Alexeenko, Aeronautics and Astronautics

Poster Number: 3053 :: Mathematical/Computational Sciences

College of Engineering

Geospatial Analysis of Ecosystem Services on Purdue University Campus

Author:

Xiangxing Long

Abstract:

The goal of this project is to examine the economic value of ecosystem service (ES) provided by trees on Purdue campus. We used tree data from Purdue Arboretum as the basis for estimation of ecosystem services (ES) using the I Tree Streets model, designed by USDA Forest Service. ES calculations were based on tree genus and size, which were obtained from the Purdue Arboretum database. I-Tree Streets estimates ES values by calculating energy savings, CO2 sequestration, air quality improvements, stormwater interception, and aesthetic value of urban trees. The model relies on regionally averaged utilities prices, current market prices for treating CO2 emission and air pollutants, the cost of stormwater interception, average home resale value, tree health condition, various city characteristics, as well as maintenance costs associated with the trees themselves. Because all benefits of ES are assigned in dollars, I Tree Streets estimates the economic value of ES provided by trees in dollars. Based on currently available data, we estimate that trees on Purdue’s West Lafayette campus generate ES $397,920 annually (gross) and $148,000 (net) after accounting for the $249,899 that Purdue Physical Facilities spends on tree maintenance each year. We conducted a geospatial analysis of ES provisioning across the Purdue Campus to identify and map hotspots, areas of high ES provisioning that can be used to inform campus tree maintenance efforts.

Research Mentor: Brady S. Hardiman, Forestry & Natural Resources and Environmental & Ecological Engineering

Poster Number: 3161 :: Physical Sciences

College of Engineering

Assembly of nanostructures for quantum optics

Author:

Oksana Makarova

Abstract:

Information privacy and communication security are amongst the greatest issues of our time. Quantum cryptography techniques may lead to communication systems that prevent the possibility of eavesdropping, based on the most fundamental laws of physics. Efficient single photon sources are vitally important for such systems. An efficient and fast single-photon source could be realized by coupling a solid-state atomic defect to a nanophotonic structure. The proposed project aims at creating and characterizing various single-photon sources (SPS). A fast and simple Atomic Force Microscope (AFM)-based technique must be developed to assemble the structure. The procedure should allow the transport of metallic nanocubes and dielectric nanodiamonds across different substrates and assemble these particles with nanometer precision.

Research Mentor: Alexandra Boltasseva, Electrical Engineering

Poster Number: 3231 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Development and Distribution of Assistive Technology Using 3D Printing Methods

Authors:

Camila Marrero Torres

Shruthi Suresh

Shanmugan Muruga Palaniappan

Brett English

Connor Hage

Abstract:

3D printing has revolutionized the approach to assistive technology (AT) by making it more accessible and customizable for individuals with disabilities. 3D printing allows for mass customization, where a standard product can be developed to later be adapted to the person's individuals needs. This rapid customization approach is very helpful in developing AT devices as often times individuals with the same disability will not share the same needs, or experience a change in needs over time. Either way, this renders the initial AT product obsolete. 3D printing would also allow for easier repairs. Most AT devices are developed in rehabilitation hospitals, but as time goes on, and the device wears out, breaks, or becomes outgrown, it becomes a very difficult task in trying to repair it. Additionally, the ability to share CAD drawings allow for relatively easy replication anywhere with a 3D printer, even for those who do not have access to commercial AT providers. In this study, we are evaluating two different 3D printed AT devices which were designed and developed for tetraplegics. The first study is based on replacing a device that had to be re-engineered from the original. The second study focused on creating a wrist orthotic that could be adapted to an individual's specific needs. Satisfaction interviews were performed to determine successful employment of the AT devices. Both scenarios were compared according to approaches in design, fabrication, distribution, and testing. Subject assessment was performed using a questionnaire, contextual inquiry, and task performance measures.

Research Mentor: Bradley Duerstock, Biomedical Engineering and Industrial Engineering

Poster Number: 3392 :: Life Sciences

College of Engineering

Fluorescent Biosensor to Measure LRRK2 Kinase Activity in Live Cells

Author:

Abhipri Mishra

Abstract:

Parkinson’s Disease (PD) is a neurodegenerative disease affecting about ten million people worldwide. The Leucine-Rich Repeat Kinase 2 (LRRK2) gene is most commonly found mutated in familial PD, which accounts for about ten percent of familial PD cases. The most common mutation of LRRK2, G2019S, is located within LRRK2’s kinase domain. G2019S has been demonstrated to increase LRRK2’s kinase activity, leading to mutant LRRK2-mediated neurotoxicity. Protein kinases play a pivotal role in cellular signaling events through phosphorylation of proteins in a signaling cascade. These events depend on the localization and time of protein activation in cells. Our goal is to develop a LRRK2 fluorescent biosensor, an optical tool allowing us to monitor its kinase activity in live cells. The kinase biosensor is composed of a phospho-binding domain, a peptide substrate, and fluorescent proteins (FPs). LRRK2-dependent changes in the biosensor conformation can be detected in live cells by monitoring changes in Förster Resonance Energy Transfer (FRET). Here we will present preliminary results on sensor development and characterization. Development of this sensor will allow us to understand the role of LRRK2 in pathways leading to neuronal death.

Research Mentor: Mathew Tantama, Chemistry

Poster Number: 3059 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Low Cost Sweat Analysis Model for Testing Wearable Devices

Author:

Dana Moryl

Abstract:

The non-invasive nature of sweat analysis has led to an increase in wearable sweat biosensors. A lasting issue in this field, however, is testing. Since most animal models do not sweat, two distinct methods are commonly used to test sweat biosensors: human testing and in vitro testing. However, human trials are confounded by variances in concentration and composition. Furthermore, device testing for rare conditions or illicit drugs may encounter issues finding volunteers or approval for human subjects testing. Typical in vitro testing of biosensors fully submerges the device, giving proper concentration readings, but do not simulate fluid dynamics of sweating. Some sweat models do exist, but they can be quite expensive and require clean room use. As such, there is a need for a simple model that replicates human sweating patterns for testing sweat biosensors. Thus far, we have modeled sweat rates using a small laboratory syringe pump. Furthermore, we are evaluating different materials for a small, easily fabricated porous membrane that best fits physiological parameters such as sweat pore diameter, density, and flow pattern. Our membrane is composed of commercially available 0.2 micron track etched polycarbonate membrane laminated onto a silicone-based porous material. Such a device could be highly beneficial for researchers and reduce the overall costs of developing sweat biosensors, maximizing the chance of device functionality before reaching human trials.

Research Mentor: Jacqueline Linnes, Biomedical Engineering

Poster Number: 3381 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Empatica E4, Wearing Health Data on your Sleeve: A Look into Accuracy and Precision

Author:

Laura Mudge

Abstract:

Wearable sensors are a popular way to monitor health conditions and behavior, but their accuracy and reliability is unknown. Researchers use gold standard devices, such as the Shimmer3 GSR+ and the Polar H7 to collect data on electrodermal activity (EDA) and heart rate variability (HRV) to monitor cognitive and physical activity, respectively. However, usability limitations exist, such as longer setup times and more complicated application. The Empatica E4 is a new wrist-worn device that is designed to deliver accurate HRV and EDA measurements, but the accuracy of measurement remains undetermined. The purpose of this project is to analyze the validity and reliability of the Empatica E4 by comparing the accuracy of its readings to those of the Shimmer3 GSR+ and Polar H7. Participants completed a cognitive or physical task at two levels of intensity and the EDA and HRV readings from the Empatica E4 were compared against the Shimmer3 GSR+ and Polar H7. Each task included a motion component. A usability survey was completed at the end of the task. The preliminary results indicate that the heart rate readings for the Polar H7 and Empatica E4 are very similar, though the Polar H7 HRV readings are greater than the Empatica E4. In addition, the Shimmer3 GSR+ has an average peak count that is greater than the Empatica E4 and the average mean and median recorded by the Shimmer3 GSR+ are greater than the Empatica E4. Under this study environment, the Empatica E4 wristband did not perform at the same level as the accepted gold standard devices.

Research Mentor: Denny Yu, Industrial Engineering

Poster Number: 3187 :: Mathematical/Computational Sciences

College of Engineering

Rain Garden Ecosystem Services

Authors:

Caitlin Nelligan

Anne Hays

Hannah Hawrot

Abstract:

Rain gardens are a type of green infrastructure that provides many ecological and social benefits. Typical stormwater infrastructure lets runoff flow along impervious surfaces into a system of pipes gathering pollutants along the way. Green infrastructure, such as rain gardens, allows stormwater to infiltrate into the ground thereby reducing hydrologic impacts and improving water quality. Rain gardens provide additional ecosystem services including habitat for wildlife, carbon storage, and beautification. The purpose of this study was to assess ecosystem services at three rain gardens in Lafayette, Indiana, focusing on nutrient concentrations, plant biodiversity, soil carbon, and denitrification rates. We measured water quality of inflow to the rain garden via first flush samplers and infiltrating water using lysimeters. We also measured soil properties and potential denitrification via enzyme assays seasonally, and plant biodiversity (species richness, abundance) during peak flowering in the summer. At the study site, ammonium and nitrate concentration were similar in groundwater and stormwater runoff while phosphate and dissolved organic carbon concentrations were higher in the groundwater than the runoff. Significant differences in nutrient concentrations also varied across sites, which we attribute to their proximity to paved surfaces, surrounding green spaces, and land use within their drainage areas. All sites have recorded high plant densities ranging from 570 to 760 plants per square meter, with varying species richness depending on the location. We are currently analyzing denitrification rates at the sites. Continued storm-based research is planned, which will enable expansion of this study to determine the transferability of the results to other locations and a greater spatial scales.

Research Mentor: Sara McMillan, Agricultural & Biological Engineering

Poster Number: 3232 :: Physical Sciences

College of Engineering

CNC-Reinforced PCM Encapsulation for Incorporation in Asphalt Formulations

Author:

Fiona O'Dowd

Abstract:

Phase change materials (PCMs) have emerged as a cost-effective route to passively regulate living space temperatures during the hot summer and cool winter months providing comfort and saving energy. Recently, PCMs have been tested in asphalt formulations to minimize snow and ice accumulation. The objective of this project is to synthesize and characterize strong microcapsules composed of cellulose nanocrystals (CNCs)-reinforced poly(urea-urethane)-shells with methyl laurate (PCM) cores and their incorporation in asphalt formulations. CNCs were embedded in poly(urea-urethane) (PU) microcapsules via in-situ emulsion interfacial polymerization. FTIR and DSC were used to characterize the drop composition and confirm the presence of the CNCs. The use of vibration-assisted drop generation and electrospraying techniques to form monodisperse microcapsules was explored. High-speed imaging techniques were used to collect information on drop generation rates as well as their size distribution. This work will result in improved capsule strength and reduced synthesis costs.

Research Mentor: Carlos J. Martinez, Materials Engineering

Poster Number: 3348 :: Life Sciences

College of Engineering

Understanding and controlling epigenetic regulation in anaerobic fungi to enhance hemicellulase production for renewable energy biofuels

Author:

Adrian Ortiz-Velez

Abstract:

Anaerobic fungi express a diverse array of lignocellulolytic enzymes that may be used to harness fermentable sugars from plant biomass for bioenergy and sustainable chemistry. Degradation of the hemicellulosic fractions of plant biomass by anaerobic fungi, however, is limited by a cellular strategy that tightly regulates its cellulose and hemicellulose degrading enzymes (carbohydrate-active enzymes; CAZymes). We propose that epigenetic factors like histone acetyltransferases (HAT) and histone deacetylases (HDAC) influence the expression of CAZymes in response to available substrate. In our fungal isolate, P. indianae, CAZyme secretion varies with the hemicellulose makeup of the feedstock, suggesting that the fungi are able to tailor their secretome to the biomass composition. Additionally, gene expression data collected from related species grown across a variety of carbon sources demonstrate that the expression of epigenetic factors change as a function of substrate. Correlations between epigenetic factors, including HATs and HDACs, exist with the expression of hemicellulase (GH10 family) enzymes. Understanding the epigenetic regulation of anaerobic fungal enzymes and how they affect complex hemicellulose breakdown can lead to a feedstock degradation system that exceeds natural productivity. Harnessing control of these epigenetic factors and reversing signals that halt hemicellulase production will enable the full potential of these gut fungal genome to renewably process hemicellulolytic substrates for biofuel production.

Research Mentor: Kevin Solomon, Agricultural & Biological Engineering

Poster Number: 3356 :: Life Sciences

College of Engineering

Analyzing Neuronal Transcriptome Data

Authors:

Anthony Park

Reed Trende

Matthew Deaton

Sarah Liu

Tania Chakraborty

Matthew Whipple

Abstract:

Current methods of neuron classification are based primarily on the size of the neurons and their location in the body. However, this classification structure is not always accurate, and makes it difficult to assign specific functions to individual neurons. However, new mechanisms of neuron classification are being explored that use neuron transcriptome data coupled with biclustering algorithms. Because they use transcriptome data, these methods of classification more accurately reflect the functions of the neurons than other, more common methods of classification. However, the calculations required to definitively identify the globally ideal classification clusters with transcriptome data is beyond the scope of human decision making, as data files can contain expression levels for tens of thousands of genes across hundreds of neurons, all of which can have significant noise. As such, computational algorithms are being developed to approximate global solutions, but each algorithm performs best on unique kinds of datasets.

To aid the Y-Lab in their research into channelopathies, we explored several biclustering algorithms, including BackSPIN, FABIA, and SAMBA, as well as ways to quantify the efficacy of individual biclustering algorithms on specific datasets. After sorting, statistical methods were used to pick out particularly prevalent genes within each cell cluster. This work has helped categorize genes in neural cells in a statistically and biologically meaningful way, which will allow researchers to determine genes or cells of interest to perform research on.

Research Mentor: Yang Yang, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 3220 :: Physical Sciences

College of Engineering

Ultrasound Measurements of Regional and Temporal Variations in the Murine Reproductive System

Author:

Hamna Qureshi

Abstract:

The biomechanics underlying several women's reproductive health issues are still not fully understood. To gain insight into the structural components contributing to these problems, high-frequency ultrasound imaging was used to study changes of in vivo geometry of the uterine region in murine models. Female mice experience a brief reproductive cycle consisting of 4 stages. The stages of interest, estrus (ovulatory phase) and diestrus (endometrial shedding phase), are marked visually as the stages in which the vaginal opening experiences the greatest dilation and constriction, respectively. In this study, female mice (n=6) between 4-8 months of age were imaged consecutively for 5 days using a Vevo2100 high-frequency ultrasound system. A 40 MHz center frequency transducer attached to a linear step motor was used to obtain 3D images with a penetration depth of at least 7 mm of the murine cervical and uterine regions. The images were analyzed for diameter, wall thicknesses, volumes, and lengths of the uterine region. At the cervical/vaginal border region, we observed that there are noticeable differences in tissue during estrus and diestrus. Diameter and wall thickness measurements taken at estrus and diestrus in the border region show that average estrus measurements are greater than average diestrus measurements. Further, anterior thickness and volume/length ratios were observed to significantly decrease during diestrus ($p<0.05$). Physical differences are particularly noticeable in the vaginal region as wall thickness varies in this area throughout the reproductive cycle. From these results, we confirmed that ultrasound imaging techniques can be applied to the murine cervix and can be employed to detect temporal and regional variations in geometry. These results are relevant to understanding the underlying biomechanical mechanisms behind pathologies associated with women's reproductive health, including preterm birth, pelvic organ prolapse, and uterine fibroids among others.

Research Mentor: Craig Goergen, Biomedical Engineering

Poster Number: 3280 :: Life Sciences

College of Engineering

VasuNzinga Gene Annotation: gene 23 - gene 41

Authors:

Vishwajit Ravichandran

Evan Shank

Yunji Hong

Abstract:

Bacteriophages (Phages) are viruses that infect bacteria cells by taking advantage of the host's cellular machinery and replicating themselves within the cell. The current understanding of phages is still largely putative due to the vast, yet dynamic population of phages (approximately 1031 particles). The SEA-PHAGES program is an attempt to illuminate the functions and the relationship between different phage genomes, and ultimately boost our current understanding of bacteriophages as a whole. To aid that goal, our group is annotating the vastly uninvestigated S cluster mycobacterium phage VasuNzinga found by Vasuprasadha Girish and Nzinga Walker in Purdue University, West Lafayette, Indiana.

In phage VasuNzinga, the startsite for genes were called by looking at common starting codons. The initial 'calling' process, which is referred to as the rough annotation, can be done in a computer program called DNA master. After conducting the rough annotation for phage VasuNzinga, there were totally 115 genes present, and we modified the rough annotation as needed based on the evidences from previously sequenced phages. Next, the gene functions will be predicted by comparing the functions of the query gene with the known functions of other genes within a specific database. Calling genes in this primarily unstudied cluster can potentially give new insights on the function of certain genes. The data from this project, also considering that there are numerous phages being sequenced and annotated by hand country-wide, can provide greater understanding in areas of biological hurdles.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 3224 :: Physical Sciences

College of Engineering

Real-Time Particle Size Measurements for a Continuous Pharmaceutical Process

Authors:

Benjamin Rentz

Mariana Moreno

Abstract:

A continuous pharmaceutical manufacturing process offers many advantages over a traditional batch manufacturing process. Unfortunately, due to the nature of such a process, current sensing techniques are often inadequate. To ensure a consistent, quality pharmaceutical product is produced, numerous product attributes must be monitored including the tablet hardness. In a dry granulation line, the tablet hardness can be directly correlated to the particle size distribution of the granules that comprise the tablet. The size of the granules is a function of the ribbon density, which is a function of the pressure of the roller compacter rolls. Therefore, with adequate monitoring of the granule size distribution, the tablet hardness can be effectively controlled. At Purdue University, online particle size distributions of granulated pharmaceutical formulations are monitored using a high-speed image-based sensor, an Innopharma EyeCon™. Additionally, off-line particle size distribution testing has been completed using both sieve analysis as well as laser diffraction techniques. Using these three different particle size distribution methodologies in conjunction, the true particle size distribution can be found, related to the roller compactor pressure, and used to control a continuous pharmaceutical tableting line in real-time. The main objective of this project is to effectively monitor the particle size distribution in real-time for a continuous pharmaceutical dry-granulation process, thereby determining the effect of the roller compactor pressure on the particle size distribution.

Research Mentor: Gintaras Reklaitis, Chemical Engineering

Poster Number: 3269 :: Life Sciences

College of Engineering

Genetic Interpretation of VasuNzinga

Authors:

Jayden Rosen

Devany Harrell

Joey Krampen

Henry Cushing

Abstract:

The goal of the research is to contribute to the genetic knowledge of bacteriophages, specifically the more rare Cluster S phages. A Cluster S phage called VasuNzinga, isolated and sequenced from Purdue University in 2014, is analyzed in this research to discover the organization and function of its genome. Methodology includes using programs such as Phamerator and Starterator which compare VasuNzinga's genes with genomes of existing sequenced genomes of other phages, showing correlations between genes throughout similar sequences. GeneMark is a program used to calculate the coding potential of the entire VasuNzinga sequence, which provides evidence for calling the locations of each gene in the genome. DNA Master is used to look into each individual gene to analyze the best possible start site locations, and BLAST data reveals how well VasuNzinga's genes match with sequences of known proteins, which sheds light on the genes' functions and locations. DNA Master auto-annotates gene locations of VasuNzinga, and these locations were confirmed or changed using the above analyzes. The purpose of this is to be able to determine the function of the genes, or what proteins they code for. Overall this research allows for a broader knowledge about genomes and potential function of proteins in phages. Many phages have not been discovered or annotated and by conducting this research, potential new information can be accessed in future experiments.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 3360 :: Mathematical/Computational Sciences

College of Engineering

Quantification and Evaluation of Thermal Fatigue for a Lunar Habitat

Author:

Nicole Rote

Abstract:

The first step in developing human settlements on the lunar surface is to quantify the environmental hazards for a lunar habitat and to understand the requirements of a resilient habitat design. On the lunar surface, the temperature at the equator fluctuates between 101.2K to 387.1K throughout a period of 28.5 Earth days. The significant thermal variation poses structural hazards for habitats on the Moon, both when analyzing the short-term and the long-term structural fatigue effects such as buckling, de-bonding, cracking, and crazing. Previous design considerations for lunar habitats have not included analyses of long-term degradation. To evaluate and quantify the thermal hazard, the structural stability of a habitat will be assessed through finite element analysis, considering lunar soil cover depth, sun exposure levels, and thermal cycle periods. The finite element analysis will lead to a better understanding of long-term thermal cycling, and insight into the degree to which the habitat becomes more susceptible to other lunar hazards. An understanding of the drastic thermal changes on the lunar surface will lead to a habitat design that better accommodates the harsh lunar environment.

Research Mentor: Shirley Dyke, Mechanical Engineering

Poster Number: 3022 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Advanced Packaging of Phase Change Materials (PCMs) for Passive Thermal Management of Cell Phone Processors

Authors:

Javieradrian Ruiz

Collier Stephen Miers

Abstract:

Cooling of cell phones and other hand-held electronics is of great importance due to the increasing power density of mobile processors in recent years. This investigation studies not only the properties of favorable phase change materials (PCMs), but also the packaging of the PCMs in order to be an effective passive thermal management technique. Various PCMs, all with differing melting points and latent heats, are investigated in this work, along with multiple enclosures designs. This study seeks to optimize the PCM-based passive thermal management systems to maintain a safe operating temperature in cell phone processors.

Research Mentor: Amy Marconnet, Mechanical Engineering

Poster Number: 3314 :: Life Sciences

College of Engineering

The Research on VasuNzinga Bacteriophage

Authors:

Christina Sanchez

Cole Miller

Emma Misicko

Zachary Falender

Abstract:

The bacteriophage VasuNzinga, was discovered at Purdue University. VasuNzinga belongs to an S cluster. A cluster is a group of bacteriophages that have similar genes and characteristics. The phage population contains approximately 10E31 very genetically diverse members, most which haven't been discovered. Annotating decisions were made with evidence from GeneMark Smeg map, DNA Master, Phamerator, and BLAST. Genes 4-22 were annotated by Group 1. DNA Master calls the genes where it thinks the gene should start with information from GeneMark Smeg map, Glimmer, and BLAST. The GeneMark Smeg Map presents the coding potential that VasuNzinga contains along with start and stop sites of the nucleotides for the entire genome. Glimmer predicts protein encoding genes within a genome sequence based on nucleotide profiles. BLAST aligns nucleotide and protein sequences. The auto-generated calls and open reading frames were analyzed with DNA Master. When the genes were blasted, the call was determined by the best alignment, e-value, and final score. Phamerator compares other S cluster bacteriophage sequences to VasuNzinga. There were two genes that were called differently, genes 8 and 10, due to the fact that they weren't called according to the Guiding Principles of Bacteriophage Genome Annotation. Gene function calls were made with BlastP, Phamerator, and HHPred. HHPred is an alignment tool that finds similar sequences in previously annotated genomes to determine protein function within a gene. The next step is to go back to the wet lab and try to find functions for the genes that currently have no assigned functions.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 3124 :: Life Sciences

College of Engineering

Identifying the role of NuMA in cancer cells' drug response

Author:

Christopher Schorr

Abstract:

It has been shown that close interactions between nuclear scaffold components (nuclear lamina, NuMA intermediate filaments) and chromatin specify the distinct spatial organization of the cell nucleus necessary for gene expression control. In vivo, the nucleus is typically spherical or ellipsoidal; however, it can undergo small-scale, yet dramatic morphological changes in response to physical or chemical alterations in the microenvironment. Interestingly, alterations of nuclear morphology have been associated with changes in expression of major genes implicated in cancer (e.g., p53). It was also demonstrated that nuclear deformation and spatial position of the nucleus trigger a mechanosensing cascade, which eventually changes chromatin organization locally (e.g., histone modifications) and the gene expression profile of cells. A nucleoskeletal framework provided by nuclear matrix proteins like NuMA maintains the physical stability of the nucleus while providing attachment sites for nuclear proteins and chromatin. Therefore, it seems very likely that upon the induction of physical stress by high cancer matrix stiffness to the nucleus, nuclear matrix proteins are capable of transferring the mechanical signals to the chromatin and gene transcription systems. However, there is still a gap in our knowledge on whether and how the aberrant nuclear morphology observed in cancer could influence mechanotransduction and impact gene expression-related drug response in cancer cells. Previously, we have shown that down-regulation of NuMA in mammary epithelial cells alters higher-order chromatin organization and perturbs tissue-specific epigenetic regulation and gene expression. Our recent data showed that in the absence of NuMA, the cancer cells tend to have bigger nuclei in comparison with the control. Interestingly, we have demonstrated that tumor nodules cultured in curved geometry display significantly different drug sensitivities compared to those cultured on a flat surface and that the major morphological differences between these culture conditions is the nuclear morphometry (notably shape and size). The overall hypothesis is that upon sensing physical stress, NuMA regulates the signaling response in cancer cells, which influences their drug sensitivity.

To validate the relationship between drug sensitivity and nuclear morphology of cancer cells in a physiologically relevant manner we cultured tumor cells in collagen matrix with adjustable stiffness to induce forces sensed by nuclei like in vivo. Nuclear morphometric analysis suggests a 14% increase in nuclear area in lower (900 Pa) collagen stiffness in comparison with the high (2020 Pa) matrix stiffness (the rigidity of the latter was similar to the stiffness experienced by tumors in vivo). Accordingly, tumors sensitivity to cytotoxic drug in low matrix rigidity was significantly higher by 45% than in the stiffer matrix. Thus, mechanical alterations in the tumor microenvironment might be associated with specific gene expression profile that affect cancer cells’ drug response. Interestingly, silencing NuMA altered nuclear shape in a matrix stiffness dependent manner. In comparison with high collagen rigidity, silencing NuMA in tumors generated in softer collagen increased nuclear area. Moreover, for the NuMA silenced cells the sensitivity to the cytotoxic drug was significantly increased in softer collagen compared to the stiffer condition. These data suggest that NuMA could be a nuclear mechanosensor that transfers physical alterations in the tumor microenvironment to the genome and regulates chromatin reorganization during cancer cells drug response.

Research Mentor: Sophie Lelièvre, Basic Medical Sciences

Poster Number: 3379 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Quantified Behaviors Of Canines And People Based On Distance Between

Author:

Huizi Shao

Abstract:

Measuring the distance between the owner and the dog to acknowledge animals' behaviors related to people. In the meanwhile, developing user-friendly wearables for canine companions. There are several concepts need to be considered for the wearables: size, weight, the way to wear, stability, etc. There is little research in the related area so far, so the results can use to quantify the canines' reactions depended on people's various attitudes.

The POZYX system is going to be used to measure the distance between the owner and dog. The system will provide the location of the pet with respect to the dog. With the ultra-wideband technology, it is possible to achieve indoor 3D positioning with centimeter accuracy. There are three subjects need to be tested related to three different pairs of dogs and owners. For designing the wearables, the methods included low-fidelity prototyping with 3D paper models; sketches of the 3D CAD models, etc.

In total, two significant factors for this research: animal size and behavior. The veterinary practitioners to study the behavior of the pet and owner will use this information over time. In February, the related information researched in the area, draft for wearable designed and Pozyx set up. In March, data need to be collected for three pairs of objects; the wearable need to be tested on dogs. In April, the results need to be analyzed based on collection, the models for user-friendly wearable for canine companions need to be settled.

Research Mentor: Denny Yu, Industrial Engineering

Poster Number: 3087 :: Mathematical/Computational Sciences

College of Engineering

A Divide-n-Conquer Approach to Syntax-Guided Synthesis

Author:

Peiyuan Shen

Abstract:

Program synthesis aims to generate programs automatically from user-provided specifications. One critical research thrust is called Syntax-Guided Synthesis. In addition to semantic specifications, the user should also provide a syntactic template of the desired program, which helps the synthesizer reduce the search space. The traditional symbolic approaches, such as CounterExample-Guided Inductive Synthesis (CEGIS) framework, does not scale to large search spaces. The goal of this project is to explore a compositional, divide-n-conquer approach that heuristically divides the synthesis task into subtasks and solves them separately. The idea is to decompose the function to be synthesized by creating a set of auxiliary functions. In this way, the whole synthesis task can be reduced to synthesizing the auxiliary functions. The auxiliary functions are of bounded size and hence can be encoded into a logic constraint in linear-integer arithmetic and solved by modern Satisfiability-Modulo-Theories (SMT) solvers. In each iteration of the synthesis algorithm, an auxiliary function is synthesized and added into the syntax for synthesizing other auxiliary functions. The algorithms repeats until a syntax-correct implementation equivalent to the reference implementation is found. Preliminary experimental results show that this approach will provide a better approach to solve the Syntax-Guided Synthesis problems.

Research Mentor: Xiaokang Qiu, Electrical and Computer Engineering

Poster Number: 3121 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Thrust Line Analysis of Topologically Interlocking Material Assemblies

Author:

Matthew Short

Abstract:

Topologically interlocked materials (TIMs) are assemblies of unit elements that resist loading via contact and friction that are held together by a confining framework. TIM assemblies have favorable material properties compared to more traditional materials, however, news models for the prediction of the behavior of TIMs are required. In previous literature, it was found that a truss model created using thrust line analysis could describe the behavior of tetrahedral unit assembly. It is hypothesized that a truss assembly resembling the dual tessellation of the TIM assembly will model the behavior of the TIM assembly. The purpose of this research is to extend thrust line analysis truss models to assemblies of different sizes and unit elements and determine the appropriateness of such models. Finite element models were used to determine the locations of thrust lines in the truss assembly and to calculate the thrust forces in the truss members. It has been found that the thrust lines in TIM assemblies derived from square tessellations and octagon-square tessellations resemble the dual of those tessellations. The truss models developed from thrust line analysis will be tested against experimental data and finite element models to test their validity.

Research Mentor: Thomas Siegmund, Mechanical Engineering

Poster Number: 3191:: Innovative Technology/Entrepreneurship/Design

College of Engineering

The Optimal Operating Room

Authors:

Nithika Sivashankar

Jiawei Lu

Abstract:

This project is targeted to find the optimal operating room layout. This optimal layout can be used to increase the efficiency of existing operating rooms in hospitals and can help pave the way for robotic surgeries in the future. The project entails the creation of a survey where users can create what they believe to be the optimal operating room layout. This survey is online and will be distributed to numerous professionals that work in the operating room, such as surgeons and nurse practitioners. Through the use of HTML and JavaScript, this survey allows users to select images of various equipment found in a traditional operating room, scaled down to fit within a coordinate plane on the screen. Upon selection, the user can then drag the object to the location that they feel is optimal for that particular piece of equipment. At the bottom of the screen, they can view the coordinates of the object. Once they are satisfied with the location, they can drop the object in that location and move on to the next. When the coordinates of all of the equipment have been finalized, the user can enter their name, email, and any comments that they may have. The data will then be sent to the lab, where it will be used along with the data from other surveys to find the optimal coordinates for each piece of equipment.

Research Mentor: Denny Yu, Industrial Engineering

Poster Number: 3063 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Global Phenology Using Social Networks

Author:

Achinthya Soordelu

Abstract:

The goal of the Global Phenology using Social Networks project is to perform environmental analysis and track changes in phenology over time using images scraped from social media. Social media presents an as-of-yet untapped resource of image data for national parks and other heavily forested areas. Collecting these images provides a pathway to analyze the images and check for change in onset of seasons and flowering over the years. As such, there are three main planks to the project: collecting data, storing data efficiently, and analyzing the image data. This submission discusses the first and last of those project planks.

First, data collection occurs on several social media websites. Methods of data collection involve deeply interacting with available social media APIs and using forms of HTML scraping to find relevant images while filtering out irrelevant images. This semester, the project has spent time on refining the process of gathering data on already supported websites, while expanding the number of websites that are searched for data, thereby increasing the quantity and quality of the overall dataset.

Next, image analysis is necessary to further determine if a downloaded image is usable for phenology purposes. This process involves using computer vision algorithms on an image to determine if the image is a landscape photograph of phenologically relevant forestry. Examples of images that need to be filtered out and removed are selfies, altered photographs, and images with the focus on a sign or other landmark with some forestry in the background.

Research Mentor: Yung-Hsiang Lu, Electrical and Computer Engineering

Poster Number: 3359 :: Life Sciences

College of Engineering

Analysis of Duckweed Cell Walls

Author:

Evan Sowinski

Abstract:

Rapid growth, high pectin and starch content, and easily digestible walls lacking lignin makes the plant subfamily Lemnoideae, or duckweed, a promising feedstock for biofuel production. I characterized the monosaccharide and linkage profiles of cell walls of three species of duckweed: *Spirodela polyrhiza*, *Lemna gibba*, and *Wolffia arrhiza* to determine the abundance of cell wall polymer types. Isolated cell walls were sequentially extracted with a Ca+2 chelator and increasing concentrations of alkali to resolve polymers into pectin, hemicellulose, and cellulose fractions. The sequential extraction confirmed that all species had high pectin and starch content, and also showed a low hemicellulose content. S. polyrhiza and W. arrhiza species contained high amounts of pectic galacturonic acid. L. gibba contained high amounts of glucose and relatively low galacturonic acid, indicating a different pectic composition. The primary pectins found by linkage analysis were rhamnogalacturonan-I and apiogalacturonan, the latter of which is largely composed of the uncommon branched sugar apiose. The hemicelluloses xylan and xyloglucan were also prominent. Cellulose content was found to be relatively low, which is beneficial from an energy standpoint, as cellulose is more difficult to break down than most other wall polymers. These findings may be used in future research on efficient disassembly of duckweed cell walls into sugars, for conversion of duckweed biomass into usable fuel.

Research Mentor: Nicholas Carpita, Botany and Plant Pathology

Poster Number: 3363 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Blockchain in Smart Energy Grid

Authors:

Casey Stowers

Aruzhan Bazylzhanova

Abstract:

One of the key elements for power grid modernization is a shift from purely centralized generation and control to decentralized generation, aided by advancements in grid digitalization and information technology. If managed properly, distributed energy resources (DERs) hold great potential to increase power systems' efficiency, reliability, and resilience while promoting sustainability. This project demonstrates the applicability of blockchain technology and a peer-to-peer system in realizing the full potential of DERs. The blockchain coordinates the secure exchange of a cryptocurrency linked to energy generated and usable only to purchase energy. More specifically, the digital coin is produced alongside prosumers' generation and disposed of when a consumer uses the coin to purchase energy. The coins can be traded for physical currency in a financial exchange market. The wholesale power price naturally caps the value of the coin, hence preventing market manipulation. The peer-to-peer market is designed as an overlay to the current distribution system through the coordination of a distributed system operator (DSO). With smart digital meters and sensors, DSOs will have real-time network information and can better balance grid supply and demand. Producers and consumers participating in the market pay fees to the utility companies for use of the distribution grid. We propose to test the proposed conceptual framework on a network of Raspberry Pis, together with simulation software, to allow for quantitative demonstration of the potential efficiency and environmental benefits.

Research Mentor: Andrew Liu, Industrial Engineering

Poster Number: 3258 :: Life Sciences

College of Engineering

Effects of neural coding transformations on stimulus information preservation in the medial geniculate body

Author:

Matthew Tharp

Abstract:

The medial geniculate body (MGB) is the primary sensory input to the auditory cortex. As part of a junction between sensory and cortical neuronal populations, it is suspected that MGB neurons participate in a “coding transformation” of stimulus representation. Throughout the auditory system, sounds are typically represented by a precise temporal organization of neuronal action potentials, or firing patterns. By contrast, cortical auditory representations are more likely to be coded in a manner that is dependent on the frequency of action potentials, or firing rate. While incoming signals to the MGB are mostly temporally coded, outputs to the auditory cortex tend to communicate via rate code. Presently, the dynamics of such a transformation are poorly understood. Specifically, the ability of single neurons to preserve information about stimulus features, such as frequency or loudness, during transformation is uncertain. To delineate possible transformation mechanisms, a model of rat MGB firing patterns was constructed in silico using NEURON software. Spike pattern inputs to MGB models were based on neural activity evoked by presentation of various amplitude-modulated sound stimuli, and resulting MGB output firing patterns were assessed. The correlations between mutual information, firing rate, and vector strength were observed for different stimulus frequencies. Results indicate a strong correlation between mutual information and firing rate, indicating the successful conversion of temporally coded inputs. By the same token, vector strength of outputs displayed a weaker negative correlation with mutual information. While the effects of stimulus modulation frequency, AMPA/NMDA excitatory synaptic receptor density, and stimulus intensity provide some implications for conversion characteristics, it appears that the individual ability of MGB neurons to maintain stimulus characteristics depends upon a relative susceptibility for larger firing rate. Importantly, neuronal properties that increase overall firing likelihood may play a vital role in the mechanism of coding transformation.

Research Mentor: Edward Bartlett, Biological Sciences and Biomedical Engineering

Poster Number: 3068 :: Social Sciences/Humanities

College of Engineering

Expectancy-Value-Cost Beliefs for Graduate Student Versus Professional Advanced STEM MOOC Learners

Author:

Lina Trigg

Abstract:

The expectancy-value-cost (EVC) motivation theory was used to examine the beliefs of graduate students and working professionals in advanced science, technology, engineering, and math (STEM) massive open online courses (MOOC). The EVC theory has three aspects:(1) belief in succeeding at a task, (2) value of the task, and (3) cost of engaging in the task. It is anticipated that both groups will have high Expectancy and Value beliefs but, Cost beliefs may differ due to time commitment along with previous experience. Two research questions are addressed. Are EVC beliefs for graduate students and professionals different? Are the EVC beliefs for these learner groups course topic dependent? The survey consists of nine questions - three for each of EVC - and was administered in the first week's material in four MOOCs offered in 2016 and 2017. Multivariate analysis of variance was conducted to examine group differences in EVC scores. Three main results were found;(1) the EVC results for one course was significantly higher for all learners, (2) professionals had significantly higher Expectancy mean in one course; while Value and Cost means were significantly higher for graduate students in other courses, and (3) the professionals' Expectancy and Value means were significantly higher than the graduate students in general. Course content and other learner demographics will be considered in the results. The key conclusion based on the findings is that these learner groups do have different EVC profiles and the content of the course matters.

Research Mentor: Karrie Douglas, Engineering Education

Poster Number: 3090 :: Physical Sciences

College of Engineering

Finite Element Model Of Mechanical Chain Reaction: The Stick Bomb

Author:

Akanimoh Udombeh

Abstract:

Stick bombs are known to be fun toys but they are also interesting engineering systems. There are numerous configurations that the stick bomb can have. One of the more popular configurations is called a “cobra weave”, because of its resemblance with the patterns found on the scales of a cobra snake. This pattern is made by setting up each individual stick alternately above and below four other sticks perpendicular to it. When one of the sticks is taken out, the remaining sticks fly apart, hence the name stick bomb. In the case of the cobra weave, we observe an even more fascinating result, the propagation of a traveling wave. Analyzing the energy of the sticks in the bent state could be the key to understanding the mechanism of the stick bomb. We suspect that the bending of the sticks makes them to store some potential energy and removing a stick releases this energy resulting in the “explosion” we observe. Analyzing the stick bomb in this way should enable us simulate what happens and this should give us a better understanding of the interactions occurring in the stick bomb.

Research Mentor: Thomas Siegmund, Mechanical Engineering

Poster Number: 3107 :: Life Sciences

College of Engineering

Using Elastin-Like Polypeptides to Achieve Temperature Dependent Control of Gene Expression

Author:

Yu Hong Wang

Abstract:

Elastin-like polypeptides (ELPs) are synthetic molecules that exhibit an interesting property of inverse temperature phase transition; they exist as soluble monomers at low temperatures and form insoluble aggregates at higher temperatures. The transition temperature depends on the pH, salt concentration, and the amino acid sequence of the ELPs. This unique and reversible behavior, along with their high biocompatibility has made them a strategic tool for various biomedical applications. Previous experiments in our lab have used confocal microscopy and fluorescence measurements to view their aggregative behavior in vivo and have generated proof of principle that they can be used to retain commercially important biologics. The present study attempts to create a fusion protein with ELPs and transcription factors so that gene expression might be correlated with ELP's temperature dependent properties. It is hypothesized that transcription shall be at normal levels while the constructs are monomeric while aggregation following temperature change will drastically reduce the activity. A preliminary construct consisting of ELP and green fluorescent protein (GFP) is made to see if the aggregation can be visualized in vivo following fusion of the two constructs. If successful, the results of this project will demonstrate that ELPs can be used as a strategic tool to achieve temperature dependent control of gene regulation.

Research Mentor: Kevin Solomon, Agricultural & Biological Engineering

Poster Number: 3378 :: Physical Sciences

College of Engineering

Testing the Sensitivity of a Neural Based Identification Algorithm to Shielding Levels

Author:

Sophie Weidenbenner

Abstract:

Radionuclide identification is an issue of great importance to nuclear security. The present work aims to investigate the influence of building materials shielding on the identification of a radioactive source by its gamma-ray spectrum. This is especially important for the detection of concealed radioactive sources and contributes to the national effort for nonproliferation and nuclear security. The approach we followed has two main steps. First, we used the Gamma Detector Response and Analysis Software (GADRAS) to simulate gamma-ray spectra with common practical shielding materials of various thicknesses. Subsequently, these simulated spectra were given as input to an identification algorithm based on a Radial Basis Function profile (RBF-profile) library built at Purdue's Applied Intelligent Systems Laboratory. From this algorithm, the relative contribution of counts due to each nuclide in the library was received and the algorithm's sensitivity to various shielding levels was observed.

Research Mentor: Lefteri Tsoukalas, Nuclear Engineering

Poster Number: 3260 :: Physical Sciences

College of Engineering

Size-Velocity PDFs for Drop Fragments Formed via Bag Breakup

Authors:

Catriona White

Grant Sondgeroth

Abstract:

Understanding secondary atomization of droplets directly relates to optimizing aircraft engine performance, pharmaceutical tablet coating efficiency, and agrochemical spray drift. Large droplets lead to lower fuel economy and higher pollutant emissions in aircraft engines. Optimizing pharmaceutical tablet coating drop size will improve drug uptake and patient comfort. Finally, agrochemical usage and spread can be better predicted and mapped to limit the spread into surrounding residential and environmental zones. Digital Inline Holography (DIH) was used to capture high resolution, three-dimensional videos with high framing rates (20 kHz) using a 5 cm diameter laser beam and a high-speed camera. Drop breakup was analyzed for Weber Numbers (We) between 11 and 30. The apparatus consisted of a CW laser, spatial filter, collimator, an air jet and drop generator, and a the DIH system. The air jet had a nearly uniform velocity profile, while the drop generator was positioned to release 3 mm diameter drops above its centerline. The initial height of the drop was chosen such that the breakup processes were similar to those for a shock tube. Drop We was varied from 11 to 30 by changing the air jet velocity. A Photron SA-Z camera was used to collect the DIH holograms, which contained 3D fragment size and position data during breakup. Fragment velocity was determined from positions in adjacent image pairs for each reconstructed hologram using a MATLAB code. The DIH data were used to create probability distribution functions for drop fragment sizes and velocities. Results were plotted against drop We as they pertain to primary physical characteristics and trends that are discussed.

Research Mentor: Paul Sojka, Mechanical Engineering

Poster Number: 4380 :: Life Sciences

College of Health and Human Sciences

Within Meal Variability of Eating Efficiency in Children with Unilateral Cerebral Palsy

Author:

Jasmine Anguiano

Abstract:

Eating efficiency, measured as average bite/sip duration during a meal, is a new measure developed in our lab found to correlate with severity of swallowing disorders (dysphagia) in children with cerebral palsy (CP). Although it is often assumed that these children experience fatigue during a meal, it is unknown if eating efficiency changes throughout the meal. The aim of this preliminary study was to examine the variability of eating efficiency within a meal in a group of children with unilateral CP.

Ten children (5 males and 5 females) with unilateral CP (6;6 to 17;6yoa) participated. Eating efficiency was assessed during a videotaped single meal, which was divided into three equal temporal parts for analysis. Eating efficiency was measured for each part. A one-way repeated measures ANOVA was completed to examine differences in eating efficiency between the three parts.

On average, children were more efficient (consumed more bites/sips) during the second and third parts of their meal (mean 27 and 23 bites/sips per part, respectively) compared to the first part (mean ~18 bites/sips). However, this difference was not statistically significant ($p=0.39$).

Eating efficiency did not substantially change throughout the meal in a group of children with unilateral CP, however descriptively eating efficiency increased as the meal progressed. Even though the children were able to consume on average more bites/sips as the meal progressed, it is unclear if their feeding and swallowing functions remained stable or became worse. We plan to complete feeding evaluations separately for these three parts to further understand if efficiency is beneficial or hinders swallowing function.

Research Mentor: Georgia Malandraki, Speech, Language, and Hearing Sciences

Poster Number: 4075 :: Social Sciences/Humanities

College of Health and Human Sciences

"Contraception is God's gift to humanity!": Family planning decision-making among women living in Italy

Author:

Kelsie Basile

Abstract:

Italy has one of the lowest birth rates in the European Union, yet the majority of Italian women report engaging in unprotected sexual intercourse. Women report using less effective contraceptive options (i.e., the pill, natural family planning), despite high acceptability of non-daily methods, serving as an example of an imperfect contraceptive society. Literature gaps persist despite recent research on contraceptive knowledge and uptake among Italian women.

The purpose of this study was to assess contraceptive knowledge, attitudes, and behaviors of reproductive-aged women living in or near Florence, Italy to empower women in their sexual and reproductive health care decision-making

As part of a larger mixed methods study, researchers conducted 46 interviews (June-July, 2017) with women aged 18-45 living in or near Florence, Italy who used the Italian healthcare system. Researchers used techniques from expanded grounded theory to explore women’s contraception decision-making and use. HyperRESEARCH 3.7.5 assisted in data organization and analysis. Researchers utilized a constant comparative method to contextualize the data and identify emergent themes.

The mean age participant (N=46) was 32.1±6.3 years (range=19-45). Resulting themes were related to pregnancy prevention, religion, access, and body function. Condoms and birth control pills were the most frequently used contraceptive methods among participants.

Negative contraception perceptions may lead to decreased use and/or difficulties accessing hormonal and non-hormonal contraception for women living in Italy. Increased public health messaging and healthcare professional training regarding how contraception works and what methods are available could reduce confusion and stress. Findings offer practical recommendations to guide contraceptive decision-making within reproductive healthcare in Italy to increase women’s involvement and empowerment in decision-making and use.

Research Mentor: Andrea DeMaria, Consumer Science

Poster Number: 4251 :: Life Sciences

College of Health and Human Sciences

PGC-1α Adenovirus Transfection in Human Primary Skeletal Muscle Myotubes

Authors:

Katherine Bender

Zachary Hettinger

Shihuan Kuang

Abstract:

Introduction: Peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1α) is the master regulator of mitochondrial biogenesis. In skeletal muscle, PGC-1α is increased with endurance exercise and promotes positive benefits in addition to mitochondrial biogenesis. To investigate potential benefits of PGC-1α, skeletal muscle cells were transfected with adenovirus containing PGC-1α. Methods: Adenovirus amplification and purification was completed in HEK 293a cells. Human primary skeletal muscle myotubes were transfected with the crude PGC-1α containing virus and PGC-1α content was analyzed using western blotting and immunofluorescent staining. Results: PGC-1α overexpression was confirmed using immunofluorescence and western blotting identified a 26X fold change PGC-1α vs. GFP control. Conclusion: These findings demonstrate that amplification using HEK 293a cells effectively overexpresses PGC-1α in human primary skeletal muscle myotubes.

Research Mentor: Tim Gavin, Health and Kinesiology

Poster Number: 4051 :: Life Sciences

College of Health and Human Sciences

Binding Interactions between the Herbicide Atrazine and Functionalized or Nonfunctionalized Graphene Nanoplatelets

Author:

Nudar Bhuiya

Abstract:

Atrazine, the second most common agricultural herbicide used in the U.S., is often reported to contaminate drinking water sources above the current U.S. EPA regulatory level of 3 parts per billion (ppb), resulting in human exposure. Graphene nanoplatelets (GNPs) are an emerging nanoparticle with potential uses for the remediation of environmental contamination. This study's aim is to determine binding interactions between atrazine and GNPs to mimic a mixture composition. To evaluate binding interactions, GNPs with different functional groups (none, carboxylated, aminylated) were evaluated. GNPs at concentrations of 0, 0.5, 1, 2, or 3 mg/ml were incubated with atrazine at 3 ppb for 24 hours. Following incubation samples were centrifuged and supernatant was collected. The supernatant was used to quantify the concentration of atrazine using an Abraxis Atrazine ELISA assay. The assay detected the unbound atrazine, therefore a subtractive method was used to calculate the percent of atrazine bound to the GNPs. The data demonstrated that as the concentration of GNPs increased, the percent of atrazine bound increased until it plateaued between 2-3 mg/ml of GNPs. The nonfunctionalized GNPs bound the most atrazine compared to the functionalized GNPs. Future directions include beginning chemical exposures with mouse macrophages and the zebrafish model system to determine possible alterations in toxicity resulting from atrazine association by GNPs.

Research Mentors: Jennifer Freeman, Health Sciences; Jonathan Shannahan, Health Sciences

Poster Number: 4020 :: Life Sciences

College of Health and Human Sciences

How speech errors change with disease progression in Parkinson's disease

Author:

Casie Blair

Abstract:

A speech error may occur at the phonology, morphology, syntax, lexical, social, contextual, and conceptual levels. Speech errors occur due to a host of self-monitoring, speech motor, and speech planning problems. Speech errors such as mazes are studied most commonly in cross-language studies between Spanish and English or in children with and without language disorders. The purpose of this presentation is to expand the examination of speech errors to an adult neurogenic population: individuals with Parkinson's disease. The motor speech changes in Parkinson's disease may influence and increase the use of speech errors in comparison to age- and sex-matched typical older adults. Categories of speech errors depending on length of error, form of error, and function of error were developed for this project based on prior literature. Data will be presented from 4 people with Parkinson's disease and 4 age- and sex-matched older adults.

Research Mentor: Jessica Huber, Speech, Language, and Hearing Sciences

Poster Number: 4263 :: Social Sciences/Humanities

College of Health and Human Sciences

Adaptive Behavior Skills Deficits in Early Development of Children with Neurogenetic Disorders

Authors:

Madison Brewer

Amber Swint

Ziyuan Zhang

Abstract:

Adaptive behavior skills are used by an individual to meet their everyday needs and include domains such as communication, motor abilities, socialization, and daily living skills. Children and adults with neurogenetic syndromes (NGS) often show deficits in these skills, however, it is unclear how atypicalities unfold in early development. The present study compared adaptive skills in infants and toddlers who were typically developing (TD) with children of various NGS – Angelman syndrome (AS), Williams syndrome (WS), and Prader-Willi syndrome (PWS). We hypothesize that the NGS group would show lower adaptive behavior skills in early development, particularly in AS.

Mothers of 72 children (16 WS, 13 AS, 13 PWS, and 30 TD; age M=25.802 mo) completed the Vineland Adaptive Behavior Scales semi-structured interview as part of an ongoing study. We analyzed Adaptive Behavior Composite (ABC) scores using Wilcoxon-Mann-Whitney tests to compare scores across groups.

Our results showed that ABC scores were higher in the TD group (M= 92.667, $p<.001$) relative to the NGS groups. Among syndrome groups, children with WS (M=72.313) and PWS (M=73.462) showed similar abilities ($p>.05$), but children with AS symptoms showed the lowest scores (M=53.154, $p<.001$). Final analyses will examine subdomains of adaptive behavior in an expanded sample.

Our findings suggest that children with NGS show more deficits in adaptive skills than neurotypical children, even in early development. These results support the importance of early adaptive behavior screenings for children at risk for NGS, particularly in children with AS.

Research Mentor: Bridgette Tonnsen, Psychological Sciences

Poster Number: 4033 :: Social Sciences/Humanities

College of Health and Human Sciences

Evaluating Job Satisfaction of Local Speech-Language Pathologists in School Settings

Author:

Breeah Carey

Abstract:

The focus of this research is to propose solutions to a current problem in the world of speech language pathology. Literature shows that there is a shortage of speech language pathologists (SLPs) nationwide. The American Speech Language Hearing Association (ASHA) reports that reasons for decreased job satisfaction include high caseloads and lack of collaboration time among other things. Local speech language pathologists in the Greater Lafayette area were anonymously surveyed to gain insight into their jobs and how they feel about their professions. Implementable solutions and plans were proposed that will aim to increase job satisfaction and could possibly result in a rise in the number of SLPs serving in school systems.

Research Mentor: Jason Ware, Honors College

Poster Number: 4138 :: Social Sciences/Humanities

College of Health and Human Sciences

Parental Differential Treatment and Adolescent Adjustment in the Context of Parent-Child Relationships

Author:

Olivia Clem

Abstract:

Extant literature has consistently demonstrated an association between parental differential treatment (PDT; or adolescents' perceptions of being favored or unfavored by each parent compared to their sibling) and adolescent antisocial and depressive symptoms. However, there has been little work on influential contexts in which the association between PDT and adolescent adjustment occurs, especially within the parent-child relationship dynamic. The current study addresses this gap in the literature by focusing on parent-child relationship quality as a moderator of the association between adolescents' perception and interpretation of PDT and adolescent antisocial and depressive behavior. This study draws from the US-based Non-shared Environment in Adolescent Development study. The sample consists of 708, predominantly White (94%), families of twins and siblings. Utilizing R(lavaan), multiple regression analyses were conducted, using Full Information Maximum Likelihood to accommodate missing data. Results regarding main effects of PDT replicated previous work: PDT and adolescent antisocial and depressive behaviors were significantly associated. Further, we found significant interactions between PDT and parent-child relationship quality for both adolescent antisocial and depressive behaviors. For instance, for older siblings who reported more mother-child negativity, levels of maternal PDT did not influence antisocial behavior; however, among older siblings who reported lower levels of mother-child negativity, higher maternal PDT was associated with increased antisocial behavior. These findings suggest that poorer mother-child relationships is associated with lower sensitivity to PDT for older siblings. Additional models (e.g., models of depressive symptoms, models including fathers' PDT, parent-child positivity, and models including younger siblings) will be discussed during the poster presentation.

Research Mentor: Kristine Marceau, Human Development and Family Studies

Poster Number: 4071 :: Social Sciences/Humanities

College of Health and Human Sciences

Children Diagnosed with ADHD Display Increased Prosocial Behaviors with Animal-Assisted Intervention

Author:

Hannah Collins

Abstract:

Currently, intervention for Attention Deficit Hyperactivity Disorder (ADHD) symptoms include: pharmacological, psychological, and behavioral therapy. This study examines whether the use of a novel intervention technique, interaction with a dog, increases the amount of prosocial behaviors, talking, and gesturing in children diagnosed with ADHD. Interaction with animals has been found to lower stress levels and increase happiness and self-esteem. Therefore, we hypothesize that interacting with a dog will increase prosocial behaviors, talking, and gesturing in children with ADHD. Thirty-six children between the ages of 7 and 9 participated in group Cognitive Behavioral Therapy (CBT) sessions and were randomly assigned to two different conditions. The control condition had a toy dog and the experimental condition had a live dog that was present during all of the CBT sessions. Both conditions wrote in journals, read books to a group, and learned coping mechanisms during CBT sessions. All sessions were video-recorded and three minutes from each session were randomly selected for behavioral coding. In total, 328 minutes of recorded videos were behaviorally coded using the Observation of Human-Animal Interaction for Research-Version 3 (OHAIRE-V3) Coding System. The findings suggest that the presence of dogs is positively correlated to prosocial behaviors, talking, and gesturing.

Research Mentor: Kerri Rodriguez, Comparative Pathobiology

Poster Number: 4164 :: Social Sciences/Humanities

College of Health and Human Sciences

Positive Moments and Relationship Outcomes: Which Relationship Interactions Benefit Insecure Individuals?

Author:

Emmy Denison

Abstract:

Individuals with insecure attachment styles often experience poor outcomes in their relationships. But not all forms of attachment insecurity are the same. Anxiously attached individuals fear their partner will abandon them or not be available when they need them, while avoidant individuals are reluctant to trust and depend on their partner and prefer to be independent. The current study focused on specific interactions with a relationship partner that are theorized to increase attachment security. For relatively avoidant individuals, fun and novel interactions (fun-focused condition) were predicted to increase closeness and relationship quality, relative to a control condition or to interactions that promote emotional intimacy (relationship-focused condition). For anxious individuals, fun-focused and relationship-focused interactions were both predicted to increase positive outcomes, compared to a control. Couples were screened to ensure one partner was secure and the other was either anxious, avoidant, or secure. During the initial lab session, the secure partner received instructions to either try fun new things with their partner (fun-focused), show their partner how much they care about them (relationship-focused), or focus on their morning routines (control) during the weeks following the lab session. A 10-day diary period followed the lab session, in which participants completed daily measures of closeness and relationship quality. This study highlights a novel method of delivering an intervention to one (secure) couple member, in order to affect the target couple member. Data collection is ongoing, and initial findings will be presented. This study is relevant to developing strategies partners can use in their daily lives to reduce the negative effects of attachment insecurity.

Research Mentor: Ximena Arriaga, Psychological Sciences

Poster Number: 4092 :: Social Sciences/Humanities

College of Health and Human Sciences

"It's part of being a woman!": Menstruation-related knowledge, attitudes, and behaviors among women living in Italy

Authors:

Chandler Dykstra

Morgan Boncyk

Abstract:

Menstruation remains a stigmatized condition in many parts of the world. Current literature demonstrates culture and religion influence women's attitudes toward menstruation. Women often attempt to conceal menstruation, expressing feelings of shame and fear related to perceptions of uncleanliness or contamination. Most menstruation literature primarily focuses on women living in the United States, with limited research regarding geographically-diverse women's attitudes and beliefs about menstruation. The current study sought to understand Italian women's attitudes and behaviors toward menstruation including menstruation management and cultural antecedents impacting practices and/or emotions.

A two-phase study, including a web-based survey and in-depth interviews, was conducted. Individual interviews occurred in May to August 2017, while survey collection is ongoing through December 2017 with 86 completed surveys collected to date. Participants were reproductive-aged women, aged 18-45 years, utilizing the Italian healthcare system, who lived in or near Florence, Italy.

Emerging themes included: 1) Experiences with menarche; 2) Menstruation education and communication; 3) Menstrual management; and 4) Side effects and complications associated with menstruation. Women revealed their menarches were vivid memories; however, most women had not received proper education or preparation for what to expect prior to onset. Women expressed relief at the beginning of each menstrual cycle, yet many women noted the side effects of menstruation were akin to illness. In line with dominant cultural narratives related to menstruation, Italian women prioritized cleanliness, often utilizing the bidet more frequently during this time.

Results of this study provide insight into Italian women's attitudes toward menstruation and an in-depth description of menstruation management behaviors including maintenance and cleanliness products. Findings provide practical recommendations to inform public health and education interventions and offer direction for clinicians to better understand women's concerns and insecurities regarding menstruation.

Research Mentor: Andrea DeMaria, Consumer Science

Poster Number: 4018 :: Social Sciences/Humanities

College of Health and Human Sciences

Capturing UX Practitioner Conversations About Ethical Design on Twitter

Authors:

Madison Fansher

Shruthi Chivukula

Abstract:

There is increasing interest in the role that ethics plays in UX practice, however current guidance is largely driven by formalized frameworks and does not adequately describe “on the ground” practitioner conversations regarding ethics. In this study, we identified and described conversations about a specific ethical phenomenon on Twitter using the hashtag #darkpatterns. The term “dark patterns” was created by UX designers to describe design techniques that often employ some sort of user deception for the benefit of a stakeholder. We collected 458 tweets containing “#darkpatterns” over the course of four months and then determined the authors of these tweets and analyzed the types of artifacts or links they shared. Prior research establishing specific categories of unethical design allowed us to classify the artifacts shared based on the manipulative techniques employed. We found that UX practitioners were most likely to share tweets with this hashtag, and that a majority of tweets either mentioned an artifact by providing an image or link to a dark pattern. Another common theme among the tweets was that authors would often “shame” specific organizations engaging in manipulative UX practices. These tweets and the conversation they represent have the potential to provide insight into designer practices, concerns, and potential remedies that could impact ethics scholarship in the HCI community.

Research Mentor: Colin M. Gray, Computer Graphics Technology

Poster Number: 4218 :: Social Sciences/Humanities

College of Health and Human Sciences

Effects of a Generative Language Training Program Using a Mobile Technology Application

Authors:

Morgan Fawbush

Megan Smit

Katelyn Warner

Oliver Wendt

Abstract:

One of the hallmarks of severe Autism is a “delay in, or total lack of, the development of spoken language” (American Psychiatric Association, 2013). Many use alternative communication strategies such as tablets and other mobile devices. However, alternative communication can restrain output, and utterances are often limited to single-word responses. A language intervention training called matrix training is used to systematically teach longer word combinations, as well as to build up vocabulary. As the name suggests, words are arranged in a matrix format. Some phrases are taught directly, and others develop without explicit instruction. This study aimed to answer: 1. Does matrix training with a mobile application, SPEAKmore!, facilitate production of new word combinations? 2. Do newly learned skills generalize to untrained word combinations? An experimental multiple probe design (Horner & Baer, 1978), was used across sets of action-object combinations with generalization probes of untrained combinations. This design was implemented with three participants, between 7-16 years, diagnosed with minimally-verbal autism. These students were taught action-object combinations on a 6x6 matrix with SPEAKmore! The results show a pattern of successful acquisition during intervention, as well as the generalization to untrained stimuli. Participants mastered, on average, over 80% correct of the presented stimuli, and performance remained constant. Generalization skills increased steadily during intervention. Effect sizes as measured by the Non-overlap of all Pairs Index reveal medium-strong to strong effects. This suggests that matrix training through a mobile application may be a promising approach to teach new vocabulary and enhance the complexity of utterances in severe autism.

Research Mentor: Oliver Wendt, Speech, Language, and Hearing Sciences

Poster Number: 4301 :: Life Sciences

College of Health and Human Sciences

Differential Response of Mouse (RAW264.7) and Human (U-937) Macrophages Following Exposure to Copper Oxide Nanoparticles

Authors:

Lexi Ferngren

Sherleen Adamson

Abstract:

Copper Oxide (CuO) nanoparticles (NPs) have diverse applications in electronics, optics, sensors, catalysts, and medical applications. Due to the widespread use, increased production, and biomedical applications of CuO NPs, human exposures are continuing to increase in occupational, environmental, biomedical, and commercial settings. Inhalation is the primary route of NP exposure. Macrophages residing in the lung serve as the first line of defense against extrinsic particulates. Therefore, to evaluate the toxicity of NPs, it is necessary to investigate the biological responses of macrophages following exposure. The current study was designed to compare the differential immune response of mouse (RAW264.7) and human (U-937) macrophages following CuO NP exposure. After a 72 h-culture, RAW cells proliferated significantly faster than U-937 monocytes. The addition of phorbol 12-myristate 13-acetate (PMA) in the culture media at 100 ng/mL induced the differentiation of U-937 monocytes into macrophages. Upon differentiation, floating U-937 monocytes attached to the culture surface showing macrophage morphology. RAW and PMA-differentiated U-937 cells were exposed to 0, 6.25, 12.5, 25, 50, 100, 200, and 400 µg/mL of CuO NPs for 24 h to determine cytotoxicity utilizing the MTT assay. We observed significant cell death in RAW cells exposed to 50 - 400 µg/mL of CuO NPs. Whereas the PMA-differentiated U-937 macrophages started to demonstrate significant cell death at concentrations equal to or higher than 100 µg/mL. The cellular uptake of CuO NPs was evaluated using atomic absorption spectroscopy (AAS). Following a 24 h exposure to 0, 25, or 50 µg/mL of CuO NPs, RAW and U-937 macrophages were harvested, digested, and analyzed by AAS to determine cellular Cu content. Our AAS results demonstrated that mouse macrophages internalized more CuO NPs than human macrophages. These findings indicate that mouse macrophages have a higher capacity to internalize NPs compared to human macrophages which may explain their enhanced susceptibility to CuO NP exposure. Our ongoing studies will continue comparing the surface expressions of receptors and transporters, inflammatory response, and toxicity consequences of these two chosen cell lines.

Research Mentor: Jonathan Shannahan, Health Sciences

Poster Number: 4189 :: Social Sciences/Humanities

College of Health and Human Sciences

Teaching Preschool Special Education Teachers to Implement Function-Based Supports for Challenging Behavior

Authors:

Kathryn Fleming

Anna Hershberger

Abstract:

Preschool special education teachers are often undertrained and under supported in assessing, preventing and responding to challenging behavior (Hemmeter, et al., 2016). When undertrained teachers work with young children with disabilities, there is increased risk for escalating challenging behavior (Giangreco, Broer, & Suter, 2011).

To address these issues, we designed a professional development program titled, Supporting Teachers in Evidence-Based Practices using Practice-based coaching (STEPP). STEPP integrates empirical knowledge bases of early childhood special education, teacher professional development, and practice-based coaching to improve teacher pedagogy and practical application of research-based methods for challenging behavior assessment and intervention. STEPP is delivered over a 16-week period and includes two half-day workshops and weekly practice-based coaching sessions. In the first workshop, teachers learn about practice-based coaching and functional behavior assessment. In the second workshop, teachers learn about designing and implementing function-based intervention. Following each workshop, teachers participate in weekly practice-based coaching sessions in which they learn how to assess their own learning needs, set goals for improving their practices, make action plans to meet those goals, self-monitor their implementation of target practices, and make data-driven decisions.

In this poster, we present on data and pre- and post-STEPP training measures of teacher self-efficacy in functional behavior assessment and in function-based intervention using The Teacher Sense of Efficacy Scale. We also present data on how STEPP influenced teacher knowledge and skills in implementing functional behavior assessments and usage of function-based intervention to prevent challenging behavior and promote positive social-communicative interactions with other children.

Research Mentor: Mandy Rispoli, Educational Studies

Poster Number: 4103 :: Social Sciences/Humanities

College of Health and Human Sciences

Health Disparities in Lake County, IN

Author:

Hannah Gallion

Abstract:

EPA's superfund sites contain environmental contaminants which have the potential to cause adverse health effects on communities living near or in the area. The superfund site in East Chicago, Indiana has elevated lead and arsenic concentrations. Lake County, IN has other industrial sites that may also contribute to environmental contamination. The goal of this project is to determine whether health indicators in Lake County, IN indicate poorer health than in other regions, possibly due to the superfund site and other industrial warehouses. Data on life expectancy, all-cause mortality, and selected cause-specific mortality rates for each county was obtained from the Global Health Data Exchange website. The standard error and standard deviation were found using the population, median, upper limit, and lower limits given for each category. From there summary data statistical analyses were run to find if there were statistical differences between Lake County and other surrounding counties. To date, statistical analysis of life expectancy, all-cause mortality, ischemic heart disease mortality (IHD), cardiovascular disease mortality (CVD) and cerebrovascular disease mortality (CVA) of Lake County and the six surrounding counties has been completed. The results show that there is a significant difference in life expectancy, all-cause mortality, and IHD between Lake County and surrounding counties ($p < 0.01$) as well as CVD ($p=0.003$). Lake County ranks in lower range of these values if not the lowest for most categories. In ongoing work, we are repeating these statistical analyses on a group of counties with demographics similar to Lake County.

Research Mentor: Ellen Wells, Health Sciences

Poster Number: 4057 :: Social Sciences/Humanities

College of Health and Human Sciences

Parent Perceptions of Psychological Assessment in Neurogenetic Syndromes

Authors:

Tessa Garwood

Samantha Howell

Abstract:

Developmental assessments are often stressful for parents of children with rare neurogenetic syndromes, especially when little is known about expected developmental trajectories. The present study is an ongoing evaluation of assessment concerns in families of children with fragile X syndrome (FXS) and other neurogenetic syndromes. Parents of children with various neurogenetic syndromes (n=33) completed an online questionnaire designed to measure anticipated areas of concern regarding their child's most recent developmental assessment. Quantitative results in the domains of cognitive testing, parent-report questionnaires, and written feedback were measured using Likert scales (1="strongly disagree";5="strongly agree"). Parents could also provide qualitative responses to contextualize their quantitative responses. Primary quantitative results indicated parental agreement that assessment feedback was helpful in identifying areas of child weakness and developing future care plans. No significant differences were found in assessment perception between FXS and other syndromic groups. Preliminary qualitative analysis suggested parental frustration involving lack of focus on child strengths and over-standardization of the assessment process. Considerations for future analysis may include expanding to a larger and more diverse sample, exploring causes of variance in assessment satisfaction, and expanding analysis to other components of developmental assessments. These results will inform better development of future assessment protocols that may ensure assessment experiences are as informative and positive as possible for both parent and child.

Research Mentor: Bridgette Tonnsen, Psychological Sciences

Poster Number: 4331 :: Life Sciences

College of Health and Human Sciences

Monitoring Leucine-Rich Repeat Kinase 2 Activity in Parkinson’s Disease

Author:

Chace Henning

Abstract:

In Parkinson’s Disease (PD), mutations in the Leucine-Rich Repeat Kinase 2 (LRRK2) gene are closely linked to the neurodegeneration in familial and sporadic cases. One of these mutations, G2019S, located within LRRK2’s kinase domain, increases its kinase activity, thus causing neuronal death. Protein kinases play a vital role in various diseases and cellular processes by modifying other proteins through phosphorylation. Understanding the role of LRRK2 in cells is important for developing treatment for PD. However, the large size of LRRK2 and the complexity of cellular signaling makes it difficult to study LRRK2 kinase activity using currently available techniques. Our goal is to develop a LRRK2 fluorescent biosensor to monitor its kinase activity in different cellular environments. LRRK2 dependent phosphorylation changes the sensor conformation that can be detected by Förster Resonance Energy Transfer (FRET), where a donor fluorescent protein (FP) non-radiatively transfers energy to an acceptor FP in close proximity. Here, we will present the development and characterization of a LRRK2 sensor.

Research Mentor: Mathew Tantama, Chemistry

Poster Number: 4170 :: Life Sciences

College of Health and Human Sciences

Changes in Cellular Prion Protein Following Manganese and Lead Coexposure

Author:

Erin Kay

Abstract:

The prion protein (PrP) is known to play a critical pathogenic role in the prion disease, an infectious spongiform encephalopathy typically seen in the “mad cow” disease or prion protein scrapie (PrPSC). The natural function of cellular prion protein (PrPC) is hypothesized to be a Cu-binding protein with a potential role in cellular Cu transport and uptake. It is known that Mn exposure can increase prion protein levels in the brain. This study was conducted to test the hypothesis that Mn and Pb coexposure to PrPC changes its expression and localization. We will use a Z310 cell line established by this lab as a cellular model of the BCB. Our work has shown that mRNA levels did not change upon exposure to Mn. We immunostained Z310 cells for PrPC and counterstained with nuclear stain Topro-3 to visualize changes in localization and levels of PrPC expression. We expect to see an increase of PrPC following Mn exposure and perhaps a greater increase in Mn and Pb coexposed groups. This work may have clinical implications for welders, smelters and those living near those industries.

Research Mentor: Wei Zheng, Health Sciences

Poster Number: 4146 :: Life Sciences

College of Health and Human Sciences

Postural strategies while performing a manual task on an unstable support surface

Authors:

Madison Koester

Kennon Little

Carly McKean

Angela Tharp

Abstract:

Motor behaviors performed in daily life typically require people to perform multiple tasks simultaneously. For example, standing while putting away groceries requires individuals to maintain balance while performing precision movements with their hands. Past research examining the performance of multi-task behaviors in young adults has demonstrated that balance becomes less stable when performing a concurrent manual or cognitive task, suggesting manual behavior may be prioritized. This counterintuitive finding may have emerged because laboratory-based motor tasks are often examined while participants stand on a stable surface. In this study, we therefore examine if the prioritization between posture and manual movements changes when balance becomes more challenged (i.e. standing on an unstable surface).

Three out of an anticipated 15 healthy college-aged participants performed a standing precision manual task that required them to fit a block into either a large or small opening while standing on either a stable or unstable surface. Forty trials were performed within each of the four unique fitting conditions. An uncontrolled manifold analysis (UCM) was conducted using full body kinematic and kinetic data. This analysis examines how individuals coordinate multiple body segments to complete the task. We found that young adults successfully performed a difficult postural and manual task without the need to prioritize either behavior when standing on a stable surface. Interestingly, manual control was prioritized at the expense of balance when the support surface was unstable. Future work will examine if issues related to postural prioritization contribute to fall risk and injury in older adults.

Research Mentor: Jeffrey M. Haddad, Health and Kinesiology

Poster Number: 4078 :: Social Sciences/Humanities

College of Health and Human Sciences

Do End of Life Treatment Preferences Drive Prognosis Discussions in Palliative Care?

Author:

Morgan Kramer

Abstract:

Prognosis communication is a key element of palliative care consultations. End of life treatment preferences might influence whether and how patients, families and palliative care teams discuss prognoses. This paper examines patients' end of life treatment preferences at the time of referral and their relation to the occurrence and characteristics of prognosis discussions during palliative care consultation.

We enrolled 240 hospitalized patients with advanced cancer into a multi-site longitudinal palliative care cohort study. Prior to palliative care consultation, we assessed patient's preferences for medical treatment in the last months of life (comfort care, survival, and no preference). We then audio recorded the palliative care consultations and analyzed these conversations for the presence of prognosis discussions. This analysis reports findings from the first 193 coded conversations.

Seventy-nine percent (152/193) contained some Prognosis Talk. Prognosis Talk occurred more frequently among patients who endorsed a preference for comfort-oriented EOL treatment compared to those who endorsed a preference for longevity-oriented EOL treatment (OR=3.1; 95% CI=1.1, 9.0). This association persisted when controlling for age, gender, race, education, functional status, and quality of life. The prevalence of conversations including both quality-of-life and survival Prognosis Talk was highest among patients having strong preferences for EOL comfort-oriented treatment (53%) followed by those with no strong preference (34%) and lowest among those with strong preferences for longevity-oriented EOL treatment (23%, p=0.02).

Conversations involving patients who have formed comfort-focused treatment preferences in the last months of life are more likely to engage in prognosis discussions with palliative care team members. Among these discussions, the occurrence of quality of life and longevity prognoses significantly differs based on end of life treatment preferences.

Research Mentor: Stewart Chang Alexander, Consumer Science

Poster Number: 4384 :: Life Sciences

College of Health and Human Sciences

Medical Uniforms and Transmissions of Infectious Agents

Authors:

Anna Krefta

Ryan Neligan

Elise Guveiyian

Sarah Leuther

Kiley Wendt

Kayla Ritzenthaler

Sharon Benjamin

Abstract:

Healthcare providers have frequent exposures to infectious agents in the healthcare environment. Controlling where uniforms go before and after patient care may be a significant public health issue. The focus of this study was on the transfer of infectious agents via medical uniform.

The purpose of this study was to examine the perspectives of healthcare providers on the hygiene of medical uniform. The setting of the study was three hospital units in Midwest.

For data collection, a five-item questionnaire was distributed to healthcare providers. Items on the questionnaire included (A) uniform washing (1) frequency, (2) method, (3) policy, and (4) education, and (B) outside of hospital facilities where attire is worn.

The preliminary results showed that 76% of the healthcare providers that completed the questionnaire wash their scrubs after every shift, while 19% wash their uniforms on a weekly basis. Results also revealed that 95% reported wearing their medical uniform to additional public facilities, with gas station and supermarket been the most common places. In addition, 57% reported washing their medical uniform along with other clothing. Furthermore, 85% reported that additional education and healthcare policies on uniform hygiene are not necessary.

With the recent incidence rate of flu in the country, policies regarding medical uniform hygiene may be needed to ensure that healthcare providers are not wearing contaminated uniforms to healthcare facilities and public places such as supermarkets. Such policies if followed by healthcare providers, may have significant positive implications in reduction of outbreak and incidence of infectious diseases.

Research Mentor: Mopelola Tolulola Adeola, Nursing

Poster Number: 4355 :: Life Sciences

College of Health and Human Sciences

Oral-Mandibular Side Effects of Brain Radiotherapy

Author:

Natalie Lamport

Abstract:

In humans, common oral-mandibular side effects of head and neck irradiation include xerostomia (dry mouth) and osteoradionecrosis (bone death). Both of these afflictions may lead to severe discomfort, difficulty eating, and other complications. In our prior work with a mouse model of brain irradiation we had observed oral side effects that led to weight loss and MRI abnormalities in the jaw region. Animal survival rates were heavily impacted by the severity of their oral side effects. There is currently no established mouse model of oral osteoradionecrosis. The goal of this study is to track fine structural changes in the oral-mandibular region following brain irradiation. Female 8-9 week old BALB/c mice were irradiated at 10, 20, 30, 40, or 50 Gy with a 5 x 5 mm square beam to the left side of the head. This is the irradiation procedure, but with different doses, that we had used to model brain injury and with which we had seen magnetic resonance imaging (MRI) abnormalities. The MRI and histological procedures used in this study reveal curious pathology of the mandible, salivary glands, and surrounding tissues that will be key in explaining patient signs and symptoms. A clearer understanding of these changes will be useful in selecting drugs to prevent, correct, or compensate for oral-mandibular side effects following brain radiotherapy.

Research Mentor: Carlos Perez-Torres, Health Sciences

Poster Number: 4140 :: Social Sciences/Humanities

College of Health and Human Sciences

Behavioral Differences of Children Raised by Same-Sex versus Different-Sex Adoptive Parents

Author:

Harlie Lane

Abstract:

Adoptive parenting is a much-studied phenomenon; however, most previous research has focused on different-sex adoptive parents. Same-sex parents often face stigma related to their family composition, although limited research has focused on understanding whether parent sex is associated with child outcomes. Thus, the current study examined behavioral outcomes of adopted children at Meanage 7.22 years (SD = 1.01) raised in same-sex and different-sex parent households. We hypothesized that children raised in same-sex parent households would not differ from children raised by different-sex parents in terms of internalizing, externalizing, and total behavior problems.

Participants were drawn from the Early Growth and Development Study (EGDS; Leve et al., 2013), a prospective study of birth parents and adoptive families. Families were initially selected based on available data for same-sex parent dyads. Different-sex parent dyads were 1-1 matched on child gender and age at adoption placement, and approximately matched (based on mean, median, and range) on demographic variables (e.g., parental age, education, household income) and birth parent problem behaviors (indexing genetic risk) in order to ensure no systematic differences in other adoptive parent and child characteristics that could affect findings. The final sample included 60 families (30 same-sex and 30 different-sex dyads). Data were analyzed using independent samples t-tests.

Overall, there were no significant differences in child internalizing behaviors, $t(56)=-0.65$, $p=0.521$, externalizing behaviors, $t(56)=-1.43$, $p=0.157$, and total behavior problems, $t(56)=-0.98$, $p=0.331$, for children raised by different-sex vs. same-sex parents, suggesting that the composition of adoptive parent dyads did not significantly impact child outcomes.

Research Mentor: Kristine Marceau, Human Development and Family Studies

Poster Number: 4325 :: Social Sciences/Humanities

College of Health and Human Sciences

Designing Effective Mental Health Services for International Students in the United States: A Systematic Qualitative Review

Authors:

Zehan Li

Ankita Krishnan

Abstract:

Mental health stressors are prevalent among college-aged international students, the largest growing student population in the United States. Several university institutions have designed and developed mental health services and programs for students. However, despite the substantial number of studies on mental health programs for international students, many of these services and programs are not science-based and lack concrete criteria for evaluating program effectiveness. This qualitative review systematically examined the key factors in designing effective mental health programs and university policies for international undergraduate students. Approximately twenty studies published between 2000 and 2018 in peer-reviewed journals and dissertations were reviewed. Results indicate that an effective program consistently contains factors that address stigma reduction, culturally-sensitive help-seeking methods, awareness of gender differences, and acculturation education. Future implications for developing evidence-based mental health programs by university administrators to increase international student well-being, as well as other limitations, are discussed.

Research Mentor: David Rollock, Psychological Sciences

Poster Number: 4046 :: Social Sciences/Humanities

College of Health and Human Sciences

Creating the Authentic Chinese Hotel Experience: A Case study of the SCHOTEL brand

Author:

Yizhu Liao

Abstract:

After an initial period of consumer preference for foreign brands, China is seeing growing demand for local brands. This is evident in the hotel sector where, after a period of growth in foreign brands, demand for hotels that reflect Chinese heritage and culture is growing. Chinese hoteliers are challenged to determine the best strategies to incorporate Chinese cultural elements to the hotel experience while maintaining perceptions of authenticity. In implementing these strategies, Chinese hoteliers must determine if adding these elements creates customer loyalty and creates competitive advantage. The current research examines the case of SCHOTEL hotels, a company that has incorporated Chinese cultural values into their products and overall brand. The case will use semi-structured survey questions to explore what managers perceive to be the key elements of Chinese culture to be incorporated into the hotel experience, how they balance functionality with authenticity and whether the addition of Chinese cultural elements increases customer loyalty to the brand.

Research Mentor: Jonathon Day, Hospitality and Tourism Management

Poster Number: 4256 :: Life Sciences

College of Health and Human Sciences

The Effect of Dietary Potassium on Blood Pressure in Pre-Hypertensive Women

Author:

Nicolas Lisowski

Abstract:

Urinary sodium and potassium excretion have been associated with variations in blood pressure; however, specific sources of potassium have not been evaluated. This study consists of a four phase cross over design to evaluate the addition of 1000 mg of potassium from potatoes, French fries, and a supplement compared to a control diet containing 2340 mg. This report is a partial analysis of data from 6 (out of 40) mildly-hypertensive female adults ages 45 and above. This summary includes analysis of the first 15 days of each phase. Blood pressure was taken on days 1, 4, 6, 8, 11, 13, and 15. Participants were asked to collect all urine throughout the 15-day intervention periods. Changes in systolic blood pressure (SBP) over each intervention phase were correlated with changes in urinary sodium, potassium, and the sodium-to-potassium ratio. Decreases in blood pressure were associated with higher levels of potassium intake from potatoes (r=-0.79) and supplements (r=-0.70) compared to the control (r=-0.22). Additionally, decreases in the sodium-to-potassium ratio show a stronger relationship with SBP for potato (r=0.64) compared to control (r=0.11), French fry (r=0.16), and supplement (0.29). Sources of potassium may be critical in defining its effect on blood pressure.

Research Mentor: Berdine Martin, Nutrition Science

Poster Number: 4343 :: Life Sciences

College of Health and Human Sciences

To Study the Role of Plk1 in Ascorbate-Toxicity in Prostate Cancer Cells

Author:

Zian Liu

Abstract:

Prostate cancer (PCa) is among the most commonly diagnosed cancer and the third leading cause of death in the U.S.. It was shown that PCa cells have elevated ROS levels compared to their normal counterparts. Ascorbate at millimolar concentrations displays pro-oxidative cell-killing properties specific to tumor cells through DNA damage and ATP depletion in a hydrogen peroxide-dependent manner. Polo-like kinase 1 (Plk1) is a serine/threonine kinase which plays critical roles in cancer progression, and its shown to be inhibited by DNA damage. Considering that Ascorbate causes DNA damages, we hypothesized that down-regulation of Plk1 is a method of action for ascorbate effectiveness in PCa cells. Preliminary evidence suggests that administration of ascorbate reduces Plk1 expression; co-treatment with BI 2536, a Plk1 inhibitor, further inhibits PCa cell proliferation in MTT assay. Currently, experiments are conducted to assess the effects of Plk1 knockdown in PCa cells, Plk1 overexpression in normal prostate cells, and Plk1 upstream/downstream target activation will be assessed to evaluate our hypothesis.

Research Mentor: Xiaoqi Liu, Biochemistry

Poster Number: 4370 :: Life Sciences

College of Health and Human Sciences

Determining the Greatest Contributor of Sugar-Sweetened Beverages in the Diets of Food Pantry Clients in Indiana

Author:

Jamie Mara

Abstract:

Consumption of sugar-sweetened beverages (SSBs) contributes to excess energy intake, poorer diet quality, and obesity, outcomes that are over-represented among food pantry clients, a low-income and food-insecure population. Yet, neither SSB intake nor source of intake has been characterized. The hypothesis of this project was that food pantry clients would consume a high proportion of total energy from SSBs, of which a smaller proportion would come from food pantries and soup kitchens compared to other sources. English speaking food pantry clients ≥ 18 years were recruited at Indiana food pantries and interviewed for characteristics, dietary intake, and source using a questionnaire and the Automated Self-Administered 24-hour Dietary Recall (ASA24™-2016). SSBs were classified by What We Eat in America food subcategories; total and proportional energy from SSBs was derived from the USDA Food and Nutrient Database for Dietary Studies. SSB energy from each source was calculated as a percentage of total energy intake and modeled as the dependent variable in adjusted multiple linear regression. Results showed that SSBs contributed to 17.6% of total energy intake of food pantry clients. Food pantry/soup kitchen and other sources accounted for 11.9% and 88.1% of energy consumed from SSBs, respectively. Other sources contributed 76.3% more calories from SSBs compared with food pantries and soup kitchens ($P < 0.001$). These findings suggest that direct nutrition education for pantry staff and clients, empowering them to limit sweetened beverages from pantry shelves and food selection decisions, could reduce added sugar intake.

Research Mentor: Heather Eicher-Miller, Nutrition Science

Poster Number: 4179 :: Social Sciences/Humanities

College of Health and Human Sciences

Investigating Graph Construction Practices and Reasoning of Undergraduate Biology Students

Author:

Jacqueline Mercader

Abstract:

Choosing and creating effective graphs to interpret and communicate numerical data is critical in the field of biology. However, the work of ours and others shows this is an area of which students struggle. For example, when given an experimental scenario and a table of numerical data undergraduate biology, students plot all the data and do not always keep the purpose of the scenario in mind when making graphing choices. To solidify effective learning techniques in the areas of graph construction and reasoning, we need a clearer understanding of the areas in which students are competent and have difficulty. We sought to augment our understanding by conducting think-aloud interviews that included pen-and-paper graphing tasks from data described in words in a passage of text. To analyze patterns among a subset of interviewees (n=12 undergraduate biology majors), we performed thematic analysis using interview transcripts to identify themes in responses and compose an analysis tool (codebook). Reflecting the data, the codebook included the themes: graph choice, data manipulation, variable relationships, and interpretations. Results showed that most undergraduate biology students were able to define variables, manipulate the information into usable data and explain the variable relationships and data trends. Most of the undergraduate students were not able to elaborate on the logistical reasoning behind the mechanisms of graph construction and did not relate to the entirety of the scenario. These analyses help show the gap between graph construction and conceptual understanding and outline what modifications may need to be made in undergraduate learning.

Research Mentor: Stephanie M Gardner, Biological Sciences

Poster Number: 4206 :: Life Sciences

College of Health and Human Sciences

Effects of Electrical Pulse Stimulation on Skeletal Muscle Exosome Release

Authors:

Derek Middleton

Ron Garner

Abstract:

Skeletal muscle is acknowledged as an endocrine organ. Exosomes are nano-sized vesicles containing proteins, mRNAs, and miRNAs and can be produced and released by skeletal muscle. Exosomes act in paracrine and endocrine manners by fusing with local and distal tissues influencing biological processes. Electrical Pulse Stimulation (EPS) is a model of muscular contraction in cell culture. The purpose of the current work is to determine if EPS stimulates skeletal muscle exosome release in vitro. It was hypothesized that EPS would stimulate exosome release from skeletal muscle as evidenced by exosome protein marker expression being lower in cells and greater in cell media.

Primary human skeletal muscle cells (HuSkMC) from eight subjects (lean, healthy college-age males) were grown in culture. On day 8 of differentiation, HuSkMC were electrically pulse stimulated (EPS) for 24 hours and cellular protein collected. Non-stimulated HuSKMC served as controls (Con). HuSKMC isolated protein exosome protein markers were analyzed by Western blotting.

In HuSKMC, there was no effect of EPS on exosome protein markers: Alix (1.0±0.6 Con, 1.1±0.6 EPS, $p=0.58$), Clathrin (1.0±0.8 Con, 0.9±0.6 EPS, $p=0.31$), TSG-101 (1.0±0.6 Con, 1.3±1.0 EPS, $p=0.22$), or CD-63 (1.0±0.4 Con, 1.1±0.4 EPS, $p=0.33$). Exosomes were isolated from the cell media using ExoQuick Solution and results on exosome protein markers from cell culture media remain to be analyzed.

Our results show no difference in intracellular protein content of exosome markers between Con and EPS conditions. Previous pilot data had shown a strong trend ($p=0.06$) for decreased Alix protein in EPS compared to Con, indicating a release of exosomes. Further work will analyze exosome proteins from cell media, which is the best indicator of exosome release. Additional work is needed to optimize a model for exosome release in skeletal muscle exosome release in vitro, including a time-course to determine peak exosome release from skeletal muscle following EPS.

Research Mentor: Tim Gavin, Health and Kinesiology

Poster Number: 4290 :: Innovative Technology/Entrepreneurship/Design

College of Health and Human Sciences

Artificial Intelligence and the Supply Chain

Author:

Reika Narita

Abstract:

Nowadays, the demands of high-quality products and customer service, along with efficient shopping and quick delivery, are unprecedentedly high. Companies are increasingly adopting Artificial Intelligence (AI) technologies (e.g., augmentation and automation) to enhance productivity and profitability. On one hand, manufacturing and service companies are using AI to automate production activities, allocate budgets, procure materials, manage warehouses, and help with logistics and shipping. On the other hand, AI is also helping retailers through visual search, Chatbots, and deep learning in understanding consumer needs, making better forecasts, allowing consumers to quickly navigate retail sites, and improving inventory efficiency. In this poster, we will use case studies to illustrate and forecast how the emerging AI technologies will reshape the coordination and competition among supply chain partners (e.g., manufacturers and retailers), and offer insights on firms' supply chain strategies.

Research Mentor: Jiong Sun, Consumer Science

Poster Number: 4088 :: Social Sciences/Humanities

College of Health and Human Sciences

"You have to be clean:" Pubic hair grooming behaviors among women living in Italy

Authors:

Alyssa Renee Miller

Laura Long

Abstract:

Women worldwide engage in hair grooming practices, including pubic hair removal. Literature demonstrates a relationship between pubic hair modification and removal, and genital self-image, with hair removers reporting higher genital self-image. A majority of the pubic hair and genital self-image research describes United States women, leaving pubic hair perceptions and behaviors in Europe ambiguous. The purpose of this study is to describe pubic hair removal attitudes and behaviors among reproductive-aged women living in or near Florence, Italy.

Research was conducted in two phases. Individual interviews (n=46) occurred in May to August 2017, while survey collection is ongoing (n=101 to date). Eligible participants were reproductive-aged women, aged 18 to 45 years, living in or around Florence, Italy, and currently utilizing the Italian healthcare system.

Pubic hair removal was popular among Italian women. Women mainly removed pubic hair by waxing, especially when going to the beach. Sexual partners influenced removal in various ways, as did cultural norms and a desire for cleanliness. Most participants indicated pubic hair removal onset during adolescence, often by visiting an esthetician for a waxing appointment. Genital self-image ranged between highly positive, neutral, and negative. Negative views were linked to insufficient information regarding the normal size, shape, and function of female genitalia; however, pubic hair removal often related to more positive genital self-image.

Pubic hair removal among Italian women differed from the current literature among US women, with Italians engaging in more frequent and earlier waxing, often prompted by members of their social network, specifically their mothers. Results of this study may assist clinicians in understanding the common insecurities and concerns women have about their genitals or bodies. Additionally, findings offer opportunities for clinicians to proactively address topics women may be afraid to discuss during consultations and women's wellness visits.

Research Mentor: Andrea DeMaria, Consumer Science

Poster Number: 4328 :: Social Sciences/Humanities

College of Health and Human Sciences

Visitor Harassment in China: The Case of Shanghai

Authors:

Xinyi Zhou

Annmarie Nicely

Aileen Fan

Mark Meng

Abstract:

While there has been studies on the harassment of visitors by local micro-traders in other parts of the world (namely Africa and the Caribbean), studies on the phenomenon in Asia has been scarce. Hence, the goal of this study was to address this deficiency in the scholarly literature by looking at the harassment of visitors in one popular city in China, Shanghai. With a population of 24.15 million persons, Shanghai is one of the most populous cities in the world. And according to the Shanghai Tourism Bureau (2017) in 2016 approximately 8.5 million international tourists visited this city. Over the years there have been many reports of trader harassment largely on social media. Hence, the aim of this study was to examine the phenomenon in this city with the view of understanding: 1] the types of vendors that harass visitors in this location; 2] the types of harassment behaviors they display; 3] the factors that cause them to harass visitors; and 4] the strategies used by various local entities and groups to reduce these behaviors.

To achieve the objectives of the study a qualitative research methodology will be used. More specifically, case analysis will be used. Archives and stakeholder interviews will be used to determine the type of vendors that harass, how they harass visitors, the reasons they harass visitors and the strategies used to minimize these behaviors. Meanwhile, a focus group of tourism experts from China will be used to explicate the findings generated from the analysis of the archives and interview transcripts. Examples of archives to be used include newspaper articles, news reports and blog postings; and examples of some of the stakeholders to be interviewed include representatives of vending communities, expatriates as well operators of hotels, restaurants and attractions in the Shanghai area. All study’s data will be analyzed using thematic content analysis.

Research Mentor: Annmarie Nicely, Hospitality & Tourism Management

Poster Number: 4149 :: Life Sciences

College of Health and Human Sciences

Sulfonyl-Containing Boronate Caps for Optimization of Biological Properties of 99mTc(III) Radiotracers [99mTcCl(CDO)(CDOH)2B-R] (CDOH2 = Cyclohexanedione Dioxime)

Author:

Isabelle Olejniczak

Abstract:

The objective of this study was to use sulfonyl-containing boronate caps to optimize the biodistribution properties of 99mTc(III) complexes [99mTcCl(CDO)(CDOH)2B-R] (99mTc-3Sboroxime: R = 3S; 99mTc-3SPboroxime: R = 3SP; 99mTc-3MSboroxime: R = 3MS; 99mTc-3DMSboroxime: R = 3DMS; 99mTc-3MSBboroxime: R = 3MSB; 99mTc-3MMSboroxime: R = 3MMS; 99mTc-3MSAboroxime: R = 3MSA; 99mTc-3DMSAboroxime: R = 3DMSA; 99mTc-4Sboroxime: R = 4S; 99mTc-4MSboroxime: R = 4MS; 99mTc-4MSBboroxime: R = 4MSB; and 99mTc-4PSboroxime: R = 4PS). Each new 99mTc(III) radiotracer was prepared with high radiochemical purity (RCP > 95%). Sprague-Daley rats were used for biodistribution and imaging studies. Myocardial washout kinetics was assessed through planar image quantification. The results showed that the initial heart uptake and myocardial retention of the new 99mTc(III) radiotracers was similar or better than 99mTc-Teboroxime, a well-known radiotracer approved by FDA for myocardial perfusion imaging. The best SPECT images of the rat hearts were taken during any 5-min window over the first 30 minutes after injection of 99mTc-3SPboroxime. Out of all 99mTc-Teboroxime derivatives evaluated in SD rats, 99mTc-3SPboroxime achieved the best image quality. Liver uptake of 99mTc-3SPboroxime increased at a steady rate and peaked at ~15 min in pigs. Heart/liver rations remained between 0.75 and 1.65, indicating no significant liver radioactivity interference. In conclusion, 99mTc-3SPboroxime is an excellent radiotracer for SPECT/MRI cameras due to its high heart uptake, long myocardial retention and high heart/background ratios.

Research Mentor: Shuang Liu, Health Sciences

Poster Number: 4353 :: Social Sciences/Humanities

College of Health and Human Sciences

Compliance of Infection Control Protocols in the Hospital Environment

Authors:

Mary O'Malley

Whitney Stedman

Maria Touvannas

Sarah Myers

Anne Keimig

Lauren Kirwan

Carly York

Kaitlyn Borowitz

Abstract:

Infection control is a major part of the effort to achieve positive patient outcomes in the healthcare environment, yet many health care professionals often falter in its compliance. The focus of our research was on health care professionals' compliance with hand washing and personal protective equipment protocols at a hospital in the Midwest.

The purpose of our research was to investigate the reasons health care professionals may fail to follow infection control protocol.

Three approaches were used for data collection and they included (1) observation of staff members "foaming in and out" of patient rooms, (2) observation of staff members removing and donning of personal protective equipment, and (3) distribution of a questionnaire to the hospital staff to examine their perspectives concerning infection control protocol compliance. The setting for the study was four hospital units.

The preliminary results revealed that each worker who filled out the questionnaire had seen a co-worker fail to "foam in or out" of a patient's room in the past. In addition, a health care professional is less likely to "foam in or out" of a patient's room when responding to an emergency inside the patient's room. Findings from nursing students' observations revealed that the break in infection control protocol occurred more with "foaming out" of a patient room.

There needs to be ongoing surveillance to track health care workers' compliance with infection control protocol. Findings from such surveillance effort may help healthcare administrators in identifying potential sources of nosocomial infections.

Research Mentor: Mopelola Tolulola Adeola, Nursing

Poster Number: 4344 :: Social Sciences/Humanities

College of Health and Human Sciences

Personality Ratings in Social Relationships

Author:

Julia Pennington

Abstract:

Interpersonal relationships are crucial parts of wellbeing as indicated by the lack of social support relating to numerous negative health consequences. However, this area is not well studied, with much of the previous research in the area of self-other personality focusing on romantic relationships. The general mechanism of interpersonal interactions are not well understood either. The present study examined a variety of relationship types. More broadly, the aim of this research is to better understand the perception of participants' own personality, how others view them, and their understanding of how they are viewed by others. These perceptions of self as well as others likely influence people's behaviors in interpersonal relationships. This was done within the five-factor model framework, a popular comprehensive personality model. Thirty eight dyads were filmed as they interacted through playing the game Operation. Following the game, a survey was administered to each participant that included multiple personality inventories, both about the self and about the other participant, as well as a questionnaire about the relationship quality between the partners. The preliminary results are promising. The agreement between self-rating and the acquaintance's rating of participants were high. The initial findings for the accuracy of how participant's perception of how their acquaintance would rate them were relatively high, as well.

Research Mentor: Doug Samuel, Psychological Sciences

Poster Number: 4341 :: Social Sciences/Humanities

College of Health and Human Sciences

The Grammatical Function of Head Nods in American Sign Language

Author:

Megan Pentecost

Abstract:

Despite 50+ years of research, so much of the structure of American Sign Language (ASL) remains to be investigated. Here we investigate the different types of grammatical head nods. Previously identified functions are: emphasis, assertion, affirmation, existence, or focus (Liddell, 1980; Pfau & Quer, 2010; Wilbur, 2000). From other sign languages, e.g. Japanese Sign Language (JSL), we know that head nods can combine with other nonmanual markers (NMMs), such as eye gaze, which results in numerous specific functions (Ichida, 2010). Therefore we expect that their usage in ASL may be more extensive than previously reported. Detailed observations of multiple videos of ASL reveal that certain head nods, even those that do not face forward, are systematically paired with a forward eye gaze. We argue that the combination of these two NMMs may reflect an unreported grammatical head nod function in ASL, namely to distinguish the lexical categories of signs, e.g. noun versus verb. This would be significant because research on the ability to identify a sign's part of speech in ASL has thus far been highly limited, and focused entirely on the movement of the hands (Supalla & Newport, 1978). This type of information has broad implications for teachers and learners of ASL, profoundly affecting the content of grammar lessons. Only through careful analysis of details such as this can ASL structure be properly conveyed to educators of deaf children, thereby improving their education.

Research Mentor: Margaret Crabtree, Interdisciplinary Studies

Poster Number: 4185 :: Life Sciences

College of Health and Human Sciences

Autophagy dysfunction associated with an in vitro model of Parkinson's disease

Author:

Charles Price

Abstract:

Parkinson's disease is a neurodegenerative disorder in which the pathological progression involved remains un-clear. Autophagy is an intracellular process that maintains cellular stress levels through self-degradation of proteins and organelles. One form of autophagy involving mitochondria (mitophagy) is thought to play a critical role in early stage Parkinson's disease. To better understand autophagic dysfunction, we aimed to find a threshold for autophagic stress – i.e. when autophagy becomes detrimental, rather than protective. Here, we tested the hypothesis that autophagic stress would precede cell loss. To accomplish this, we considered the quantity of autophagosomes present in the soma when cell death signals commenced. Here, we used SH-SY5Y cells supplemented with galactose, treated with varying doses of rapamycin (autophagy inducer) while maintaining a negative control group treated with DMSO and a positive control group treated with rotenone, a toxicant known to induce Parkinson's disease symptoms. Through MTT cytotoxicity assay analysis, cell population density amongst the varying treatments were normalized to the negative control group to evaluate cytotoxicity. Doses in which significant levels of cell death resulted were identified and utilized for further investigation. We then considered expression and puncta formation of LC3 (autophagy biomarker) in conjunction with expression of cell death markers by immunocytochemistry. The results from these experiments will help with refined analyses of autophagic stress in Parkinson's disease and other neurodegenerative diseases. Further investigation into autophagic thresholds within cells in varying pathways could lead to clarification of how autophagy dysfunction affects the progression of Parkinson's disease.

Research Mentor: Jason Cannon, Health Sciences

Poster Number: 4050 :: Life Sciences

College of Health and Human Sciences

rnf14 and ttc3 Expression During Zebrafish Embryonic Development with or without Exposure to the Agricultural Herbicide Atrazine

Author:

Leeah Reidenbach

Abstract:

Atrazine is an herbicide commonly applied to crops in the Midwest part of the United States. The chemical moves into drinking water sources after rainfall events, which increases the risk of human exposure. The United States Environmental Protection Agency (EPA) set the Maximum Contaminant Level (MCL) at 3 parts per billion (ppb) in drinking water, but even these levels are suspected to cause adverse health effects. Developmental exposure to atrazine is reported to increase birth defects and result in endocrine disruption. Previous studies in our laboratory have shown that genes related to the neuroendocrine and reproductive system, cell cycle, and carcinogenesis have altered expression in the zebrafish after an embryonic exposure to atrazine (1-72 hours post fertilization (hpf)). Two of these genes, rnf14 and ttc3, were further tested in this study. rnf14 is a gene that interacts with the androgen receptor. When expression of rnf14 is increased, it is expected to cause abnormal cell growth and lead to carcinogenesis. ttc3 is expected to be involved with neuronal proliferation and differentiation when expression is increased. Overexpression of ttc3 leads to strong inhibition of neurite extension. The purpose of this experiment was to first determine how gene expression changed over the zebrafish embryonic developmental time course at 24, 36, 48, 60, and 72 hpf. Then, gene expression was assessed following atrazine exposure at 0, 0.3, 3, or 30 ppb at multiple developmental time points. Expression of rnf14 was consistent throughout the developmental time course and was not impacted by atrazine exposure ($p>0.05$). In addition, expression of ttc3 was consistent throughout the developmental time course ($p>0.05$), but was significantly increased at 60 hpf with atrazine exposure ($p=0.0099$; $n=6$), which was similar to the previous findings at 72 hpf. The data shows that the rnf14 and ttc3 expression is steady throughout embryogenesis and that changes caused by atrazine exposure only occurs at the time points of 60 and 72 hpf for ttc3 and only at 72 hpf for rnf14.

Research Mentor: Jennifer Freeman, Health Sciences

Poster Number: 4267 :: Social Sciences/Humanities

College of Health and Human Sciences

Appearances of Characters in Dreams of an Adolescent Follow the Zipf-Mandelbrot Law

Authors:

Liron Saletsky

Xiaofang Zheng

Abstract:

In daily life, an individual comes into contact with some people more than others. For many forms of contact, e.g., e-mail, contact frequencies follow the Zipf-Mandelbrot Law (a variant of Zipf's Law). According to the continuity hypothesis, frequencies of events in dreams correspond to frequencies of those events in daily life. If so, the frequencies of appearances of characters in the dreams of an individual would follow the Zipf-Mandelbrot Law. We find evidence for the Zipf-Mandelbrot Law in the dreams of an adolescent in high school and college. This lawful behavior shows that although events in dreams are sometimes bizarre, a series of dreams reveals a systematic form of character appearances. The next question is are aspects of the distribution form different in different phases of life? Using a chi-square test, we found a significant difference in the frequency distributions of character appearances in high school and college dreams. Differences in the frequencies of character appearances in high school and college dreams are likely due to the dreamer developing a new set of relationships in college. By the continuity hypothesis, the new contacts would be reflected in college dreams. Further details to resolve include determining if the parameters for the Zipf-Mandelbrot Law are different for high school and college and also which of the two distributions has more information based on Information Theory.

Research Mentor: Richard Schweickert, Psychological Sciences

Poster Number: 4177 :: Social Sciences/Humanities

College of Health and Human Sciences

Do End of Life Treatment Preferences Drive Goal Communication in Palliative Care?

Author:

William Schrock

Abstract:

Discussing patients' long term goals of care are common in palliative care consultations. End of life treatment preferences might influence whether and how patients discuss these long-term goals with palliative care team members. This paper examines patients' end of life treatment preferences at the time of referral and their influence on the likelihood of goal discussions during a palliative care consultation.

We enrolled 240 hospitalized patients with advanced cancer into a multi-site longitudinal palliative care cohort study. Prior to palliative care consultation, we assessed patient's preferences for medical treatment in the last months of life (comfort care, survival, and no preference). We then audio recorded the palliative care consultations and analyzed these conversations for the presence of goal discussions regarding: place of care, symptom management, social role, and survival. This analysis reports on the first 196 coded conversations.

Almost two-thirds of consultations (61%) contained some discussions about a patient's long term goals. The most common goals discussed were place of care (30%), followed by symptom management (25%), social role (19%) and, finally, survival (11%). We observed significant differences in the presence of any goal expression (p=<0.01), place of care goals (p=0.03) and symptom management goals (p=0.05) between patients who preferred comfort care and those who either opposed or had no preference. There were no significant differences found for discussions of goals relating to social role and survival.

Conversations involving people who have a formed preference for comfort-focused treatment in the last months of their lives are substantially more likely to involve goal discussions. For participants who strongly favored comfort care, goal discussions more often focus on place of care and symptom control.

Research Mentor: Stewart Chang Alexander, Consumer Sciences

Poster Number: 4178 :: Life Sciences

College of Health and Human Sciences

Impact of Heat Therapy on Skeletal Muscle Structure and Function in a Mouse Model of Peripheral Arterial Disease

Author:

Griffin Selch

Abstract:

Alterations in skeletal muscle morphology and function, including increased connective tissue infiltration and reduced strength, contribute to exercise intolerance in patients with symptomatic peripheral arterial disease (PAD). We tested the hypothesis that repeated exposure to heat therapy (HT) would reverse skeletal muscle abnormalities in a mouse model of PAD.

Male 42-week-old C57Bl/6 mice underwent bilateral ligation of the femoral artery to induce hindlimb ischemia. After two weeks of recovery, the animals were randomly assigned to receive HT or a control intervention. Heat therapy was applied by placing the animal in a flat bottom restrainer and immersing the lower half of the body in a glass container filled with water at 37°C (n=12), 39°C (n=12), or 41°C (n=12) for 30 min daily over 3 consecutive weeks. Animals assigned to the control group (n=12) were also restrained, but were placed in an empty container. Rectal temperature was measured before and during exposure to a single session of HT or the control intervention (n=2/group). Forty-eight hours following the last treatment session, the animals were anesthetized and the soleus and extensor digitorum longus (EDL) muscles were harvested for the assessment of contractile function in vitro and histological determination of fiber morphology and collagen infiltration.

Rectal temperature increased rapidly during exposure to HT and reached a steady state within approximately 10 min (37ºC: 37.1±0.1°C, 39ºC: 38.7±0.2°C, 41ºC: 40.1±0.1°C), while in the control group rectal temperature remained at baseline levels throughout the session (34.9±1.1°C). Muscle weight relative to body weight was significantly higher in animals exposed to HT at 39ºC as compared to the control group in both the soleus (Control: 0.36□0.01mg/g vs. 39HT: 0.41±0.01mg/g, p=0.023) and EDL muscles (Control: 0.43±0.01mg/g vs. 39HT: 0.48±0.01mg/g, p=0.029). Maximal absolute force of the soleus tended to be higher in animals treated with HT at 37ºC (p=0.072) and at 39ºC (p=0.108) when compared to the control group (Control: 274.3±7.7mN, 37ºC: 303.0±7.8mN, 39 ºC: 301.1±13.5mN). In the EDL muscle, collagen content was lower in the group treated with HT at 37ºC (Control: 5.1±1.3% vs. 37ºC: 2.9±0.8%, p=0.028). Similarly, there was a tendency for lower collagen infiltration in the soleus muscle in the group treated with HT at 39ºC when compared to the control group (Control: 5.7±0.8% vs. 39ºC: 4.6±1.4%, p=0.101). There were no differences between groups in specific muscle force, number of fibers with central nucleation and fiber-cross sectional area in both the EDL and soleus muscles. Conclusion: These findings suggest that repeated exposure to HT at 37°C and 39°C, but not at 41°C, ameliorates skeletal muscle abnormalities in a mouse model of PAD.

Research Mentor: Bruno Roseguini, Health and Kinesiology

Poster Number: 4024 :: Social Sciences/Humanities

College of Health and Human Sciences

Nuclear Security Culture Assessment of Radiation Users at an Academic Institution

Author:

Courtney Sheffield

Shraddha Rane

Eric Foss

Abstract:

Significant progress has been made globally to secure vulnerable nuclear materials. But, as threats constantly evolve, attention to nuclear security in non-nuclear material specific industries, such as academic institutions and medical facilities, has become increasingly important. To assess and evaluate nuclear security culture at an academic institution, a written survey and in-person interview were developed and conducted on radioactive material users. The survey consisted of a series of questions segregated into four categories: policy, enforcement, leadership, and behavior. Users were classified based on age group, work classification and radioactive material work experience. A series of eight nuclear security awareness questions formed a subset of the four nuclear security categories. Results showed that students and radioactive material users in the "20's" age group possessed a greater degree of awareness towards nuclear security than faculty, other more experienced radioactive material users, and older age group individuals. The response from all three user classification groups emphasized the need to enhance threat response preparedness. The data also implied the need to facilitate effective communication between leaders (faculty and other staff members) and students for establishing a stronger nuclear security culture at the institution. Most of the survey outcomes were verified through in-person interviews. A customized education and training program, based on the level of experience with radioactive materials, was proposed as a form of corrective action to address gaps in nuclear security awareness at the academic institution.

Research Mentor: Jason Harris, Health Sciences

Poster Number: 4298 :: Life Sciences

College of Health and Human Sciences

Investigating the Role of Delta-Like-Ligand 1 on Foxp3 in Colorectal Tumors

Author:

Faith Stirm

Abstract:

Tumor angiogenesis and hypoxia resulting from lack of blood supply within solid tumors play a critical role in the development and treatment of cancer. Recent studies have shown that cancer has ways of hiding and escaping the body's immune system. One potential factor suppressing an anti-tumor immune response is by up-regulating Foxp3, inducing a regulatory T cell phenotype and functionality. The purpose of this experiment is to investigate the overlap between Delta-Like-Ligand 1 (DLL1) and Foxp3 expressing regions of the tumor, and the role that hypoxia plays in this process. For the experiment, ten syngeneic MC38 colorectal mouse model and three immune component control mice were used to investigate DLL1, FoxP3, HIF-1a and HIF-2a in tumors and normal tissue. Of the three control mice, one mouse was kept as a negative control (normal breathing), and the other two (positive controls) used to determine the link between the above proteins, specifically HIF-1α and HIF-2α. The first protocol involved chronic sustained hypoxia with the mouse being kept in an environment of around 6% oxygen for 6 hours before being euthanized. The other protocol used chronic intermittent hypoxia using a cycling of oxygen levels from 20% to 5% on a 20 minute/10 minute cycle for 6 hours. The tissues that were extracted were the lung, the liver, the intestines, the spleen, the kidney, and the thymus. The mice harboring MC38 tumors were excised at different tumor volumes. IHC is being performed on tissue samples, which will provide measurements of HIF-1α, HIF-2α, Foxp3, and DLL1. The samples will also be stained with hematoxylin and eosin and the resulting samples will be analyzed for tissue irregularities and corresponding regions of increased expression of one or more of the above factors. These results provide evidence that the notch pathway can be a novel pathway inducing immune suppressive activities in solid tumors, and if hypoxia plays an important role.

Research Mentor: Keith Stantz, Health Sciences

Poster Number: 4100 :: Social Sciences/Humanities

College of Health and Human Sciences

Home Numeracy Environment and Numeracy Skills in Spanish-Speaking DLLs and non-DLLs

Authors:

Kelsey Stolz

Joyce Lin

Melody Kung

Abstract:

The home numeracy environment (HNE) can impact a child's mathematics performance prior to formal education. Factors including socioeconomic status (SES) and language minority status can also influence a child's HNE and subsequent numeracy skills. The majority of current research focuses on the HNE among non-DLL populations, thus little is known about subpopulations such as the growing Spanish-speaking Dual Language Learner (DLL) population. Therefore, the purpose of this study was to better understand the relationship between the HNE and numeracy skills in DLLs and non-DLLs and whether there are language status differences in the HNE. Using a sample of preschool students ages 3-5 (n = 98), from families with low SES, we examined differences between DLLs' (n = 61) and non-DLLs' (n = 37) mathematics performance were assessed in English when DLLs are assessed in English and Spanish, differences in their HNEs, and if HNE predicts numeracy performance. Using t-tests and linear regressions, we found that numeracy skills were not significantly different between DLLs and non-DLLs, regardless of the assessment language. However, DLLs had lower HNE scores (M = 1.66, SD = .94) than non-DLLs (M = 2.11, SD =.80), and this difference was significant, $t(96)$= 2.548, p = .012. Specifically, reading number storybooks, counting down and simple sums were less frequent activities in DLL households. Lastly, HNE does not significantly predict numeracy performance between DLLs and non-DLLs, regardless of assessment language. This study is an important step in identifying which aspects of the HNE may be different between DLLs and non-DLLs.

Research Mentor: David Purpura, Human Development and Family Studies

Poster Number: 4397 :: Life Sciences

College of Health and Human Sciences

Influence of pH in LC50 calculations for acidic environmental chemical contaminants: The herbicide glyphosate as a case study

Authors:

Lucas Turner

Leeah Reidenbach

Abstract:

Glyphosate is the most widely used herbicide in the United States and the world. Because of its popularity, the debate over glyphosate's hazardous health risks is being addressed, and one concern is the carcinogenicity of glyphosate. In 1995, the EPA established the maximum contaminant level of glyphosate at 0.7 parts per million (ppm) in drinking water, and research suggests glyphosate may be a carcinogen. As with many pesticides, studies have been done to investigate the effects of glyphosate. However, in some of the literature, the acidity of the solutions used is not noted, thus there is no mention of the possibility that the lowered pH glyphosate elicits is the issue instead of the chemical toxicity. In this study, we aim to provide insight and data on the effects of glyphosate to zebrafish embryos and believe the acute toxicity of unadjusted glyphosate solutions as reported by some researchers is caused by pH rather than chemical toxicity. To do this, zebrafish embryos were collected and exposed immediately after fertilization to a range of glyphosate (0ppm-1000ppm) and pH solutions (control, 3.0-4.5). Embryos were checked for mortality every 24 hours for 120 hours post fertilization (hpf). The LC50 of glyphosate without adjusting the pH was found to be 49.779ppm and the curve generated from this test followed the pH LC50 curve. Also, the results from the glyphosate with adjusted pH mortality showed that there was no significant difference between the mortality of the control sample and that of the other concentrations used.

Research Mentor: Jennifer Freeman, Health Sciences

Poster Number: 4303 :: Life Sciences

College of Health and Human Sciences

Influence of Iron Status on Cognitive Function in Bariatric Surgery Patients

Authors:

Sanjna Vinze

Nana Gletsu-Miller

Abstract:

Iron deficiency is common after Roux-en-Y gastric bypass (RYGB) bariatric surgery and many patients go untreated. Symptoms of iron deficiency include diminished cognitive function regarding attention span and focus. We hypothesized that improvement of iron status results in better cognitive function.

Our previous study with female bariatric surgery patients with iron deficiency demonstrated that oral ferrous sulfate supplementation improved iron status (serum ferritin, serum transferrin receptor: ferritin [Tfr/ferritin]) but supplementation with organic iron formulations was not effective. We measured cognitive function using two computer based tests: the psychomotor vigilance test (attention lapses and executive control) and go/no-go task (inhibition and accuracy). Relationships between iron status and cognitive function were assessed using Spearman correlations. Data is reported as mean and standard deviation, $P < 0.05$.

Participants were ages 45.2 ± 9.3 years, had a body mass index of 34.9 ± 5.5 kg/m2; were 9.6 ± 2.5 years out from surgery and iron deficient. Ferritin improved in the ferrous sulfate group (from 9.2 ±6.8 to 24.7± 16.4 units, P=.002) with no change observed in the control group. TfR/ferritin also improved within the ferrous sulfate group (624.9 ± 761.4 to 139.1 ± 162.2, P=.04). Cognitive function did not improve in both the ferrous sulfate and control groups.

Although iron status improved with ferrous sulfate supplementation, cognitive function did not improve and the measures were not correlated.

Research Mentor: Nana Gletsu-Miller, Nutrition Science

Poster Number: 4215 :: Physical Sciences

College of Health and Human Sciences

Accuracy of Portable L X-Ray Fluorescence (L-XRF) Machines to Quantify Lead in Condor Bones In Vivo

Author:

Emma Wallens

Abstract:

Our lab has been working on the development of a portable L-shell x-ray fluorescence (LXRF) device to quantify lead in bone in human in vivo. The purpose of this project is to determine the accuracy of the portable LXRF machine in measuring the lead content of condor bones in vivo. While the K X-Ray Fluorescence (K XRF) machine is the most accurate machine to measure lead content in vivo because it has sufficient energy to overcome soft tissue attenuation, it is not very practical for use in a research lab with animals or for researchers covering a large migratory territory of condors (from California to Arizona). The portable L XRF machine is lightweight, does not require continuous maintenance, a radioisotope source, or nitrogen cooling, and provides immediate spectra for analysis in a couple of minutes.

I calibrated the system with Pb-doped bone-equivalent phantoms that were covered with 0.54 mm, 1 mm, and 1.5 mm Lucite to mimic the effects of soft tissue attenuation. The detection limit was calculated to be 0.6 ppm with 0.54 mm Lucite thickness. Seventeen condor cadaver bones were measured twice (for reproducibility) and the spectra were analyzed with our in-house spectral fitting program written with MatLab. Significant correlation was observed between the bone Pb concentrations measured by the portable XRF and ICP-MS (R2 = 0.74, 0.78, and 0.72 for 0.54, 1, and 1.54 mm tissue thicknesses, respectively) and the linear regression of the K XRF results versus the 0.54, 1, and 1.54 mm Lucite thickness measurements was R2 = 0.9, 0.83, and 0.72. Two measurements of the same set of bones (Lucite thickness at 0.54 mm) gave rise to a strong correlation with an R2 of 0.95, which shows a great reproducibility of the results.

In conclusion, the portable LXRF device has sufficiently proven to provide accurate measurements, with a few consistent outliers across the tissue thicknesses. We would expect the correlation coefficient to move further away from 1 as the tissue thickness increased, but this trend is not visible in the linear regressions of the portable XRF versus the ICP-MS, while it is shown in the trend of the K versus L XRF linear regressions. To further expand on this inquiry, I will be measuring bones using the K XRF and L XRF multiple times to investigate the discrepancies in the results.

Research Mentor: Linda Nie, Health Sciences

Poster Number: 4238 :: Life Sciences

College of Health and Human Sciences

Behavioral Changes in Mice Post-Radiation

Author:

Rachel Yuska

Abstract:

Pediatric brain cancer patients are at a high risk for radiation induced cognitive impairment due to white matter changes in the brain. Half of 6 month radiotherapy survivors develop significant changes in white matter. The purpose of this work was to evaluate whether the mice that received brain radiation developed the same cognitive and behavioral changes seen in human patients. For this project, behavioral changes were monitored on mice that received 30 gray whole brain radiation and measured 4, 8, and 16 weeks post-radiation. The behavioral changes were observed using two tests: Open Field Test and a Marble Burying test. The radiated mice were hypothesized to have less ambulation and increased thigmotaxis in the open field test and bury less marbles due to increased anxiety. It was also hypothesized that the deficits would be more pronounced over time. From our data, we observed significant changes and impairments in brain function that impacted the behavior of the mice. However, the deficits did not worsen over time post-radiation. This data supported our hypothesis that brain radiation causes behavioral changes and that this injury can be modeled in mice to show significant impairments. This validates the mouse model of radiation injury and allows it to be used to study the effects of different therapies on protecting the brain from this injury for future studies.

Research Mentor: Carlos Perez-Torres, Health Sciences

Poster Number: 5334 :: Social Sciences/Humanities

College of Liberal Arts

Women Brewing Through the Ages

Author:

Samaah Al-Najjar

Abstract:

Beer has existed as an important beverage in ancient societies for millennia. Societies have incorporated alcoholic beverages into their diet for its nutritional value, as well as for its culture and belief systems. With alcoholic beverages existing in many societies for many reasons, this project aims to look at the group who most commonly brews it; women. Focusing on Ancient Egypt, the Andes, Medieval Europe, and modern women brewers, I will look at defining what it means to brew in each society. Looking at Ancient Egypt, women were the primary brewers at home while the mythology surrounding beer consisted primarily of goddesses. The Inca Empire revolved around a system of reciprocity, that relied on chosen women to brew chicha for the state. In the Andes in the 1970's chicheras gained economic power through the sale of chicha. Medieval Europe, up until the thirteenth century, drank ale which was brewed by alewives. As Europe began to commercialize alcoholic beverages, they also switched from drinking primarily ale to drinking beer due to gossip of alewives being witches and having dirty ale. The importance of alcohol is consistent through these societies, but the effects on the women who brew it have varied.

Research Mentor: Harold K. Cooper, Anthropology

Poster Number: 5394 :: Life Sciences

College of Liberal Arts

Hydration, Breastfeeding and Child Health Outcomes in the Yucatec Maya

Author:

Sunny Asaf

Abstract:

Genetic and environmental factors including maternal health and nutrition during pregnancy, as well as breastfeeding and postnatal nutrition, are associated with child morbidity and growth. Water is a crucial nutrient to sustaining life and a primary facet of nutrition; however, accessing enough water of adequate quality can be challenging as a result of difficulties shaped by socioeconomic status, the environment, and local ecology. The situation in the Mexican states of Yucatan and Campeche illustrate these difficulties. The Maya who live away from tourist destinations, and use primarily traditional subsistence methods, receive unreliable water service and due to the limestone landscape, no standing water is available for use. Instead, underground aquifers are accessed through sinkholes, or cenotes, and provide water that is likely contaminated. Due to the unreliability and limited availability of piped water, water is often stored or purified water from stores may be used. Water is important to growth and overall health, but some sources may be better than others and influence child morbidity and growth in Yucatec Maya. Additionally, water source may possibly effect infant feeding practices which can impact morbidity and growth. I will describe the challenges associated with accessing water as well as statistically test hypotheses of the associations between water storage, child morbidity and growth. I wish to determine whether purified water sources from the store versus piped and stored water, either inside or outside the home, are associated with breastfeeding duration, use of non-breastmilk formula, child growth in height and weight, and child morbidity. I also seek to determine whether a path exists between water source and storage, infant feeding practices, and child growth outcomes. It is expected that there will be an association between water source and storage, child morbidity, and growth. Purified water sources are expected to be associated with fewer instances of morbidity, accounted for as digestive and respiratory disease, and increased rate of growth. Following this is water stored inside and purified water sources, water stored inside only, water stored outside, and water that is stored outside coupled with purified water sources. Understanding the associations between water source, storage, and child growth and morbidity can provide useful application for broader policy affecting public health education and water management infrastructure.

Research Mentor: Amanda Veile, Anthropology

Poster Number: 5285 :: Social Sciences/Humanities

College of Liberal Arts

All Women Artists Exhibitions in the United States before the 1970s

Author:

Brenda Culver

Abstract:

All-Women Art Exhibitions before the 1970s in the United States

Long before the feminist revolution of the 1970s, all-women art exhibitions had been organized through the various societies of women artists that emerged in the late 1800s or in the context of World Exhibitions such as the Woman's Building at the Columbian Exposition in Chicago in 1893. Yet, the history of these exhibitions remained mostly uncharted, beyond some isolated studies on specific societies or events.

To tackle what researchers see as a new and promising research field, the researcher works to help build a descriptive and analytical catalogue of all-women exhibitions since the 19th century in the United States, and to engage in a collective reflection on their specific history, especially on the evolution of the social, cultural, and institutional conditions that permitted or made them necessary, and on the various levels of mediation and organization at work in these events.

This internship thus seeks to highlight, through research and the creation of a catalog, the history of all-women art exhibitions prior to the 1970s in the United States. The research is particularly interested in questions of professionalization, circles of sociability, and female patronage, but also in the commercial and critical receptions of these exhibitions, and their positions (or lack thereof) within the history of modern art and historiography. Through the collection of information about these all women art exhibitions and the creation of a catalog, the foundation for more extensive and continuing research on these exhibitions and their place in a larger socio-cultural context is laid.

Research Mentor: Catherine Dossin, Visual and Performing Arts

Poster Number: 5186 :: Social Sciences/Humanities

College of Liberal Arts

YouTube, Learning Community, and Social Media

Author:

Diyuan Deng

Abstract:

The goal of this research is to gain a better understanding of how learning communities form on social media by studying the comments section of popular music tutorial videos on YouTube. We collect data from 100 videos with over 500 comments by downloading comments from videos into excel spreadsheets and then we study interactions between users using critical thinking and two rounds team discussion. After discussion, we will have individual reflection to justify the different in our results. This research can offer students great experience of analyzing qualitative data and it is beneficial for who has strong interest in communication, media, music, sociology and education. It also focuses on gaining well-rounded comprehension by discussing thoughts with peers and go through the process of negotiation.

Research Mentor: Christopher Cayari, Visual and Performing Arts

Poster Number: 5202 :: Social Sciences/Humanities

College of Liberal Arts

The Effect of Gender Systems in L1 and L3 Language Transfer: A Study Comparing Masculine/Feminine and Masculine/Feminine/Neuter Gender Systems

Author:

Sheyenne Fishero

Abstract:

Research that addresses the difference between L2 and L3 acquisition is lacking despite the fact that these are two vastly different mental processes. Even less research has been done on how different grammatical gender systems manifest themselves in L3 acquisition. L3 research proposes L2 has a special status factor that blocks L1 from transferring into L3, while other research indicates the most psychotypologically similar language to the L3 will transfer the most in L3 regardless of order of acquisition. This study brings mixed evidence for the psychotypology argument mentioned above by comparing speakers with distinct gender systems in L1 and L3 to those with similar gender systems in L1 and L3. L1 Hindi speakers learning L3 German were compared with L1 Spanish speakers learning either L3 Italian or L3 French. Results indicated greater success in L3 when the L1 was from the same language family. Participants who perceived their L1 and L3 to be the most similar to each other were most successful in L3 gender acquisition. However, participants were not more accurate for words whose L1 gender matched the gender in their L3. The study is limited in its sample size (n=12) and does not implement a grammaticality judgment task in addition to a production task. Therefore, possible performance effects may have affected the results. Further research in the form of a longitudinal study following L3 learners is necessary to understand how the relationship between gender systems in L3 acquisition changes over time.

Research Mentor: Jessica Sturm, Languages and Cultures

Poster Number: 5288 :: Social Sciences/Humanities

College of Liberal Arts

Creating Dynamic and Expressive Movement Vocabulary Based on Laban Movement Analysis Principles

Authors:

Katelyn Graham

Drew Dienhart

Abstract:

The creative process for choreography requires a period of preparation in which one collects ideas. This preparation time includes choosing a thematic idea and ways to approach it. Next, the artist experiments with movement for deeper insight into the movement ideas. Later, the choreographer evaluates the movement and determines what does and does not work to support the thematic idea. The final step is to elaborate upon the selected movement ideas and form them into a choreographic composition.

This research/collection of ideas and the final choreography of the piece will illustrate:

- Multiple meanings of the word sidekick – the thematic idea for the choreography.
- Selected photographic research of couples interacting juxtaposed to photographs of the created movement shapes.
- Deeper insight into the observed movement expressivity by using photo examples of movement dynamics and character, LMA (Laban Movement Analysis).
- Examples of how the use of a single dynamic or mixture of dynamics is related to playing a character and the state of being the character.
- Select photographs of final choreography and a link to view a video of the choreography.

This research and creative process utilizes original dance vocabulary which support the thematic idea of “sidekick.” The collection of research will be structured into a choreographic duet by Professor Carol Cunningham-Sigman, and will be performed at the international dance “Sea Sun Festival” in Lloret de Mar, Spain, May 8.

Research Mentor: Carol Cunningham-Sigman, Visual and Performing Arts

Poster Number: 5399 :: Social Sciences/Humanities

College of Liberal Arts

Anthropology, Law, and Human Rights: A Look at How Anthropologists Approach Government and Legal Regimes in Different Regions of the World

Author:

Hannah Hawkins

Abstract:

Prior to World War II, the American Anthropological Association condemned the idea of universal human rights and instead favored the concept of cultural relativism. At the time, it was typical for universal human rights and cultural relativism to be seen as mutually exclusive by anthropologists. The thought that both concepts could exist simultaneously was highly controversial. However, since the United Nations' formulation of the Universal Declaration of Human Rights in 1948, anthropologists have been a driving force in protecting international human rights. Today it is widely acceptable for anthropologists to be culturally relative while also remaining activists for human rights. With this in mind, one challenge some anthropologists may still face when working on human rights issues abroad is navigating their relationship with the local government regime. I will be looking at three regions' governmental and legal regimes in which anthropologists work, in hopes to uncover patterns regarding possible similarities with the problems they face. I will be considering work done in anthropology and human rights, the law and human rights, and finally the relationship between anthropology, human rights, and the law altogether in the three general regions of Latin America, Africa, and Asia. Finally, I will propose my recommendations for new ways in which anthropologists could engage with these large humanitarian challenges. To do this I use the work of Ellen Messer's 1993 review article, Anthropology and Human Rights, as a basis for my research.

Research Mentor: Zoe Nyssa, Anthropology

Poster Number: 5398 :: Social Sciences/Humanities

College of Liberal Arts

All-Women Art Exhibitions

Author:

Muxuan Hua

Abstract:

Long before the feminist revolution of the 1970s, all-women art exhibitions had been organized through the various societies of women artists that emerged in the late 1800s or in the context of World Exhibitions such as the Women's Building at the Columbian Exposition in Chicago in 1893. Yet, the history of these exhibitions remained mostly uncharted, beyond some isolated studies on specific societies or events. In collaboration with AWARE (Archives of Women Artists, Research & Exhibition), I have thus started working on a descriptive and analytical catalogue of all-women exhibitions since the 19th century.

Working with Catherine Dossin, Associate Professor of Art History at Purdue University and in collaboration with the AWARE team, I worked on the exhibition in the U.S in the 1970s. I expand the database of all women exhibitions. And Localizing exhibitions catalogues and archives for these exhibitions. Also, I gather detailed information on these events and reporting them on the database.

Research Mentor: Catherine Dossin, Visual and Performing Arts

Poster Number: 5357 :: Social Sciences/Humanities

College of Liberal Arts

Research Abstract

Author:

Yaxuan Jiao

Abstract:

Living in a mediated culture, individuals are constantly exposed to a variety of messages delivered through mass media channels, such as television, radio and Internet. When it comes to the effects on commodity market, mass media not only offers information, but also affects consumers' attitudes toward goods based on priming and framing effect. In this research project, I'd to figure out how strong media effects are by analyzing the influence of email marketing, which is the act of sending commercial messages. To be more specific, I'd like to pick some commercial emails, and then design questions for students in Purdue to reflect their thought process after reviewing the emails.

Research Mentor: Collin Raymond, Economics

Poster Number: 5184 :: Social Sciences/Humanities

College of Liberal Arts

Is This a Recycling or a Trash Bin? Effects of the Prototypicality of Bins on Recycling Behavior

Authors:

Cheng Mun Loke

Juan Pablo Ramírez

Bruno Sanchez-Ortiz

Chuande Ye

Abstract:

What affects people's behavior when they dispose items? Our project aims to understand how people make recycling decisions in front of bins. This specific project focused on two main factors: How easy/hard it is to identify a bin as a trash vs recycling bin and on consumers' knowledge about recycling. In a first phase of the project, we took pictures of bins outside of buildings on Purdue's West Lafayette campus and systematically described the distribution of bins. In this second phase of the project, we took pictures of bins inside of buildings. We expected and found that bins inside of buildings were less standardized and varied more widely in their size, color, and shape than bins outside of buildings. Some bins inside of buildings could not be categorized as recycling or trash bins without looking very closely at the bin. As an outcome of this project, we offer the prototype hypothesis that warrants future empirical testing. The prototype hypothesis assumes that consumers have a representation of a prototypical trash and recycling bin in their memory. When they want to dispose an item and look at a bin they categorize the bin based on its similarity with the two prototypes. The hypothesis predicts that ambiguous bins are used less often overall and are used more often wrongly than bins that can be easily classified as trash or recycling bins. This project is part of the Purdue Recycling Project (PuRe) and the Communication and Cognition Lab in the Brian Lamb School of Communication.

Research Mentor: Torsten Reimer, Communication

Poster Number: 5375 :: Social Sciences/Humanities

College of Liberal Arts

Women Artists from the Purdue Galleries' Permanent Collection

Author:

Jessica McDaniel

Abstract:

This project created an interactive, geographical timeline of women artists in Purdue University Galleries' Permanent Collection utilizing ArcGIS software. Hidden in the basement of the Physics building, Purdue Galleries' Permanent Collection houses over 5,000 objects that do not have a space for permanent display. This website gave the Permanent Collection a way to display these hidden works to the public. In the creation of this website, the prominent female artists and their works housed in the collection were researched, data was collected and assembled in chronological order for each artist, and a story map of their lives was created through ArcGIS. A major correlation between the Purdue Galleries' Permanent Collection and the women artists housed in it was found to be that both are hidden; the Permanent Collection is hidden from the public because there is no space to permanently display it on campus, and female artists have been kept hidden throughout art history. A platform to help solve these problems was created through ArcGIS to publicly display both the collection and underrepresented female artists. The ArcGIS story map format of the website also proved to be a great educational tool in demonstrating how art history is not a linear sequence of events, but has many branches with many different influences happening simultaneously.

Research Mentor: Catherine Dossin, Visual and Performing Arts

Poster Number: 5400 :: Social Sciences/Humanities

College of Liberal Arts

Social Influences of Marijuana Criminalization in the U.S.

Author:

Jorden McKibben

Abstract:

The project I am currently working on explores the social influences of marijuana criminalization in the United States since the early 1900s. I am working with Brian Kelly, a professor of sociology throughout my research as well as a professor at Ohio State. This project was created in due part to the recent major changes in policy regarding marijuana. Many states within the U.S. have been recently focusing on influences that have prompted major changes in policy related to marijuana. We want to know why marijuana was criminalized and can arrive at an answer by looking at public representations of marijuana over time. This will allow us to not only understand why marijuana was criminalized in the mid 1900s but will also allow us to understand the later shifts in legislation providing an overall understanding of influencing sociological factors. My particular focus within this project is coding data for the qualitative and quantitative content analyses; I do this by evaluating newspaper articles related to marijuana with the codebook created for the project.

Research Mentor: Brian Kelly, Sociology

Poster Number: 5278 :: Social Sciences/Humanities

College of Liberal Arts

Breaking Project

Author:

Saad Mukhtar

Abstract:

The project address' the oral history of Hip Hop dance, breaking. There is little to no quantitative or qualitative data about the practitioners and scholars in the culture. Most of the information regarding its history is locked away in old video footage, like VHS tapes, or passed around by word of mouth. This impacts future generations who want to learn the culture and dance because their resources are limited and fragmented. My research answers the questions, "what are the race dynamics in breaking culture?", "which countries in the world are dominating the competitive aspect of the dance", and "how can this culture be studied in academia?".

I am creating a digital archive from VHS tapes, and other magnetic tape media. After conversion, the videos are annotated so that viewers can search through the footage using keywords, like an index. Then, dancers are analyzed using the Human Development Index (HDI). This research enables me to answer questions about which countries are most involved in the culture, and a "summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living".

There are no established visual components to teach breaking culture in academia, therefore my project fills this gap. By analyzing video, I can argue the impact of the culture in a global context. I am able to identify which countries are dominating the culture, in the competitive context, and build trends and graphs that reflect this analysis.

Research Mentor: Rayvon Fouche, American Studies

Poster Number: 5350 :: Social Sciences/Humanities

College of Liberal Arts

Translation of Milton in Puebla, Mexico

Author(s):

Brenae Newhard

Abstract:

The goals for the project are to produce 1) an Anglophone translation of (English_El Paraíso perdido: Drama en 4 Actos arreglado por Ambrosio Nieto, sobre la inspiración del inmortal Milton_ [Paradise Lost: Drama in 4 Acts Arranged by Ambrosio Nieto, Upon the Inspiration of the Immortal Milton] (c.1900), published in Puebla, Mexico by Ambrosio Nieto (1875-1950), and 2) conduct research for the introduction and annotations that describe the international forces of the late 19th century that gave rise to the work, including the Latin American drive to claim its stakes on the Spanish language originally imported from Spain; Mexico's theatrical strengths centered in Puebla; the growth of the international prestige of the works of the early modern English Protestant poet and political author John Milton (1608-74), even in Catholic countries like Mexico; and the printing press in Mexico, imbricated in a publishing network and physical production encompassing Western Europe, especially Germany. These two products will be used for a dramatic reading on campus. Further goals either at the end of Spring 2018 or a possible Fall 2018 MKWURI is investigation into literary criticism and cultural criticism that explores questions of the adaptation of epics into drama, the use of prose drama in Mexico at the beginning of the 20th century, and the compilation and critical assessment of the literary production of Ambrosio Nieto, who is a minor figure in Mexican literature.

Research Mentor: Angelica Duran, English and Interdisciplinary Studies

Poster Number: 5333 :: Social Sciences/Humanities

College of Liberal Arts

Facial Expressions in Sign Language Grammar: What does the 'flat chin' mean?

Author:

L. R. Nikolai

Abstract:

In sign languages, Non-Manual Markers (NMM) supplement information given by the hands, but are produced elsewhere on the body. For example, raised eyebrows mark interrogatives. Though NMM are common, many of their purposes are still unknown. This study looks at the linguistic function in American Sign Language (ASL) of the NMM Action Unit 17 (AU-17) (Ekman and Friesen, 1978), which looks like a pout and is produced using the chin’s mentalis muscle. Previous research suggests AU-17 correlates with expressing disgust cross-culturally (Ekman, Sorenson, & Friesen, 1969) and, within ASL, negation (Benitez-Quiroz, Wilbur, & Martínez, 2016). Using evidence from *The Face of ASL* video series, we hypothesize AU-17 has three functions: indicating speaker evaluation, focusing on detail, and signaling specific words. AU-17 most frequently occurs when indicating speaker evaluation, such as in FEEL IDENTICAL FINISH (Translation: “When you're finished and feel you've signed (the example) identically...”), where the signer expresses uncertainty over how satisfactorily she has signed something. We also see AU-17 over phrases focusing on detail, such as NOW VIDEOTAPE SPLIT FEW CL:1+5 “parts” CUT (Translation: “Now, this videotape is cut into a few parts.”). AU-17 occurs over the phrase describing how the video is split apart into smaller pieces. Finally, AU-17 consistently accompanies signs such as MISS. Given this data, we argue that in ASL, AU-17 has three functions besides negation. Ultimately, our analysis will feed the development of automatic sign language translation algorithms as well as improving the accuracy of ASL second language instruction and first language interpretation.

Research Mentor: Ronnie B. Wilbur, Speech, Language, and Hearing Sciences

Poster Number: 5079 :: Mathematical/Computational Sciences

College of Liberal Arts

Using Transition Analysis to Examine Age at Death in Tombos

Authors:

Isabelle Ortt

Kaitlyn Sanders

Abstract:

Traditional methods of age estimation based on skeletal evidence assign all older aged individuals to the broad category of 50+ years of age. To more accurately determine the age of individuals belonging to this group, we utilized transition analysis to examine an archaeological collection of individuals excavated from Tombos, Sudan, an Ancient Nubian settlement occupied from the New Kingdom through the Napatan period. Based on the age-related characteristics of each element, we scored the crania, auricular surfaces, and pubic symphyses according to the methods outlined by Boldsen et al. to estimate age in individuals who appeared 50+ years using traditional methods. Thirty well-preserved individuals from the collection are included in this study. These data, along with sex estimates, were analyzed using the transition analysis program ADBOU to generate a 95% CI age range and maximum likelihood age estimate for each individual. Calculated ages vary, with 70% of individuals displaying characteristics consistent with an age of 50 or greater. Of these 21 older individuals, 10% were aged 50-59, 24% fall within the age category 60-69, 38% likely died between age 70 and 79, and 29% had an age at death exceeding 80 years. This study demonstrates that transition analysis can reveal considerable variation in samples of advanced age. Such an analysis not only provides more accurate estimations of life expectancy in Ancient Nubia, but also presents an opportunity to consider the Osteological Paradox of health in populations who live to advanced age but display few pathological lesions.

Research Mentor: Michele Buzon, Anthropology

Poster Number: 5205 :: Mathematical/Computational Sciences

College of Liberal Arts

Computational Statistics in Zooarchaeology

Author:

John Rapes

Abstract:

WLKE Student

Research Mentor: Erik Otarola-Castillo, Anthropology

Poster Number: 5284 :: Social Sciences/Humanities

College of Liberal Arts

Pronunciation in L2 French

Author:

Lucinda Ray

Abstract:

In a world that has become so interconnected, improving language acquisition is not only an important endeavour but an imperative one. More over, formulating methods to better pronunciation is essential in truly ameliorating the ability to communicate for L2 learners. It is not merely enough to be able read and write in a second language, rather pronunciation must also be clearly decipherable. Otherwise, if a speaker is conversing in a tongue other than their own, but is still unable to be understood due to pronunciation patterns too different from that of the L2 language, their knowledge is rendered ineffective.

This research examines the role of instruction on French pronunciation by native English speakers in the early stages of learning. College students in French 102, French 201, and French 202 classes record themselves reading a text at the beginning and end of the semester. The recordings are next segmented into sentences and then further into the words with the specific sounds being looked at: [p], [y], and [u]. These specific sounds are then further analysed to see how pronunciation has improved throughout the course of the semester.

Research Mentor: Jessica Sturm, Languages and Culture

Poster Number: 5151 :: Social Sciences/Humanities

College of Liberal Arts

Dependent Visas and Labor Market Access: How Immigration Policies Disadvantage Migrants

Authors:

Meron Tamene

Daniella Gonzalez

Pablo Balcazar

Eesha Patel

Abstract:

The United States is a major destination for many high-skilled migrants who come here for academic and employment opportunities on temporary visas. These high-skilled workers often migrate with their spouses, who become dependent visa holders. Restrictions placed on dependent visa holders limit their ability to freely work and study. By doing this, the U.S. is hindering them from contributing to their households and the economy. Presumably, if given the authorization to work, dependent visa holders would choose to work and generate an income. In this study, we seek to answer two questions: what is the loss to the dependent spouse and society when the government denies labor market access and is the host government's policy the only impediment to labor market access? We hypothesize that the spouses of high skilled migrants will be skilled themselves and thus the labor losses will be sizeable for the dependent spouse and society. We also hypothesize that country of origin will influence dependent spouses desire to work in the destination. We rely on survey and interview data collected during summer 2017 to answer our research questions.

Research Mentor: Natasha Duncan, Political Science

Poster Number: 5361 :: Social Sciences/Humanities

College of Liberal Arts

Proximate Bodies and Social Landscapes: A Look Into the Immediate Connections of Social Media Through Dance

Author:

Frankie Tao

Abstract:

The research conducted in this project intends to examine the the relationship between an online persona and how it impacts one's interpersonal relationships. In other words, the research intends to see whether an individual's social proximity with their social circles is connected to their social media activity. Through an on campus survey, which will lead to college student responses, the results will be analyzed and interpreted to see if there are any connections between social media and the social bonds that an individual has. This information will then be conveyed through dance and interactive technology. Within the dance and the research, the concepts of proximity versus intimacy and how this relationship works with curated movement will be explored. The technology component will also explore how light can cause and effect changes the human qualities in choreography.

Research Mentor: Kathleen Hickey, Visual and Performing Arts

Poster Number: 5327 :: Life Sciences

College of Liberal Arts

Thermoregulatory and Predation-Risk Trade-Offs to Nocturnal Activity in a Diurnal Great Ape

Author:

Addie Walters

Abstract:

Western chimpanzees (Pan troglodytes verus) inhabiting protected savanna biomes are sympatric with large predators and experience risk of heat stress, but little is known about their antipredation and thermoregulation behaviors. We studied this trade-off at Mount Assirik in Niokolo-Koba National Park, Senegal by investigating activity patterns of chimpanzees and their potential predators. Camera traps were used to assess spatial and temporal overlap of chimpanzees, leopards (Panthera pardus), spotted hyenas (Crocuta crocuta), and African wild dogs (Lycaon pictus). We summarized activity on a 24-hour cycle and found chimpanzees to be most active during daylight hours, especially in the early morning and late afternoon, but they were also active at night. We verified spatial synchrony between chimpanzees and large carnivores and, in one case, near complete spatio-temporal synchrony among chimpanzees and a leopard. This study confirms that Assirik chimpanzees are nocturnal and experience predation risk. These great apes may be nocturnal to cope with heat stress, however, this strategy may also lead to increased risk of predation.

Research Mentor: Stacy Lindshield, Anthropology

Poster Number: 5368 :: Social Sciences/Humanities

College of Liberal Arts

Bringing the Past to Life: Historical Archaeology and Public Education

Author:

Natalie Young

Abstract:

In early 2016, the Tippecanoe County Historical Association established The Ouiatenon Preserve — a Roy Whistler Foundation Project and Archaeological Conservancy Research Preserve — located at the site of an 18th century French fort and fur-trading post along the Wabash River. The creation of this site offers professionals at the intersection of archaeology, history, and education an opportunity to examine trends and best practices for sharing the past with public audiences. Although these public audiences include all those who may visit the site, special attention is given to K-12 students and their teachers in order to consider how archaeologists, historians, museum professionals, and educators can best collaborate, using informal and engaging strategies at museums and historic sites to “bring history to life.” The knowledge gained from this research will be made available to the Tippecanoe County Historical Association as they continue to develop the facilities and programming at The Ouiatenon Preserve.

Research Mentor: H. Kory Cooper, Anthropology

Poster Number: 5365 :: Social Sciences/Humanities

College of Liberal Arts

The Role of User Status and Experience in the Network Structure of Health Message Sharing on Twitter: Replies, Retweets, and Mentions during the National Diabetes Awareness Month

Author:

Lu Yu

Abstract:

The current study examines how Twitter is used as a conduit of message sharing in a health campaign context. We focus on the following questions to understand the patterns of interaction and identify key influencers: First, how does Twitter facilitate users' engagement in reciprocal dialogues beyond simply offering a one-way message dissemination channel? Second, who occupies influential positions in the network of information sharing and which factors explain certain positions of social influence? We build upon, yet add a unique extension to these inquiries by considering a relatively under-examined aspect of Twitter: the role of users' status and experience in the online space. Further, by employing network analysis method, we disentangle the micro-level communicative practices on Twitter – reply, retweet, and mention – by highlighting the similarities and differences among their network structures. These examinations provide valuable insights for users striving to utilize various communicative features of Twitter for health promotional goals.

Poster Number: 5362 :: Social Sciences/Humanities

College of Liberal Arts

Purdue Cybersecurity Scorecard

Author:

Ziqin Yuan

Abstract:

This project represents the process of creating a Cybersecurity Scorecard for the State of Indiana. Purdue University Homeland Security Institute is working with the office of the Cybersecurity Program Director at the Office of Technology & Indiana Department of Homeland Security to measure the status of Indiana's cybersecurity across eight industry and government sectors.

The poster will describe the methodology for building up a cybersecurity scorecard based upon the National Institute of Standards and Technology's (NIST) framework for improving critical infrastructure cybersecurity. The need for this project highlighted by research findings that scorecards are effective communication mechanisms for formulating and transmitting information for organizations. The goal is to provide Indiana Executive Council on Cybersecurity tool quarterly for identifying priorities and tracking process. The project is intended to provide academic rigor to the design and analysis for Cybersecurity Scorecard and actionable reports and protect that will respondent's anonymity as required.

Research Mentors: J. Eric Dietz, Computer and Information Technology; James Lerums, Computer and Information Technology

Poster Number: 6351 :: Life Sciences

College of Pharmacy

The impact of differential ligand engagement on downstream signaling of epidermal growth factor receptor.

Author:

Avni Bhalgat

Abstract:

About 12% or 1 in every 8 women in the United States will develop breast cancer in their lifetime. There are a number of different approaches currently used to treat breast cancer but there is still no cure for metastatic disease.

The epidermal growth factor receptor (EGFR) is encoded by the EGFR gene. It is a transmembrane receptor that drives downstream signaling. Binding of a ligand to the receptor outside the cells leads to dimerization (homo or hetero) and activation of several different downstream signaling pathways.

EGFR has been well established as a proto-oncogene, a gene known to have the potential to cause cancer. It is also known to be aberrantly activated and amplified in one-third of all epithelial cancers. Therefore, there are multitudes of drugs that have been developed to antagonize EGFR including monoclonal antibodies and kinase inhibitors. However, EGFR also has a paradoxical function as a tumor suppressor gene as well, which can help protect a cell from becoming cancerous. Three major pathways downstream of EGFR are MAPK, AKT, and STAT 1. While MAPK and AKT lead to oncogenic effects, STAT 1 is a transcription factor that has tumor suppressor qualities.

We seek to address the hypothesis that differential, activation of EGFR using different endogenous or non-natural ligands will lead to preferential downstream signaling to STAT 1. Not only would this enhance the tumor suppressor effect of EGFR, but it also has the potential to block the oncogenic effects of EGFR activation. If successful our studies could lead to the development of a novel therapeutic for breast cancer.

Currently, we are evaluating our hypothesis by analyzing different cell lines through immunoblot western blot protocols and 3D organotypic growth assays that mimic the metastatic environment. Using already available drugs and mice and human cell samples we hope to conclusively determine the feasibility of this hypothesis.

Research Mentor: Michael Wendt, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 6396 :: Life Sciences

College of Pharmacy

Derivatives of Diphyllin: Inhibitors of V-ATPase

Author:

Christopher Blackwell

Abstract:

Vacuolar ATPase (v-ATPase) is an essential component for the invasion of filoviruses or more specifically the ebolavirus. Endosomal acidification allows ebolavirus to enter cells which is part of the action of v-ATPase. There are several known natural inhibitors of v-ATPase which would suggest that it prevents ebolavirus and others similar from entering the cells. An example of a known natural inhibitor is diphyllin. Usually harvested from a plant, the research created a five step synthesis that has a high yield. Improvements were made to a couple steps to improve yield and the recrystallization process.Other reactions occurred with adding n-methyl piperazine. The addition of amides with cyclic rings is under investigation after a succesful to produce one compound with the modification.

Research Mentor: Vincent Jo Davisson, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 6142 :: Social Sciences/Humanities

College of Pharmacy

"And understand I am a person and not just a number:" Reproductive health decision-making among Italian women

Author:

Martasia Carter

Abstract:

Italy represents a reproductive health paradox. The fertility rate is among the lowest in Europe, yet Italian women use less effective contraceptive methods. Healthcare decision-making provides one opportunity to understand reproductive health choices, with prior literature suggesting increased need for patient involvement and shared decision-making.

The objective of this study was to explore Italian women's reproductive health decisions and experiences through a shared decision-making lens.

As part of a larger mixed methods study, researchers conducted 46 interviews (June-July, 2017) with women ages 18-45 living in or near Florence, Italy who used the Italian healthcare system. Researchers used techniques from expanded grounded theory to explore women's reproductive health decisions and decisional roles, with HyperRESEARCH 3.7.5 assisting in data management. A constant comparative approach allowed for identification of emergent patterns and themes.

Participants expressed a desire for informed choice; however, knowledge gaps related to hormonal contraceptive safety impacted women's healthcare access. Findings suggested Italian women may not be fully informed of their reproductive health options and need increased opportunities for decision-making involvement, especially given the significance Italian women place on listening during healthcare consultations. Preferred decisional roles illustrated many women desired autonomy. Additionally, social network served an important function in decision-making; participants weighed the opinions and experiences of others when choosing a reproductive health option. The economy and religion emerged among participants in relation to decisional power, suggesting a complex interaction between social norms and reproductive health choices.

Findings offer practical recommendations to guide shared decision-making in Italian reproductive healthcare to increase women's involvement and empowerment in decision-making.

Public Health Implications: Findings inform patient and provider interventions and campaigns aimed at improving shared decision-making in reproductive health contexts. Additionally, findings may assist public health practitioners in identifying effective communication channels to inform women of their options.

Research Mentor: Andrea DeMaria, Consumer Science

Poster Number: 6130 :: Life Sciences

College of Pharmacy

Dose Response Effect of Dried Blueberry Powder on Bone Turnover in Post-Menopausal Women Using 41Ca Technology

Author:

Julia Czarnik

Abstract:

Osteoporosis is a medical condition that impacts the majority of post-menopausal women and causes brittle bones. Half of women over the age of 50 will suffer from a bone fracture during the rest of their lifetime. Oxidative stress is one of the main factors that leads to reduced activity in bone cells, resulting in bone loss. A diet rich in fruits and vegetables has been found to reduce oxidative stress and increase bone mineral density. Blueberries have one of the highest antioxidant properties among fruits due to the high concentration of polyphenolics. Our study aims to examine the effects of three different doses of dried blueberry powder added to a regular diet on net bone calcium retention and bone turnover in postmenopausal women. We hypothesize that an increased consumption of blueberry powder will improve the retention of calcium in bones. Using the Ca41 labeling methodology, we track the excretion of Ca41 in urine and use the changes in urinary Ca41 excretion to estimate the effect of blueberry consumption on bone. The results of this study are forthcoming and will be presented at the Undergraduate Research Symposium on April 10th, 2018. This study will increase our understanding of calcium metabolism in humans and provide insights about potential non-pharmacological treatment of osteoporosis.

Research Mentor: Joanna Hodges, Nutrition Science

Poster Number: 6095 :: Life Sciences

College of Pharmacy

Repurposing Acetazolamide as an Inhibitor of Vancomycin Resistant Enterococcus

Author:

Amanda Graboski

Abstract:

Enterococcus strains such as E. faecium and E. faecalis are opportunistic pathogens commonly found with low virulence in mammalian GI tracts. Due to their intrinsic and acquired resistance genes, the amount of hospital acquired infections caused by these strains has increased. Approximately 30% of these hospital acquired infections are from enterococcus strains resistant to vancomycin (VRE), leaving few options for treatment. The CDC has classified enterococcus as a serious antibiotic resistance threat, and the need for a rapid influx of new therapeutic options is high. A popular method of developing new therapeutic options rapidly is by repurposing FDA approved drugs. A high-throughput screen for inhibitors of VRE was performed against a library of previously approved FDA drugs. A novel class of inhibitors was identified. A carbonic anhydrase inhibitor, acetazolamide, exhibited no toxicity against normal gut microbiota and selected for VRE. With this knowledge, a structure-activity relationship (SAR) study of acetazolamide derivatives against VRE was explored. Approximately 25 novel analogues were synthesized, with improved MIC's of 0.06-1μg/mL, compared to acetazolamide which yielded values of 2-64 μg/mL. These analogues maintained selectivity against normal gut microbiota. SAR optimization will continue to be explored while the most effective analogues will begin to be tested in mouse models. Resistant mutants to acetazolamide have been isolated and suggest a target unique to enterococcus strains. Validation of the binding of our molecules to this target both in vitro and in bacteria is in progress.

Research Mentor: Daniel Flaherty, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 6058 :: Life Sciences

College of Pharmacy

Effect of Medication Adherence on Health Outcomes in Patients with Heart Failure in a Health Information Exchange

Authors:

Sarah Hood

Anthony Giazzon

Abstract:

Previous studies have demonstrated a correlation between poor treatment adherence to heart failure medications and increased hospitalizations or a composite endpoint of hospitalization and death. Incremental adherence increases in a large population have not yet been examined.

We explored the possibility that incrementally increasing adherence to medication may result in better outcomes including reduced mortality in adult heart failure patients.

A retrospective cohort study conducted using electronic health record data from the Indiana Network for Patient Care (INPC) between 2004 and 2009.

Patients were ≥ 18 years of age with a diagnosis of heart failure and prescribed at least one medication for heart failure. Adherence was measured as the proportion of days covered (PDC) calculated using pharmacy transaction data. Clinical endpoints from the INPC included emergency department visits, hospital admissions, length of hospital stay, and mortality. Generalized linear models were used to determine the effect of a 10% increase in PDC on clinical outcomes adjusting for race, age, sex, comorbidities, and medication type.

Electronic health records were available for 55,312 patients (mean age ± SD 67.868 ± 16 years; 54% women; 65% white). Mean PDC for all heart failure medications was 63% ± 23%. For every 10% increase in PDC, emergency department visits decreased 11% (odds ratio 0.89; 95% confidence interval 0.89-0.90), hospital admissions decreased 6% (odds ratio 0.94; 95% confidence interval 0.93-0.94), length of hospital stay decreased 2% (odds ratio 0.98; 85% confidence interval 0.98-0.98), and all-cause mortality decreased 8% (odds ratio 0.92; 95% confidence interval 0.91-0.93).

Medication adherence increases were significantly associated with reductions in emergency department visits, hospital admissions, length of hospital stay, and all-cause mortality.

Research Mentor: Michael D Murray, Pharmacy Practice

Poster Number: 6106 :: Life Sciences

College of Pharmacy

Screening Peptoids for Molecules that Bind Rpn-6

Author:

Nathaniel Macatangay

Abstract:

The ubiquitin-proteasome system exists across all eukaryotic cells, including cancerous cells. There are currently two FDA-approved drugs that target the proteasome for cancer treatment, but these cancers rapidly become resistant. The current drugs target the protease-like core particle (20S CP) to prevent hydrolysis of proteins into peptides. Rather than targeting the 20S CP, we are interested in discovering molecules that inhibit the non-catalytic regulatory particle (19S RP), which plays a critical role in facilitating 20S CP function. We are focused on the Rpn-6 subunit of the human proteasome because it has multiple protein-protein interaction sites and it behaves as a molecular clamp to hold the 19S RP and the 20S CP together. We recently conducted thermal shift assays to survey peptoids that stabilize Rpn-6 when subjected to heat. Through this screen we discovered a variety of scaffolds that interact with Rpn-6. We are currently determining if any of these molecules behave as an inhibitor that disrupts the protein-protein interaction sites to dissociate the proteasome, leading to the accumulation of waste proteins and ultimately death of the cancerous cell.

Research Mentor: Darci Trader, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 6211 :: Innovative Technology/Entrepreneurship/Design

College of Pharmacy

A Green HPLC Method to Ensure the Quality of Albendazole Tablets

Author:

Holly Maize

Abstract:

Substandard and Falsified (SF) medical products are a major global health issue, especially in developing nations. According to The World Health Organization (WHO) in 2013, “an estimated 100,000 deaths in Africa are linked to the counterfeit drug trade, 700,000 deaths worldwide are caused by fake malaria and tuberculosis drugs, and the counterfeit drug market in Africa is worth over $4 billion”. Previous analytical methodologies have required solvents or supplies that are not green, affordable, or easily accessible.

Therefore, the present study is aimed at High-Performance Liquid Chromatography (HPLC) method development for the anti-parasitic drug Albendazole using the “Green Method”. This research was implemented at Purdue University and the Kilimanjaro School of Pharmacy located in Moshi, Tanzania. HPLC analysis was performed on Albendazole tablets obtained by Purdue University using United States Pharmacopeia (USP) methodologies and an internal standard, Parbendazole, as a comparator. Peak height responses from the chromatograms were recorded and the quantity of medication was calculated using a standard formula.Results indicate that ammonium phosphate and pure ethanol that is diluted with water can produce a validated method for the detection and establishing the purity of Albendazole.

HPLC method development using the Green Method was achieved for the testing of Albendazole tablets. Further studies using the Green Method will allow additional medications to be analyzed to help with combating SF medications throughout Tanzania and the developing world. Studies will be conducted with this method to quantify Albendazole medications obtained in Tanzania.

Research Mentor: Stephen Byrn, Industrial and Physical Pharmacy

Poster Number: 6216 :: Life Sciences

College of Pharmacy

In vitro and ex vivo Characterization of β-arrestin Biased δ-opioid Receptor Signaling

Authors:

Arbaaz Mukadam

Grace Mulia

MeeJung Ko

Abstract:

Seven transmembrane G-protein coupled receptors (GPCRs) can activate different signaling pathways by binding different agonists that can change the conformation of the receptor in unique ways to activate effector molecule(s) that are linked to various behavioral phenotypes. Targeting this kind of 'biased receptor signaling' mechanism of GPCRs has become an increasingly attractive alternative to traditional (unbiased) receptor activation. Previous research has indicated that, when stimulated, there are two main signaling pathways elicited by the δ-opioid receptor (δOR), G-protein and β-arrestin mediated signaling. Our preceding studies have shown that the selective δOR agonist, SNC80, could preferentially activate the β-arrestin pathway while also demonstrating an anxiolytic-like profile in mice. Therefore, we further investigated the intracellular signaling pathways of β-arrestin that may potentially aid in the development of GPCR-targeted drugs. In our studies, we characterized the in vitro as well as ex vivo aspects of β-arrestin-mediated signaling pathway. Chinese Hamster Ovary (CHO) cells overexpressing the δOR and β-arrestin proteins were incubated with the agonist, SNC80, at different time points from 0-60 mins following incubation, after which mitogen-activated protein kinase (MAPK) phosphorylation was quantified using Western blot analysis. We specifically quantified three MAPKs (ERK1/2, p38, and JNK) that have been well described as common downstream effectors of the β-arrestin pathway. We found that in particular, the phosphorylation of ERK1/2 significantly increased in a time-dependent manner when compared to the other two MAPKs. Using this information, we also assessed the effects of SNC80 in mice brain. Similar to our in vitro characterization, an intraperitoneal administration of SNC80 at a dosage of 20 mg/kg significantly activated ERK1/2 phosphorylation in the amygdala, the hippocampus, the nucleus accumbens, and the striatum. By utilizing these approaches, our results may suggest that the binding of SNC80 to the δOR results in β-arrestin-mediated downstream signaling, involving ERK1/2 phosphorylation. These findings will be useful in further understanding how biased signaling can be modulated in order to produce cellular responses and behavioral responses, enabling the development of novel therapeutics with fewer side effects.

Research Mentor: Richard M. van Rijn, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 6402 :: Life Sciences

College of Pharmacy

FGFR Signaling Facilitates Acquired Resistance to Trastuzumab Emtansine

Author:

Stephen Connor Purdy

Abstract:

Breast cancer is the most common form of cancer diagnosed in women. Currently, one out of eight women will be diagnosed with breast cancer at some point in their lives. Of the patients diagnosed with breast cancer, around 20% of them are considered to be the Her2+ subtype. Human Epidermal Growth Factor 2 (Her2) is a receptor tyrosine kinase, in which its amplification is linked to aggressive tumors, poor prognosis, and an increase chance of recurrence. Trastuzumab emtansine (T-DM1) is an anti-Her2 monoclonal antibody-drug conjugate that has been successful in treating early stage Her2+ breast cancer. Upon binding to Her2, the antibody-drug conjugate gets internalized, allowing emtansine to elicit a cytotoxic effect by inhibiting microtubule polymerization. This therapy has shown significant tumor regression and an extension in the average overall survival of Her2+ breast cancer patients. However, there is a subset of patients that show resistance to T-DM1. To determine the mechanisms of resistance, our lab has developed T-DM1 resistant cell lines. We have shown that Her2 amplified cell lines that have resistance to T-DM1 downregulate Her2 expression. As these cell lines *in vitro* and tumors *in vivo* develop resistance, Her2+ expression gets reduced significantly, lowering the efficacy of T-DM1. Furthermore, as Her2 expression is reduce, Fibroblast Growth Factor Receptor-1β (FGFR-1β) is upregulated. In order to overcome the acquired resistance to T-DM1, we then investigated the use of novel FGFR inhibitors to treat T-DM1 resistance tumors in vivo and found this to be efficacious. Our data supports that administering FGFR inhibitors in patients with T-DM1 resistant tumors, may improve prognosis and overall survival.

Research Mentor: Michael Wendt, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 6252 :: Life Sciences

College of Pharmacy

The selective nEGFR antagonist through the nuclear-targeting tag

Author:

Anqi Shao

Abstract:

Epithelial Growth Factor Receptor (EGFR) has been extensively investigated as an important target in cancer therapy over decades. EGFR mainly regulates four major signal pathways and inducing cell proliferation, angiogenesis, cell cycle progression, and transformation. Due to gain-of-function mutations, EGFR acquires enhanced intrinsic tyrosine kinase activity to distort the signal pathways regulation by elevation its nuclear translocation. The exact mechanism of this elevation of nEGFR remains unrevealed and treating nEGFR inside cell becomes more difficult due to the sequestration of EGFR. Utilizing a nuclear localizing sequence derived from viruses and peptoids, we developed a nuclear-targeting tag to conjugate with gefitinib, a first generation EGFR inhibitor, to treat nEGFR within nucleus. The result showed an efficient compartmentalization of gefitinib as well as selective inhibition of STAT3 phosphorylation without interrupting ERK1/2 signaling, or other cytosolic signal cascade. However, more exploration is needed to verify the actual interaction in vivo. Considering the roles of EGFR plays in transcription and as a co-factor to DNA repair complex, we proposed that the nEGFR may affect DNA damage repair pathway. By inhibition of its ATP binding site, we may push cancer cells toward apoptosis by down-regulation of repair pathway.

Research Mentor: Vincent Jo Davisson, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 7296 :: Innovative Technology/Entrepreneurship/Design

College of Science

Bio-friendly Adhesives Inspired on Mussel Chemistry

Author:

Jose Adorno-Cancel

Abstract:

Adhesives are used in our daily lives, from school projects to holding the electronic pieces of a phone together. These adhesives tend to permanently bond items together, making disassembly for recycling challenging. Natural polymers such as starch and hide glue are not strong enough to match the performance of petroleum-based polymers. Because of this, it is imperative that we design a glue that is strong bonding but also biodegradable and renewably sourced. Inspiration for such a polymer comes from marine mussels that use the amino acid 3,4-dihydroxyphenylalanine (DOPA) in their adhesive plaques. Incorporation of this adhesive chemistry into a renewably sourced, polylactic acid backbone, was accomplished with a polyesterification reaction. The adhesive strength of the resulting polymer, poly[(3,4-dihydroxymandelic acid)-co-(lactic acid)] was tested in a lap shear configuration using an Instron Materials testing system. The bonding strength of this polymer matches that of petroleum-based polymers under similar conditions. Future work includes testing the adhesion strength of this polymer overtime in air, underwater and in acidic or basic environments. Understanding how this polymer degrades in different conditions will ensure that materials bonded together can be taken apart for recycling when needed.

Research Mentor: John Wilker, Chemistry

Poster Number: 7099 :: Social Sciences/Humanities

College of Science

Twitter Entity versus Tweet Sentiment Analysis

Author:

Pranav Ram Anappindi

Abstract:

The problem I try to tackle is understanding the sentiment relationship between a tweet and the twitter entities in the tweet (hashtags and @mentions). Using a random baseline, I evaluated my performance as a ternary classification problem. I explore different models and their possible pitfalls. To get a representation of the text, I compare and contrast word embedding techniques like WordVec, DeepWalk etc. The model that uses all the embeddings together gets a classification accuracy of 52% in the class classification task.

Research Mentor: Dan Goldwasser, Computer Science

Poster Number: 7387 :: Life Sciences

College of Science

Characterization of the GXXXG Dimerization Motif of the Yeast Isoprenylcysteine Carboxyl Methyltransferase

Author:

Sahej Bains

Abstract:

Ninety percent of pancreatic cancers are attributed to activating mutations in the oncogene K-Ras. Thus, it is important to inhibit the activity of the K-Ras enzyme in cancer cells. This research targets oncogenesis by studying an enzyme, isoprenylcysteine carboxyl methyltransferase (Icmt), which post-translationally modifies K-Ras by transferring a methyl group to the C-terminus of K-Ras. This modification guides the K-Ras protein to the membrane where it signals cellular growth. Our goal is to understand the structure of Icmt in order to develop inhibitors. The yeast homolog of Icmt, Ste14, is known to form and function as a homodimer. In this study, we aim to further explore the effect of dimerization on the function of our protein. Ste14 is comprised of six transmembrane (TM) domains and TM1 contains the dimerization motif, G31XXXG35XXXG39. Using cysteine-scanning mutagenesis and the addition of sulfhydryl specific cross-linkers, we have determined several residues that potentially comprise the dimerization interface. We also characterized the TM1 cysteine mutants for their effects on protein expression, activity, and stability. Residues S27, Y28, L30, G31, G35, and G39 are critical for methyltransferase activity. Trypsin digestion revealed that Y28C, G31C, G35C, and G39C show differential protease sensitivity, suggesting that the differential cleavage patterns correlate with the loss of methyltransferase activity of these mutants. Together, these data suggest that the amino acids comprising and surrounding the GXXXG domain play a pivotal role in dimer formation, along with protein expression, stability, and folding. Further structural analysis of Icmt will be utilized to design more potent therapeutics to minimize K-Ras signaling in cancer cells.

Research Mentor: Christine Hrycyna, Chemistry

Poster Number: 7010 :: Innovative Technology/Entrepreneurship/Design

College of Science

The Lean Scrum: Making Scrum more dynamic for the Entrepreneurial Environment

Authors:

Arjun Banerjee

Lisa Campbell

Guna Kondapaneni

Abstract:

Scrum is a subset of Agile that is hard to implement in smaller teams. It creates some waste with features that sometimes are not useful or desired by users which can be costly especially to small businesses. In order to eliminate costliness, we created a new framework called Lean Scrum which is a blend of Lean Startup methodology and Scrum. As opposed to original Scrum, this framework is more dynamic in terms of time frames and connects the team more with what the customer wants in order to develop a product that will be much better received on launch. To test this new framework, we created a new Android application that became our test product. We developed a several prototyped features for the application and then sent out the application to beta testers who were in our target market for our new product. In this case, we leveraged college students as our target market. After we received feedback on these prototyped features, we then made decisions on whether to fully build out a certain feature or to scrap that feature. We keep repeating the process of creating prototyped features, getting feedback from our users, deciding how to move forward based on this feedback, acting upon this knowledge until the application was ready for initial launch or the semester ended. From using our new Agile framework on this test product, we primarily learned what to add onto this lean framework in order to make it retain more information from user feedback.

Research Mentor: Buster Dunsmore, Computer Science

Poster Number: 7031 :: Physical Sciences

College of Science

Catalytic Cyclopentanation of enones using Dicholoromethan

Author:

Nishit Banka

Abstract:

A Ni(quinox) catalyst has been identified to enable the reductive cyclopentanation of a, b-unsaturated ketones. The reaction involves a sequential transfer of carbene equivalents in a [2+1+1+1] cycloaddition. Dichloromethane (CH2Cl2) acts as the carbene source, precluding the necessity for the use of highly reactive diazoalkane reagents as carbene precursors. This form of cycloaddition represents the first example of catalytic access to carbocycles larger than cyclopropanes from multiple carbene additions to enones.

Research Mentor: Christopher Uyeda, Chemistry

Poster Number: 7274 :: Life Sciences

College of Science

The Effects of 1a,25-dihydroxyvitamin D3 treatment on SNAIL1 mRNA Expression in Breast Cancer Epithelial Cells

Author:

Tamara Batarseh

Abstract:

The Effects of 1a,25-dihydroxyvitamin D3 on SNAIL1 mRNA Expression in Breast Cancer Epithelial Cells

One in eight women in the United States will be diagnosed with breast cancer in their lifetime. Detection of this disease at its earliest stage is vital, as there is a 99% survival rate in treating localized tumors, while only a 22% survival rate in treating metastatic tumors. Previous studies have shown that vitamin D has been able to prevent the metastasis of breast cancer cells, although the mechanisms still remain unknown. E-cadherin, a cell-cell adhesion molecule, functions to regulate epithelial/mesenchymal transition (EMT), a process by which epithelial cells gain migratory and invasive properties to become mesenchymal stem cells that are able to differentiate. An overexpression of SNAIL1, a protein involved in the suppression of E-cadherin, has been found in multiple epithelial and endothelial cells of breast cancer. Pyruvate carboxylase (PC) is the aneplerotic enzyme that catalyzes the carboxylation of pyruvate to oxaloacetate, a process crucial in biosynthetic purposes which has been shown to potentially be up-regulated by SNAIL1. In previous studies, we identified that the active metabolite of 1a, 25-dihydroxyvitamin D3 (1,25(OH) 2D) down-regulates the protein and mRNA expression of PC. The purpose of this study was to investigate the effect of 1,25(OH)2D on SNAIL1 mRNA expression in MCF10cA1a malignant breast epithelial cells. SNAIL1 mRNA expression was also downregulated with treatment of 1,25(OH)2D. These results suggest a potential mechanism between 1,25(OH)2D and SNAIL1 repression and between 1,25(OH) 2D and PC, and show the need to study these mechanisms for possible breast cancer therapies and prevention.

Research Mentor: Chae Hyun Yum, Nutrition Science

Poster Number: 7015 :: Life Sciences

College of Science

Development and Characterization of an Endotoxemia Model in Zebrafish

Author:

Chufan Cai

Abstract:

Endotoxemia is the presence of endotoxins in the blood, and it leads to disseminating intravascular coagulation (DIC) and other manifestations. We utilized the animal model, zebrafish, to study endotoxemia based on its conserved innate immune system and imaging properties. We approached endotoxemia with a LPS blood injection model. This lead to acute systemic inflammation represented by whole body increase of NFkB which the time frame mirrors human endotoxemia development. Furthermore, we report that our endotoxemia model successfully mirrored other characteristics of endotoxemia, which include, vascular damage and immune cell mobilization/hematopoiesis. Total proteomic pathway analysis showed that our endotoxemia model biological pathway alterations was in conjunction with human studies. Finally we show that this model can be used to validate drug screens and understand the mechanism of potential treatments.

Research Mentor: Qing Deng, Biological Sciences

Poster Number: 7136 :: Life Sciences

College of Science

Characterization of learning, memory, and seizures in complement C3 knockout mice

Authors:

Zoe Carlson-Stadler

Nicole Schartz

Amy Brewster

Abstract:

The classical complement pathway is part of the immune complement system. Activation of this pathway is initiated by the complement C1q and leads to downstream activation of the complement C3. C3 is cleaved into C3a and C3b to regulate inflammatory and phagocytic responses, respectively. We recently found increased activation of the C3 in human and experimental epilepsy. In order to investigate the role of C3 in epilepsy we obtained constitutive C3 knockout (KO) mice. The objective of this study was to determine the baseline learning and memory, locomotion, anxiety, and seizure threshold of C3KO compared to wild type (WT) mice. We tested hippocampal-dependent learning and memory using the Barnes Maze (BM) and the Novel Object Recognition (NOR) test, locomotion and anxiety with the Open Field (OF), and determined seizure threshold to two different doses of the chemoconvulsant pilocarpine (325 and 350 mg/kg). We found that WT and C3KO mice displayed similar learning in the BM assessed as decreased time to reach a hidden box in an open arena during 4 days of training. Similarly, C3KO and WT mice were able to differentiate and preferentially explore a novel object compared to a familiar one in the NOR test. OF showed that WT and C3KO mice displayed similar locomotion (distance traveled and speed), and anxiety behaviors (freezing and % in inner area of the OF). Lastly, following administration of pilocarpine, C3KO and WT mice developed prolonged behavioral seizures consistently according to the Racine seizure scale (1-6). Both pilocarpine doses (325 and 350 mg/kg) promoted the development of stage 4.5-6 seizures in all genotypes. Taken together these data suggest that C3KO and WT mice have similar basal learning behaviors and seizure thresholds. Future studies will test whether C3KO mice are protected against seizure-induced injury and the subsequent development of epilepsy.

Poster Number: 7271 :: Life Sciences

College of Science

Genome Annotation of VasuNzinga Phage

Authors:

Morgan Carrithers

Zhi Yu

Zihan Gao

Zonghao Zhang

Abstract:

The genome of a phage named VasuNzinga, first discovered at Purdue, has been annotated with detailed information on the 115 gene locations and functions. The work centered around the last 15 genes in the genome, and the work ensured that all of the genes had the correct position and overlap. The program DNAMaster was the main software used to analyze the genome and identify different genes' open reading frames. This program auto-annotated the genome, and determines possible starts and functions for each gene. GeneMark was used to see where the most coding potential was located, and Phamerator showed a map of the gene locations by amount of base pairs. Starterator was used to determine which call for the gene was the most viable start, to ensure that all the other information was correct. There were several different programs used to determine gene function as well, including HHPred and BLASTP. The phage being studied has also been compared to other member of the same cluster, and contrasted with the known gene locations of fully annotated phages. VasuNzinga has been found to have several overlapping genes, with sequences being read in both the forward and reverse direction. The gene function for the last 15 genes are mostly centered around termination, inhibition, and enzymatic activity. The ultimate goal of this project is to submit a final genome annotation to phagesdb.org and GeneBank, in order to help with further research on bacteriophages and their genomic similarities.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 7261 :: Life Sciences

College of Science

Genomic Characterization and Analysis of novel Mycobacterium smegmatis phage VasuNzinga

Authors:

Catherine Carroll

Helen Flynn

Gabrielle Shapiro

Kasey Martineau

Abstract:

Bacteriophages are the most abundant organisms on Earth and can be found anywhere that bacteria exist. Phage research has spurred great advancements in the fields of molecular biology and genetics, including the passage of genetic information. There are an estimated 1031 phage entities on Earth, the vast majority of which are undiscovered and uncharacterized3 The Science Education Alliance: Phage Hunters Advancing Genomics and Evolutionary Science (SEA-PHAGES) program led by the Howard Hughes Medical Institute primarily focuses on the introduction of molecular biology lab work to undergraduates in the context of gaining insight about the genetic diversity and evolution of bacteriophages.

During the spring 2018 semester, our team studied and characterized a novel Mycobacterium smegmatis bacteriophage, VasuNzinga, using various genetic analysis tools such as DNA Master, GeneMark, BLAST, and Phamerator. Following the annotation of the genes 80 – 98, functional analysis, and alterations were done via manual annotation and comparison with previously characterized phages. The final result of this project is an annotated genome that will be submitted to an Actinobacteriophage Database. This project provides further information and insight on the ongoing investigation of bacteriophage. The investigation on mycobacteriophage genomics is far from over, but by providing another annotated genome to the database, the pool of knowledge and gene function is extended.

Research Mentor: Kari L. Clase, Technology Leadership & Innovation and Agricultural & Biological Engineering

Poster Number: 7030 :: Social Sciences/Humanities

College of Science

Training Medical Professionals to Work with Patients with Neurodevelopmental Disorders: A Systematic Review

Author:

Katherine Ceglio

Abstract:

Individuals with neurodevelopmental disorders, including intellectual and developmental disabilities, are frequently displeased with the quality of healthcare they receive. Medical personnel report that they do not feel sufficiently capable of serving patients with disabilities because they were never properly educated about neurodevelopmental disorders. The purpose of this systematic review is to summarize the research that evaluates the effectiveness of training programs given to medical personnel about neurodevelopmental disorders. Thirty-three studies met inclusion criteria. The studies were summarized in terms of format and content of training, the neurodevelopmental disorder(s) addressed, the medical personnel trained, and the effectiveness of the training, as defined by the authors. Trainings were conducted in classroom or workshop settings, through online modules, using home or school visits or standardized patients, or side-by-side observation with professionals. Medical personnel being trained included undergraduate medical students, medical residents, practicing pediatricians, and nurses or nursing students. The effectiveness of the studies and the implications for future research and practice are discussed.

Research Mentor: Mandy Rispoli, Educational Studies

Poster Number: 7175 :: Life Sciences

College of Science

Resource competition and its effect on disease dynamics in freshwater zooplankton populations

Author:

Mackenzie Chapman

Abstract:

Interspecific competition can reduce population densities of competing species. However, the effects of competition on infectious disease, particularly when only one species can become infected with a given parasite, is less understood. We performed two experiments to study the effects of resource competition between two species of zooplankton and its effects on disease dynamics. First, to quantify potential resource competition, we estimated feeding rates in both species to quantify how much an individual of each species may consume in a given time. Simocephalus sp. and Daphnia dentifera feeding rates were studied in this experiment with 15 replicates of each species. Each replicate was an individual in a falcon tube with a known amount of food. After two days of grazing, we measured absorbance values using a fluorometer and body size. This experiment was conducted once using young individuals (juveniles) and once using older individuals (adults). We did not find any significant difference in feeding rate between the two species, but older (and larger) animals consumed more food. Second, to quantify the effect of competition on disease susceptibility, we set up populations of D. dentifera with two treatments: with and without Simocephalus sp. present. Within each treatment, half of the beakers were exposed to Metschnikowia bicuspidata, a fungal parasite. Population densities and rates of infection were quantified every two weeks. Population densities of D.dentifera were lower in the presence of Simocephalus sp. indicating that competition between these two species does occur. Additionally, the presence of Simocephalus sp. reduced densities of infected D.dentifera, but not infection prevalence. There was a trend of higher infection prevalence when Simocephalus are absent in a population. These studies demonstrate that interspecific resource competition can influence both population densities and patterns of disease in this system.

Research Mentor: Catherine Searle, Biological Sciences

Poster Number: 7372 :: Mathematical/Computational Sciences

College of Science

Modeling, measuring and pricing the flood risk: An actuarial perspective

Author:

Yujie Chen

Abstract:

Floods have been the number-one disaster in terms of property damage in the United States and Canada for recent decades. Although there is the federal National Flood Insurance Program (NFIP) the U.S. and various flood related insurance products in Canada, the demand for involvement of private sectors in flood insurance market is increasing. Existing products in two countries have different limitations such as low market share, outdated flood maps and inaccurate pricing. Most of challenges encountered by flood insurance are caused by the lack of effective communication among multiple disciplines, as modeling flood risk has been well developed among assorted fields including hydrology, environmental science and climate changes.

To serve as an encompassing reference source for the actuarial community, this paper first describes the notion of the flood risk, insurable risks related to flood, flood risk management, insurance market as well as existing approaches to modeling and pricing in both U.S. and Canada. With considerations of inundation depth and flood velocity as key factors in modeling flood risk, the second part of this paper examines the feasibility of translating general stochastic (dependence) modeling techniques and encompassing toolbox of multiple factor models, which have been successfully applied in actuarial science, to the area of flood risk modeling.

Research Mentor: Jianxi Su, Statistics

Poster Number: 7017 :: Life Sciences

College of Science

Effect of site and seasonality on vocal behavior of mixed-species flocks

Author:

Cara Christensen

Abstract:

In this study, we examined variations in behavior and vocalizations of mixed-species flocks consisting of Carolina chickadees, Tufted titmice, White-breasted nuthatches and Downy woodpeckers across three forest sites in Indiana. Calls of a known predator of these species (Eastern screech owl) were played near naturally occurring mixed flocks, and the response of the flocks was recorded. Preliminary data suggested that all three populations respond to a predation threat and there is no difference in latency of flock approach between sites. Additionally, we found differences across sites in latency and approach order at the species level. Furthermore, we analyzed call and song rate for Carolina chickadees and Tufted titmice before, during, and after the predator playback. Significant differences were found between both season and site for call rates for both species.

Research Mentor: Jeffrey Lucas, Biological Sciences

Poster Number: 7203 :: Innovative Technology/Entrepreneurship/Design

College of Science

A Simplified International Model of Agricultural Prices, Land Use And The Environment

Author:

Ya-Wen Chu

Abstract:

Simple-on-a-Grid (Simple-G) is a supply and demand model to investigate global water-food-environment sustainability, whose equations include variables such as land usage, crop production, resource consumption and trades. It can be used to assess climate change, water use given a variety of future scenario of global farm and food system. Funded by the Purdue University Discovery Park's Big Idea program, the Global to Local Analysis of Systems and Sustainability (GLASS) project developed and used the SIMPLE-G economic model to predict trade-offs and impacts among land, water, and commodity prices. The GLASS project benefits a broad range of stakeholders, such as policymakers, investors, local communities and scientific researchers. Leveraging Purdue's open source HUBzero portal platform, the GLASS development team worked on bringing the Simple-G tool online so that it can be used through a browser, without the need to download and install any packages. In this poster, I will present the work I have done in developing the graphical user interface of Simple-G online for users to create/apply restrictions, aka policies, to the economic model. Main tasks include functions that allow users to import/export policies, create new policies, and modify the geographic regions and other parameters of existing policies. With Simple-G Online, researchers may impose multiple policies on the amount of available irrigation water, cropland expansion, tax, and subsidies, and evaluate the impact of these policies on global and local crop production and food security.

Research Mentor: Lan Zhao, Research Computing

Poster Number: 7253 :: Life Sciences

College of Science

A Biochemical Characterization of the SWI/SNF Complex in Small Cell Carcinoma of the Ovary, Hypercalcemic Type

Author:

Rachel Collicott

Abstract:

Small cell carcinoma of the ovary, hypercalcemic type (SCCOHT), is a rare type of ovarian cancer that represents less than 1% of ovarian cancer cases. Though rare, it is extremely aggressive and primarily affects young women around the age of 23 and the majority of patients die within 2 years. In addition, the cancer tends to occurs in families, indicating a genetic cause. By sequencing cohorts SCCOHT tumors, scientists recently discovered that these cancers are driven by a mutation of a single gene called SMARCA4, also known as BRG1. Loss of BRG1 is lethal in most cell lines. Pathology of these tumors suggest that they are not carcinomas but more similar to malignant rhabdoid tumors (MRT), another cancer affecting young people. MRTs are driven by mutations in SMARCB1 or BAF47, a subunit in the same protein complex as BRG1. This complex is the SWI/SNF chromatin remodeling complex, which is required to create regions of accessible DNA for gene activation. Over 20% of cancers have mutations in one or more subunits of this complex, making uncovering the mechanism by which the SWI/SNF complex suppresses cancer of utmost importance. In fact, the mutation of another subunit, ARID1A, is present in the majority of ovarian clear cell carcinoma patients, making our work with the SWI/SNF complex relevant for many other ovarian cancers. To evaluate the role of BRG1 in these cancers, we will re-express this protein to characterize the mechanism by which these cells have by passed the need for BRG1.

Research Mentor: Emily Dykhuizen, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 7270 :: Life Sciences

College of Science

Frequency Variation in the Song of Carolina Chickadee: An Added Dimension of Vocal Complexity?

Author:

Nickoulas Cooper-Garcia

Abstract:

Carolina chickadees (*Poecile carolinesis*) have a relatively simple song system, containing four elements – fee-bee-fee-bay. Our analysis of chickadee song patterns shows an added dimension of complexity in the form of modulation of element frequency. This study looked at variation in the frequency of song elements of chickadees across three independent populations in Indiana. Elements of the fee-bee-fee-bay song were mapped from extensive samples of natural vocalizations. We characterized song types based on shifts in frequency and duration. We further examined the effect of social networks, spatial flock dynamics, and habitat characteristics on patterns in song types across sites. Our results have shown three distinct frequency variations in the first fee element at one site and another variation transposed lower than the others at another site. Further research is in the process.

Research Mentor: Jeffrey Lucas, Biological Sciences

Poster Number: 7034 :: Life Sciences

College of Science

Inducibility of hM3Dq-mCherry Using Doxycycline After a Large Meal in the cNTS-AP

Author:

Taylor Dal Bon

Abstract:

Exciting the cells in the caudal two-thirds of the nucleus solitary tract (cNTS) and the area postrema (AP) may reduce meal size and food intake because these cells are excited during satiation. Therefore, when the cells are activated artificially, food intake should decrease, thus preventing or reversing obesity. In our mouse model, c-Fos-tTA mice are injected with a virus containing a Tet-Off expression system for hM3Dq-mCherry into the cNTS-AP. Following injection, the mice consume a chow diet containing 40mg/kg doxycycline (Dox) for four weeks. Mice are then taken off Dox and trained to eat a large meal to activate c-Fos-tTA (tetracycline transactivator) expression in the cNTS-AP. tTA triggers expression of hM3Dq-mCherry. Dox prohibits hM3Dq-mCherry expression. Mice off Dox, will have greater hM3Dq-mCherry expression because tTA binds tetracycline response element (TRE), activating hM3Dq-mCherry expression. Mice on Dox should not express hM3Dq-mCherry in the cNTS-AP. Cells containing the hM3Dq receptor can be artificially activated using the receptor ligand, clozapine-n-oxide. The experimental goal is to demonstrate inducibility of hM3Dq-mCherry in the cNTS-AP by determining the time off Dox for optimal hM3Dq-mCherry expression. Mice are divided into three Dox groups: 3 days, 2 days, and 1 day off Dox. mCherry is a fluorescent protein used to visualize and count cells with hM3Dq. We hypothesize, 2 or 3 days off Dox will have optimal hM3Dq-mCherry expression induced by a large meal and this timeframe off Dox can be used in future experiments to determine the role of these cells in satiation by artificial excitation.

Research Mentor: Edward Fox, Psychological Sciences

Poster Number: 7336 :: Social Sciences/Humanities

College of Science

An Analysis of Student Performance at the Intersection of Diversity and Information Literacy

Authors:

Michael Dalrymple

Joshua Woodard

Abstract:

This paper explores the intersection of institutional data and information literacy in an engineering design process class at Purdue. The paper examines the diversity and information literacy knowledge of the students in the course while filtering for 9 variables. The aim of the paper is to describe the students and their experiences in a manner that impacts teaching strategies, specifically in the context of information literacy education.

Information literacy education often occurs with little consideration of a student's past or current experiences with information literacy. This paper will attempt to create a well-rounded description of each student in the course and will investigate the extent to which a student's information literacy performance in the course is correlated to non-classroom factors. These non-classroom factors will consist of variables reflecting institutional data and diversity. Some of the institutional data variables analyzed include high school transcripts, financial data, and collegiate transcripts. Some of the diversity categories analyzed include underrepresented minority (URM) identification, first generation student status, and financial aid status. Some students (n=120) in the course were randomly selected to have their course data and institutional data analyzed.

Although data analysis is incomplete at this time it is believed that students with higher levels of information literacy experience, legacy status, and higher family financial contribution outperformed students with lower levels of information literacy experience, first generation status, and lower family financial contribution in their information literacy coursework. It is also hypothesized that students with URM status performed similarly as those without URM status.

Research Mentor: Nastasha Johnson, Libraries

Poster Number: 7026 :: Life Sciences

College of Science

Characterizing Dendritic Spine Dynamics in a Zebrafish Model of Acute Seizures

Author:

Elisabeth Demarco

Abstract:

Dendritic spines are the major site of excitatory synaptic transmission in the mammalian cortex. During development, dendritic spines transition from a motile filopodial shape to a stable spine morphology, characterized by an enlarged spine head and thin neck. Previous studies in a pharmacological model of epilepsy in rats have demonstrated that seizures lead to spine loss, potentially impairing excitatory transmission. Pentylenetetrazole (PTZ), a GABA-A receptor inhibitor, can be used to induce acute generalized motor seizures in several model systems, including zebrafish. The goal of this project is to develop an experimental workflow to study the timecourse of seizure-induced spine loss in pyramidal neurons (PyrNs) of the optic tectum. Experiments currently under way are using PyrN-specific expression of the calcium sensor GCaMP6s to confirm enhanced excitatory firing in PyrNs upon PTZ treatment. Preliminary results confirm enhanced excitatory firing in PyrNs in response to acute application of 10mM PTZ. The time course of these responses and time to recovery after washout will be used to design an effective treatment paradigm for repeated seizure induction. To monitor spine degeneration and potential recovery, we will conduct in vivo two-photon microscopy of single, genetically labeled PyrNs expressing a membrane-targeted EGFP label. In the future, we envision applying this model system towards the goal of identifying novel anti-epileptic drugs that protect dendritic spines from the adverse effects of seizures.

Research Mentor: Estuardo Robles, Biological Sciences

Poster Number: 7385 :: Life Sciences

College of Science

Targeted Bone Anabolic Peptides Improve Fracture Healing

Authors:

Stephanie DeVoe

Bradley Readnour

Abstract:

Bone fractures lead to serious complications and even death in elderly patients. With increasing life expectancy and the current aging population, these problems are only predicted to increase their burden of the health care system in the near future. Currently, treatment options consist of mechanical stabilization which does not address prompting the body to produce more bone tissue at the fracture site. Our research explores the use of a novel drug delivery system, in the form of a targeted bone anabolic peptide, to accelerate formation of a fracture callus. Treatment of murine osteoblast precursors, MC3T3-E1, with the targeted peptide delivery system through qPCR analysis revealed upregulated ALP expression compared to both the nontargeted peptide and control samples. After 4 weeks of daily subcutaneous injections with the targeted bone anabolic peptide of femur fractures in murine models, 3D imaging techniques revealed significant callus formation and localization of the targeted drug specifically at the fracture site. Histopathology of liver and kidney tissues did not show significant abnormalities. Our research has demonstrated the efficacy of a novel drug, in the form of a targeted bone anabolic peptide, to stimulate osteoblastic differentiation in vitro and increase bone mineralization specifically at the fracture site in vivo without detectable toxicities. The targeted approach permits a systemic delivery system through repeatable doses with no detectable toxicities offering a new, noninvasive method to treat bone fractures, and perhaps may be used for other conditions that require bone reparations such as osteoporosis.

Poster Number: 7321 :: Physical Sciences

College of Science

Phase Separation Patterns in Iridates

Author:

Oscar Dillman

Abstract:

Doped Mott Insulators have been shown to exhibit interesting metallic/insulating phase separation patterns near their transition temperature and at certain doping thresholds. Continuous phase transitions exhibit power law behavior during transition, and this sort of consideration works well when observing the change in phase between metallic and insulating in these materials. In the case of Vanadium Dioxide for example, these spatial patterns have been analyzed by calculating the critical exponents for an Ising model of the arrangement of phases of the material. The exponents for this material indicate a 2-D structure of the patterns, consistent with the sample being a thin film. We apply a similar technique in analysis of the material $(Sr_{1-x}La_x)_2IrO_4$ in order to extract analogous Ising critical exponents. These values are then compared to theoretical values calculated for different types of systems (random-field, percolation, clean, as well as 2-D and 3-D) in order to determine the characteristics of the phase separation patterns in this material. Analysis of this material indicates that these patterns follow a 3-D Random Field model.

Research Mentor: Erica Carlson, Physics and Astronomy

Poster Number: 7255 :: Life Sciences

College of Science

The Impact of EDTA on the Iron Acquisition and Virulence of Salmonella Typhimurium

Author:

Theresa Emeli

Abstract:

The rise in antibiotic resistance has placed pressure on the need to understand the modes of antibiotic resistance as well as alternatives to combat bacteria who have evolved resistance towards commonly-used antibiotics. Amongst antibiotic-resistant bacteria, bacteria that are most likely to develop resistance are Gram-negative bacteria, such as E. coli, which are of concern when treating patients in a healthcare setting. This has led to research on new antimicrobials and potential targets within bacteria that are more susceptible to interference by antibiotics or antimicrobials. Ethylenediaminetetraacetic acid, EDTA, has been of interest due to its effect on the beginning stages of logarithmic growth in Salmonella bacteria. The purpose of this project is to understand the effects of EDTA on the growth and pathogenesis of Salmonella and understand its effect on expression of genes utilized in iron uptake which is important for virulence. By understanding the effect of EDTA on the ferric enterobactin transport system in Salmonella, this information can be applied to other Gram-negative bacteria and help combat the rise of antibiotic resistance.

Research Mentor: Daoguo Zhou, Biological Sciences

Poster Number: 7006 :: Life Sciences

College of Science

Novel Potassium Channel Blocker 4-AP-3-MeOH Restores Acrolein-Mediated Conduction Loss in Peripheral Nervous System Injury

Authors:

Mara Fattah

Jessica Page

Abstract:

The neurotoxin acrolein is known to cause conduction loss, a key pathology in neurotrauma and disease, such as spinal cord injury or multiple sclerosis. Acrolein is a highly reactive aldehyde capable of interacting with lipids, proteins and DNA, whose toxicity is increased by its ability to self-perpetuate through lipid peroxidation. Acrolein application results in myelin retraction- the axonal sheath composed of lipids- exposing juxtaparanodal voltage-gated potassium channels (Kv1). Exposure leads to the efflux of potassium (K+) ions which disrupts membrane potential and blocks conduction. Previous studies have demonstrated the use of potassium channel blockers (PCBs) to restore axonal conduction, such as 4-aminopyridine-3-methanol (4-AP-3-MeOH); this mechanism has yet to be evaluated in the PNS. Recent evidence indicates acrolein is elevated both locally and systemically, suggesting its damage could affect the PNS. Therefore, the purpose of this study is to determine if acrolein causes axonal conduction loss in the PNS and can be restored by PCBs. Using rat sciatic nerve, we assessed axonal conduction by recording ex vivo compound action potentials (CAP) before and after treatment of 500 uM acrolein using double sucrose gap recordings. Following acrolein application, we observed a significant reduction in CAP amplitude. We also demonstrated 100 uM 4-AP-3-MeOH significantly restored axonal conduction after acrolein application. This is the first study to demonstrate the effects of acrolein on sciatic nerve axonal conduction and potential restoration by PCB 4-AP-3-MeOH. Our findings are consistent with CNS observations, and could present PCBs as potential treatments for conduction restoration following acrolein-mediated PNS neuropathy.

Research Mentor: Riyi Shi, Basic Medical Sciences

Poster Number: 7128 :: Physical Sciences

College of Science

Integrative Reservoir Characterization for Chemical Enhanced Oil Recovery, Tar Springs Formation, Illinois Basin, United State of America

Author:

Jack Fekete

Abstract:

Hydrocarbon reservoirs within the Illinois basin that have been extensively developed will soon reach the end of their production history without technological intervention. Although many of these mature fields have been waterflooded for decades and show a significant production decline, substantial amounts of residual oil remain in place making them ideal candidates for enhanced oil recovery (EOR) techniques. This research focuses on producing fields in southern Indiana that are being considered as a pilot study for surfactant-polymer chemical EOR. Using an integrated methodology that includes field geology, sedimentology/petrology, quantitative powder X-ray diffraction (XRD), infrared spectroscopy (FTIR), thermal analysis (TGA-EGA), and scanning electron microscopy (SEM) combined with energy dispersive X-ray spectroscopy (EDX), we present an integrated approach to reservoir characterization of the Tar Springs Formation, one of several key upper Mississippian producing horizons within the basin. The characterization approach provided here explores reservoir architecture, connectivity, and petrophysical parameters as they relate to the mineralogy and chemistry of the reservoir.

Results show the pilot study reservoir is compartmentalized by five lithofacies each characterized by distinct physical and chemical properties: F1 – very fine to fine grained horizontally stratified sandstone; F2 – very fine to fine grained flaser bedded sandstone; F3 – wavy bedded sandstone with very fine-grained sandstone and mudstone interlayers; F4 – lenticular bedded silty mudstone; and F5 – calcite cemented sandstone. Combined petrophysical and geochemical results suggest horizontally stratified and flaser bedded sandstone facies represent the best reservoir injection targets. Together, lithofacies F1 and F2 contain higher average porosity and permeability values, possess significantly higher quartz sand-clay ratios, and yield the highest amounts of residual oil. Wavy bedded, lenticular bedded, and calcite-cemented sandstone facies have the poorest reservoir quality that can be attributed to enhanced clay content that impairs porosity, permeability, and has led to diminished oil saturations. Major clay components of the Tar Springs Formation are distributed throughout the reservoir in varying proportions based on lithofacies and can influence not only flow parameters but interact with injected chemicals to alter fluid circulation and sweep efficiencies. This integrated approach to reservoir characterization has important implications for providing a framework for decision making concerning the future of other developed reservoirs that are considered close to abandonment in mature basins.

Research Mentor: Kenneth Ridgway, Earth, Atmospheric, and Planetary Sciences

Poster Number: 7143 :: Life Sciences

College of Science

Identifying factors that genetically interact with R-loops to promote gene repression

Author:

Chrishan Fernando

Abstract:

Long non-coding RNAs (lncRNAs) were once thought not to have useful functions in organisms but rather to be products of aberrant transcription. However, roles are being found for lncRNAs in beneficial processes such as controlling gene expression. In some of these cases, lncRNAs form R-loops in vivo. R-loops are nucleic acid structures consisting of hybridized strands of single-stranded DNA (ssDNA) and single-stranded RNA as well as the displaced strand of ssDNA. Formation of these R-loops is important for gene regulation by the lncRNAs. However, the mechanisms by which this form of regulation occurs is poorly understood. Thus, there is a need to identify factors that participate in R-loop mediated gene repression. To identify such factors, a genetic reporter strain has been constructed in Saccharomyces cerevisiae using the PHO84 gene. It is an appropriate gene for the reporter because expression of PHO84 is suppressed by the formation of R-loops containing an antisense lncRNA produced downstream of PHO84. The PHO84 reporter strain is being used to perform direct testing of factors that potentially interact with R-loops to suppress gene expression. A genetic screen will also be performed in S. cerevisiae to identify genes that suppress gene expression on PHO84 when overexpressed. The effects of these genes will be studied thoroughly to develop an understanding of how they interact with R-loops and how they suppress gene expression.

Research Mentor: Elizabeth Tran, Biochemistry

Poster Number: 7176 :: Life Sciences

College of Science

Lippia origanoides extract upregulates apoptotic pathways and significantly decreases the viability of MDA-MB-231 TNBC cells

Author:

Rodrigo Ferreira

Abstract:

Breast cancer is the most common type of cancer worldwide, affecting about 1 in 8 U.S. women. The most aggressive subtype of breast cancer, triple negative breast cancer (TNBC), is typically resistant to conventional therapies that target hormone receptors, as it lacks expression of genes coding for progesterone receptor (PR), estrogen receptor (ER) and human epidermal growth factor receptor 2 (Her2/neu). Previous studies have shown that an extract from Lippia origanoides, a plant native to the Amazon region of South America, possesses significant anti-cancer properties. In our study, we confirmed the concentration-dependent decrease in viability of MDA-MB-231 cells (TNBC cells) treated with Lippia extract L42, via MTT assay. We have also shown through wester blotting a significant increase in cleaved caspase 8 in MDA-MB-231 cells treated with L42, demonstrating the activation of the extrinsic pathway of apoptosis, and thereby explaining the decrease in cell viability. This study provides evidences that L42 is a potent alternative treatment for TNBC, and further investigations will lead us to an in-depth understanding of the major cellular processes regulated by this treatment.

Research Mentor: Ignacio Camarillo, Biological Sciences

Poster Number: 7221 :: Life Sciences

College of Science

The Mechanism of Regulation on "Protein A" by Aurora Kinase A (AURKA)

Author:

Benjamin Flueckgier

Abstract:

Aurora Kinase A (AURKA) is overexpressed in multiple cancers. Aurora A inhibition reverses tumorigenesis and metastasis in mice. As a result, multiple AURKA inhibitors are in chemical trials. However, AURKA is also essential for mitosis throughout the body. Thus, AURKA inhibition in clinical trials has been associated with multiple toxicities such as neutropenia and somnolescence. Our goal is to identify disease-specific targets of AURKA, which are either specifically expressed or activated in pathological states. To this end, we utilized a chemical genetic approach developed in our lab and identified “Protein A” as a direct target of AURKA. Our goal is to uncover the molecular mechanism by which AURKA regulated Protein A to promote cancer. Therefore, site-directed mutagenesis via PCR is used to determine the exact type of interaction between AURKA and Protein A. Four specific mutations were made that will allow for determination of the possible phosphorylation sites AURKA is interacting with Protein A if any. Once each of the mutants is made, double, triple and quadruple mutants are also made. Each mutant is then ligated into the plasmid TAT-HA. From here transformation into BL21 cells is performed to facilitate expression and purification of the protein. Once each mutant protein is expressed, each is checked via Western Blot. After, a kinase assay is done involving all of the mutant proteins and AURKA. This allows for identification of which specific sites AURKA phosphorylates the wild-type Protein A.

Research Mentor: Kavita Shah, Chemistry

Poster Number: 7039 :: Life Sciences

College of Science

Formulation and Characterization of DNA-Arginine Nanoparticles for the Treatment of Bladder Cancer

Author:

Helen Flynn

Abstract:

Bladder cancer is the ninth most common type of cancer and accounts for 5% of all new cancers. In the United States alone, 82,000 people will be diagnosed with bladder cancer in 2018, the majority of which will be non-muscle invasive. Current treatment methods for superficial bladder cancer are limited to surgical removal and Bacillius Calmette-Guerin, an intravesical immunotherapy treatment which causes a local inflammatory response. However, these routes often leave much to be desired; BCG therapy is associated with unpleasant side effects such as hematuria, urinary frequency, and flu-like symptoms. Additionally, up to 50 percent of non-muscle-invasive bladder cancer patients will see recurrence of bladder cancer or progression to muscle-invasive bladder cancer.

To circumvent the disadvantages of BCG therapy, immunostimulatory nucleic acids will be used to activate the immune system. Specifically, the adjuvant properties seen from single strands of DNA containing numerous repeats of cytosine and guanine nucleotides will be used. Nucleic acid therapies have long shown promise as therapeutics but need varying formulation strategies to allow delivery. This work will describe the compaction of CpG DNA with polycationic peptides of different ratios and the resultant effect on size and particle stability. Data was collected via Dynamic Light Scattering for particle size, ζ potential measurements for surface charge and stability, and gel shift assays were performed to test decomplexation conditions. Given successful nanoparticle formation, future experimentation will be focused on in-vitro cytotoxicity and uptake in bladder cancer cells.

Research Mentor: David Thompson, Chemistry

Poster Number: 7323 :: Social Sciences/Humanities

College of Science

Impacts of the Great Recession on Functional Declines in Health

Author:

Luke Francisco

Abstract:

This study attempts to quantify the impacts of the Great Recession (2007-2009) on changes in health based on three waves of data from the Survey of Mid-Life Development in the United States (MIDUS), a longitudinal study of health and well-being in older and middle-aged adults. This study focuses on changes in activities of daily living (ADLs), a variable in MIDUS that measures self-reported functional limitations. The Great Recession began between the collection of the second and third waves of MIDUS data, so subjects who were part of both of these samples are defined as the experimental group while the control group is taken to be the group of subjects who participated in the first and second waves of MIDUS. Statistical matching methods are then used to ensure similar distributions of age and other important factors between subjects in the experimental and control groups. The study hypothesizes that the Great Recession will significantly increase the rate of functional declines in health. This material is based upon work supported by the National Science Foundation under Grant No. 1246818.

Research Mentor: Elliot Friedman, Human Development and Family Studies

Poster Number: 7236 :: Life Sciences

College of Science

Investigating Cleavage of Unnatural Substrates with the Proteasome

Author:

Autumn Frerk

Abstract:

A peptide is a naturally occurring compound of two or more amino acids that can be useful for medicinal purposes. Since peptides occur naturally, they have a limited window of efficacy as they can be rapidly degraded by proteases. In pharmaceutical research, products such as unnatural compounds with longer lifetimes are more desirable. Peptoids are one of these unnatural products which last much longer then peptides.

In this research project, we are synthesizing peptides with a peptoid section attached to find out which functional groups give the desired cleavage with the proteasome. After synthesis of the peptoid, a biochemical assay is performed in which it is degraded using the proteasome. For positive results, it should cleave between the peptoid and peptide sections. By analysis with LC-MS, it can be determined if the desired product is formed and how much the proteasome degrades the peptoid. To determine which functional groups give the best results, these steps are repeated using different peptoid/peptide structures which are chosen based on the results of previous assays. For each structure, the peptide remains the same while the peptoid changes. The results will help us to better understand what substrates the proteasome can accept and eventually design peptidomimetics that can target the proteasome.

Research Mentor: Darci J. Trader, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 7153 :: Innovative Technology/Entrepreneurship/Design

College of Science

Detecting Multifunctional Proteins by Applying Deep Learning to Academic Literature

Author:

Hareesh Gali

Abstract:

Multi-functional, or moonlighting proteins have started to gain more attention due to their ability to combine several functions into one protein. The ability to express multiple functions has brought on new challenges to scientists attempting to find multi-functional databases for large data sets. Since databases, such as UniProt, do not label proteins as multi-functional scientists have a harder time finding multi-functional proteins. Our lab proposed a method (DextMP) involving language models, such as deep learning and bag-of-words, to be applied to scientific literature in UniProt (Khan et. al, 2017) to detect multi-functional proteins. In this work, we use DextMP to identify potentially new moonlighting proteins in organisms such as Arabidopsis Thaliana.

Research Mentor: Daisuke Kihara, Biological Sciences and Computer Science

Poster Number: 7042 :: Life Sciences

College of Science

Whole Cell Organic Solvent Extraction of Chaperone Protein from E. coli

Author:

Clare Gallagher

Abstract:

Alpha-beta crystallin is a protein chaperone found in retinal epithelial tissue and is a potential treatment for age-related macular degeneration. Alpha-beta crystallin serves to prevent oxidative stress in the retinal epithelial cells. A truncated 20 amino acid sequence derived from alpha-beta crystallin has been shown to maintain the chaperone activity but due to its small size, it has limited therapeutic potential. To combat this issue, a protein inspired by human tropoelastin was attached to the alpha-beta crystallin to increase therapeutic efficiency and provide ease in purification. Due to the inherent hydrophobic nature of these elastin-like polypeptide(ELP) protein polymers, crystallin was purified by a newly developed organic extraction procedure, shrinking the amount of time it takes to purify from a several hours to 30 minutes. In this work, the crystallin-ELP complex, known as CryS96, was extracted from lysate with 28 different organic extraction conditions screening for purity and yield. The best extractants were then used for whole cell bacteria to further simplify the purification process. Removal of excess organic solvent was achieved using a back extractant solvent composed of ethyl acetate and water. The extraction was evaluated with SDS-PAGE to test for protein purity from the organic extractions and relative yields. Retention of chaperone activity is paramount, thus, Alcohol Dehydrogenase (ADH) assays were performed to test if chaperone activity was retained after organic extraction. The results from the assay indicate the CryS96 was able to decrease the rate of oxidative stress, providing evidence chaperone activity was retained after organic extraction purification.

Research Mentor: David Thompson, Chemistry

Poster Number: 7286 :: Life Sciences

College of Science

The Localization of HYPE in Response to ER Stress

Author:

Adrianne Glaser

Abstract:

The Fic (filamentation induced by cAMP) family of proteins was first discovered in E. coli, where a mutation in a gene encoding a Fic protein led to a filamentous phenotype in the cells. Fic proteins have a conserved sequence HXFX(D/E)(G/A)N(G/K)RXXR, with an invariant histidine, which catalyzes the family's enzymatic activities, including AMPylation/UMPylation, phosphocholination and phosphorylation. The reactions catalyzed by Fic proteins and proteins containing Fic domains have been implicated in regulating cellular response to stress, in addition to acting as virulence factors in many bacteria. Fic proteins are found throughout evolution, including one Fic protein in humans, HYPE. HYPE, or Huntington yeast interacting protein E, acts as a mediator in the unfolded protein response system (UPR) and can determine cellular fate. As a part of this system, HYPE adenylates/AMPylates its target BiP, an Hsp70 chaperone that resides in the ER lumen and monitors protein misfolding. Indeed, HYPE's hydrophobic N-terminus also localizes it to the ER lumen, where it AMPylates BiP at Ser-365 and Thr-366 and alters its ATPase activity. Thus, by affecting BiP and UPR activation, HYPE regulates ER homeostasis. In addition to BiP, reports from this lab and others have identified new targets for HYPE, some of which reside in cellular compartments other than the ER lumen. To reconcile HYPE's localization outside the ER lumen, we hypothesized that ER stress may signal HYPE to change localization. To test this hypothesis, HYPE was fused to GFP and transfected into HEK293T cells and exposed to a variety of drugs and chemicals mimicking cellular stresses. Cells were assessed for changes in HYPE localization and cellular morphology using fluorescent confocal microscopy. My data showed that under the conditions tested, HYPE did change its localization but the resolution of confocal fluorescence microscopy is not sufficient to assess changes in localization. Further high-resolution analyses using Electron Microscopy and Electron Tomography for assessing HYPE localization is currently underway.

Research Mentor: Seema Mattoo, Biological Sciences

Poster Number: 7204 :: Life Sciences

College of Science

Reconciling single-cell and population growth dynamics for cells undergoing stochastic death

Author:

Adam Guerin

Srividya Iyer-Biswas

Abstract:

Cell population growth dynamics are a well-known deterministic process. Individual cell growth dynamics, however, are highly stochastic and still actively being researched. As such, there is a growing desire to understand the connection between the two. The dynamics have already been modeled and established in conditions where mortality (cell death) can be neglected. We seek to further bridge the differences between individual and population dynamics, but with the incorporation of effects of cell death. The cell growth data is collected through ‘switch’ experiments, where single cell imaging can track multigenerational growth of Caulobacter Crescentus before and after the cells are switched between mediums that may or may not lead to death. We then derive analytical solutions to various relevant data sets. such as cell-age distributions. Using our results, we further the understanding of physical principles and scaling laws governing stochastic individual cell death

Research Mentor: Srividya Iyer-Biswas, Physics and Astronomy

Poster Number: 7074 :: Innovative Technology/Entrepreneurship/Design

College of Science

Transport Properties of InSb/AlInSb Quantum Well Heterostructures

Author:

Charles Guinn

Abstract:

The realization of topological quantum computing requires devices on materials with a strong spin-orbit interaction coupled to a superconductor. In the past, top down processing of Indium Arsenide two-dimensional electron systems (2DES) with shallow wells have proven promising for these devices. However due to stronger spin-orbit coupling, lower band gap, higher g factor, and lower effective mass, Indium Antimonide 2DES may be better suited to topological quantum computing applications. This work considers 2DES in Indium Antimonide/Aluminum Indium Antimonide (InSb/AlInSb) quantum well heterostructures grown by molecular beam epitaxy. Magnetoresistance and Hall measurements are taken in InSb/AlInSb quantum wells at temperatures as low as 300 mK to determine electron density and mobility. The spin-orbit interaction is characterized by studying weak-antilocalization at low magnetic field and effective g factor is calculated by analyzing spin splitting of Shubnikov–de Haas oscillations. In addition, an Oxford Helium 3 cryostat is repurposed into a station to measure devices at 4 K in magnetic fields as high as 6 T. A new probe is fabricated and proper electronics are set up to support new measurements.

Research Mentor: Mike Manfra, Physics & Astronomy, Electrical & Computer Engineering, and Materials Engineering

Poster Number: 7233 :: Life Sciences

College of Science

Daily growth of young-of-year Silver Carp (Hypophthalmichthys molitrix) in the Wabash River, Indiana

Author:

Joshua Heishman

Abstract:

Understanding factors that contribute to invasion success is crucial for curbing the spread of invasive species. Silver Carp Hypophthalmichthys molitrix are highly successful invaders of the Mississippi River basin (USA). Rapid growth rates of adult Silver Carp are believed to contribute to their high success. However, growth rates of young-of-year (YOY) Silver Carp remain unquantified. In this study, we used posteriolateral scales to estimate daily growth rates of YOY Silver Carp in the Wabash River (Indiana, USA), a major tributary to the Ohio River. Although useful for ageing Hypophthalmichthys spp. in other studies, we found postcleithra and sagittal otoliths lack proper resolution for daily age estimation of YOY Silver Carp. Scale-based analysis suggested that YOY Silver Carp exhibited rapid daily growth rates that averaged 3.6±0.07 mm per day. Linear mixed models (accounting for variation among individuals) revealed that daily growth rates were more closely related to maximum daily temperature ($p<0.0001$) than maximum daily discharge ($p=0.1743$). This study fills a key gap in the knowledge of bigheaded carp daily growth rates. Future studies relating body depth-at-length of YOY Silver Carp to length-based gape limits of native predatory fishes will add mechanism to role played by rapid growth rates in this highly invasive species.

Research Mentor: Reuben Goforth, Forestry and Natural Resources

Poster Number: 7342 :: Life Sciences

College of Science

An integrated study of genomics, landscape ecology, and conservation in the Montezuma quail

Author:

Ashlyn Heniff

Abstract:

This project aims to use a genetic approach to better understand the biology of the Montezuma quail (Cyrtonyx montezumae), a galliform found in the Southwestern United States and Mexico. Due to recent population and range decline, they are considered threatened in Texas. These birds exist in small, isolated populations which are particularly susceptible to losing genetic diversity through inbreeding and genetic drift. As such, baseline genetic data is necessary to determine if management actions such as translocations or habitat corridors are needed to prevent local extinctions. This research uses both whole and partial genome sequencing methods to analyze the geographic distribution of genetic variation, which is determined primarily by organismal dispersal and reproduction. The ultimate goal of this research is to provide insights into the demographic history, population genetics, and landscape ecology of Montezuma quail in the Southwestern United States that managers can use to make effective decisions for conserving this species.

Research Mentor: Samarth Mathur, Biological Sciences

Poster Number: 7105 :: Life Sciences

College of Science

Dopaminergic Hypo-activity in Children with Autism Spectrum Disorder: A Study of Spontaneous Eye Blink Rate

Author:

Taylor Hornung

Abstract:

Spontaneous eye blink rate (EBR) is considered to be an indirect, non-invasive measure of central dopaminergic activity. Dopamine plays a critical role in several behavioral and cognitive functions, including executive control, reward-seeking, and repetitive behaviors, all of which may be atypical in autism spectrum disorder (ASD). Prior studies using a variety of methodologies have reported inconsistent dopamine findings in ASD, ranging from dopaminergic hypo- to hyper-activity. Thus, the status of dopaminergic function in ASD remains uncertain. The objective of the current study was to further investigate dopaminergic activity, as indexed by spontaneous EBR, in children with ASD. Participants included twenty-one children with ASD and nineteen age- and IQ-matched typically developing (TD) children. Electroencephalography and eye tracking data were acquired while participants completed two, three-minute blocks of eyes-open resting state. Participants were shown a grey screen with a black fixation cross and were instructed to relax, remain still, and to look at the crosshair. Spontaneous EBR was measured using a bipolar vertical electrooculography recording. For each block, blinks were scored and EBR was determined by dividing blink frequency by the block duration. EBR was entered into a mixed-model repeated measures ANOVA with between-subject factor group (ASD, TD) and within-subject factor block (1, 2). EBR was significantly reduced in the ASD group (M = 12 blinks/minute) compared to the TD group (M = 19 blinks/minute). Our findings suggest that ASD is associated with dopaminergic hypo-activity and indicate that EBR may be a useful measure of dopamine in individuals with ASD.

Research Mentor: Brandon Keehn, Speech, Language, and Hearing Sciences and Psychological Sciences

Poster Number: 7040 :: Life Sciences

College of Science

25 Years of Puberty Research: A Bibliometrics Analysis

Author:

Savannah Hottle

Abstract:

Puberty research has been extremely productive in the last couple of decades, but there is still much to discover. In an effort to obtain a “state of the field” of puberty, we conducted a bibliographic analysis to assess the sheer numbers, audience and reach, types, and impact of puberty-related publications in the broader scientific community. This analysis of journal article citations, abstracts, and keywords provides a bigger picture of the field on puberty research, gauging a field as whole including its reach, impact, and major players.

We searched the phrase “puberty or pubertal” in titles and abstracts in two different databases, PubMed and Web of Science, for articles published from 1990-2016. In Web of Science we limited the document type to “article” or “review” in order to focus on scholarly output. In PubMed we also included “Puberty” as a MeSH term.

We found that puberty publications are increasing in sheer number, have reach in many interdisciplinary fields of science, and have audience in various journals of research, including Journal of Clinical Endocrinology and Metabolism, Journal of Pediatric Endocrinology and Metabolism, PLOS One, and Hormone Research. The main publication types are empirical articles, examining puberty as a predictor or moderator of behavioral or health phenotypes, and examining the predictors of puberty. Puberty publications typically have higher impact in terms of citations than the journal averages, among the top journals for puberty publications. Recommendations for researchers to improve the impact and reach of puberty publications are provided.

Research Mentor: Kristine Marceau, Human Development and Family Studies

Poster Number: 7265 :: Social Sciences/Humanities

College of Science

Patient-Physician Communication on Tapering Opioid Medication Dosage

Authors:

Kiara Hughes

Audrey Caprio

Abstract:

Opioid misuse can lead to a barrage of medical issues and even death. Even though literature has shown that long-term use of opioids is ineffective in chronic pain management, many providers continue to prescribe these medications at alarming rates. Along with an increase in use, providers and patients alike find conversations regarding pain and pain management strategies “strenuous,” “hostile,” and “a major source of frustration.” Improving communication by breaking down these barriers is essential in the prevention of opioid misuse. To conduct the study of patient-physician communication, Dr. Shields (Purdue) and Dr. Mathias (IUPUI) recruited 36 patients from Eskenazi Hospital outpatient clinics to complete pre-observation surveys and record three sequential visits with their primary care provider. After transcription by the research team, undergraduate research assistants rated transcripts on tapering (reducing or eliminating) opioid use. Physician’s discussions were rated on a 5-point scale of how much they discussed the need to taper opioid use, and patients were rated on the same scale on how much they talked about their need for maintaining or increasing opioid dosages. Physicians discussing tapering and patients requesting the same or more opioids were highly correlated 0.85 ($p < .001$). This indicated that when physicians suggest tapering, patients might become alarmed and protective of their need for opioids. When patients mention maintenance or an increase in opioids, physicians respond with concerns about opioids and promote tapering of dosages. Future studies will examine interventions to increase tapering conversations.

Research Mentor: Cleveland Shields, Human Development and Family Studies

Poster Number: 7159 :: Life Sciences

College of Science

The impact of infectious disease on toxic effects in a freshwater zooplankton model

Author:

Juliana Ilmain

Abstract:

Contaminants in a freshwater environment can have harmful effects on wildlife. To determine a contaminant's harmfulness, the lethal dose is often tested by exposing healthy animals to various concentrations of contaminant over a short period of time. However, toxic effects may differ in communities where disease is present; diseased animals may be more susceptible to the toxic effects of contaminants. This may suggest that current studies are providing an underestimation of toxicity, resulting in a more severe ecological and environmental impact than anticipated if disease were absent. To understand if there is an interaction between infection and toxicity, we exposed Daphnia dentifera to varying levels of salinity in combination with pathogen exposure in laboratory experiments. Half of the treatments were exposed to the fungal parasite Metschnikowia bicuspidata, and each individual was exposed to one of three salinity levels. Mortality was tracked over 120 hours, and survival was compared across treatments using a Cox proportional hazards model. Infectious disease and high salinity both significantly increased mortality, but the effects were not interactive. This project will be expanded to test other contaminants such as insecticides to determine if disease significantly increases the lethal impacts of contaminated environments.

Research Mentor: Catherine Searle, Biological Sciences

Poster Number: 7369 :: Social Sciences/Humanities

College of Science

Consonant Length of Words and Non-Words in Tuscan Italian

Author:

Francis Jagiella

Abstract:

In Italian, there are "short" and "long" consonants. This means that the words "pena" and "penna" are pronounced differently, with short and long consonants respectively, and they have different meanings. This distinction does not exist in English. This project focuses specifically on the Tuscan dialect of Italian. In this dialect, there exists "pre-aspiration" for certain sounds. In English, by contrast we often have post-aspiration. Aspiration is an extra puff of air that is produced with some consonants, known as stops. Examples of stops which may be aspirated in English include t, k, and p. In the Tuscan dialect of Italian, it is possible that these stops become a different type of sound, known as a fricative. For example, a "t" sound between two vowels in Tuscan Italian may be come a "th" (as in "thing") sound. My work on the project involves using a phonetics program called Praat to mark off the short and long consonants as well as the vowels that precede them in order to see what length of time all three of these take to produce. The speakers in the project were asked to pronounce both real Italian words as well as invented words to see if the distinction in the consonant length is maintained when a distinction would not serve a meaning-differentiating purpose.

Research Mentor: Olga Dmitrieva, Languages and Cultures

Poster Number: 7157 :: Life Sciences

College of Science

An in vivo Model of Brain Metastasis of Non-Small Cell Lung Cancer

Author:

Chinyere Kemet

Abstract:

The blood-brain barrier is the most effective biological barrier in the body, regulating the flow of ions and nutrients to the central nervous system. In the presence of brain metastasis, the BBB shifts to the blood-tumor barrier (BTB). Chemotherapy is ineffective due to the lack of successful drug delivery across BTB; the greatest barrier in the metastatic tumor. Overcoming this barrier would provide effective brain tumor therapies. However, major changes in the landscape of brain tumor therapy have not yet matured due to the lack of understanding of the mechanism behind the BTB. To understand the alterations of the BTB in non-small lung cancer (NSCLC), we developed a robust and reliable experimental model of brain metastasis. Brain-seeking adenocarcinoma NSCLC cells (A549-Br) are cultured RPMI 1640 medium supplemented with 10% FBS. In this study, athymic nude mice, which are T-cell deficient and are used as xenograft models to facilitate the growth of human cancer cell lines, were used. To form the brain metastasis, cells were injected via ultrasound guided-intracardiac injection. Succeeding injections, mice were monitored every 2 weeks during the course of the study. Brain metastases were evaluated over 1-6 weeks; there was a 3-fold increase in brain metastasis between 3 and 6 weeks. At six-weeks, mice developed an average of 10 metastases. Interestingly, spinal cord metastases were present, causing paralysis. There was no significant difference in mouse weights over the experimental period. The pathology of this in vivo model will facilitate further studies the blood-brain barrier alterations during metastatic disease.

Research Mentor: Tiffany Lyle, Comparative Pathobiology

Poster Number: 7032 :: Mathematical/Computational Sciences

College of Science

Eigenvector Embeddings of Motif-Weighted Matrices

Author:

Caitlin Kennedy

Abstract:

The purpose of this research is to evaluate the embeddings of motif-weighted matrices verses conventional weightings like the normalized Laplacian or adjacency matrices. The term motif refers to specific patterns of connectedness within a graph, and previous research has shown motif-weighted matrices to be very effective in some cases. Having an effective matrix weighting for the eigenvector embedding allows a clear, visual formatting of large data sets. This will allow more meaningful information to be gathered from large data sets. The project involves developing code to run spectral embeddings of both motif-weighted and normalized Laplacian matrices on various data sets. The other major outcome is a substantial number of embeddings run on a variety of different graphs, some directed and some undirected. There is a smaller portion of data for which we have metadata, so we can find out how our visualization of our methods correlates with metadata. This project will provide results on the general effectiveness of motif-weightings, perhaps even which types of graphs (directed/undirected) see more benefits. This will be useful for the future analysis of large data sets.

Research Mentor: David Gleich, Computer Science

Poster Number: 7332 :: Physical Sciences

College of Science

Synthesis of a Water-Soluble Organic Conjugated Donor-Acceptor Oligomer

Author:

Sebastian Kenny

Abstract:

Organic conjugated oligomers have been shown to be strong optical contrast agents for biological imaging, but require the incorporation of surfactants to form water-soluble nanoparticles. In this study, the synthesis of a water-soluble conjugated donor-acceptor-donor (DAD) oligomer based on the electron rich donor methylhydroxy-3,4-propylenedioxythiophene (ProDOT-OH) and the electron-deficient acceptor benzothiadiazole was performed. The synthesis of the DAD oligomer utilizes green and atom efficient carbon-carbon coupling via C-H activation to form the donor-acceptor bonds. The oligomer was rendered water soluble by incorporation of a solubilizing group, propane sultone, to the hydroxyl group of the ProDOT-OH without the need of surfactants. After chemical doping, the oligomer showed strong absorbance in the NIR-II region (1000-1350 nm) which is optimal for biological imaging due to the characteristic of this region to have minimal endogenous contrast agent absorption.

Research Mentors: Saadia Chaudhry, Chemistry; Jianguo Mei, Chemistry

Poster Number: 7257 :: Life Sciences

College of Science

DNA-guided Endonucleases Increase Gene-editing Efficiency in E. coli

Authors:

Archana Kikla

Kok Zhi Lee

Arren Liu

Kevin Solomon

Abstract:

CRISPR/Cas9 has revolutionized genome engineering by enabling precise, programmable DNA modification using a single guide RNA. Recent findings have proposed DNA-guided endonucleases, which we term ASGARDs, as an alternative approach that does not require an adjacent sequence-specific motif for targeting as with CRISPR based approaches. Although many thermophilic ASGARD members have been shown to cleave DNA/RNA in a programmable manner, they have little to no activity at mesophilic conditions relevant to important organisms such as humans and plants. Here, we evaluate a new subclass of ASGARD family that function under these conditions. Using an in vivo survival assay in E. coli to study the interactions of ASGARD proteins with nucleic acids, we show that a candidate protein, ASGARD_A, interacts with DNA in a programmable manner. In vitro assays with purified protein demonstrate that ASGARD_A in fact cleaves DNA with and without DNA guides. To reduce non-specificity, we created ASGARD_A mutants that we demonstrate are able edit the E. coli genome and enhance targeted gene recombination by 55±16% compared to guide-free controls. I will also discuss efforts to enhance the specificity and activity further based on a two-plasmid positive selection system. These findings suggest that ASGARD_A can indeed be used to edit genomes and may serve as the basis of a competitive alternative to CRISPR/Cas9 that can be used to extend the impact of genome engineering by editing any genetic region.

Research Mentor: Kevin Solomon, Agricultural & Biological Engineering

Poster Number: 7389 :: Life Sciences

College of Science

C-tail Phosphorylation of SHP2

Author:

Haebin Kim

Abstract:

Src homology region 2(SHP2), non-receptor protein tyrosine phosphatases encoded by the gene PTPN11, contains two tandem Src homology 2(SH2) domains, one PTP catalytic domain and a C-terminal tail. SHP2 is an allosteric enzyme that is regulated by its own N-SH2 domain. When N-SH2 domain blocks its active site, which is the PTP domain, SHP2 is in a basal, inactive state. SHP2 is activated when N-SH2 changes its conformation to bind with tyrosine phosphorylated adapter proteins and is detached from the PTP domain. Recent studies have shown that many germline mutations, which have gain of functions and disrupt the auto-inhibitory mechanism, in SHP2 are associated with leukemia, Noon syndrome, and some solid tumors. The auto-inhibition between SH2 domain and PTP domain is well studied, while the function of SHP2 C-tail remains unclear. There are two phospho-Tyrosine (pY) sites in C-tail, which are Y542 and Y580. Phosphorylation of either Y542, binding with N-SH2 domain, or Y580, binding with C-SH2 domain, can enhance SHP2's activity by ~3 fold. However, the exact mechanism by which the c-tail regulates SHP2 function remains unclear. To further investigate the functions of SHP2 C-tail phosphorylation, the study will make SHP2 mutants with Y542F, Y580F mutations by Site Directed Mutagenesis, which we will overexpress them in cells and study the effects of these mutants on SHP2 related signaling pathways and cellular processes.

Research Mentor: Ruoyu Zhang, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 7337 :: Life Sciences

College of Science

The Road Not Taken: S. mansoni Miracidia Host Choice

Author:

Thomas Knowles

Abstract:

Schistosomiasis, a neglected tropical disease caused by several species of the parasitic blood-fluke Schistosoma, infects hundreds of millions of people worldwide. Treatment involving the systematic administration of praziquantal does not prevent reinfection, and no vaccine currently exists, raising concern for the development of resistance. In response, alternative Schistosomiasis control methods have been proposed, including the introduction of competitor parasites to Schistosoma in endemic areas. One such competitor, Echinostoma, infects the same intermediate snail host of Schistosoma. During a coinfection of a snail, Echinostoma may depredate upon the sporocyst life stage of Schistosoma. By doing so, Echinostoma will limit Schistosomiasis transmission by ending the Schistosoma lifecycle. Thus, to avoid being eaten, Schistosoma may alter its host choice. Details behind Echinostoma's effect on Schistosoma host choice will be important in evaluating its usefulness for Schistosomiasis control. In this study, host choice was tested using miracidia, a free-swimming stage present in both Echinostoma and Schistosoma life cycles. Miracidia follow chemical ques in water to track and infect potential snail hosts. Using two-way choice chambers, miracidia from both parasites were presented Biomphalaria glabrata snails harboring either Echinostoma or Schistosoma infections. Because an infection alters snail metabolic output, miracidia may differentially detect snails infected by each parasite. Choice chamber trials between varying snail hosts, infected or uninfected, were conducted. Miracidia host preference was documented to determine whether Echinostoma impacted Schistosoma host choice.

Research Mentor: Dennis Minchella, Biological Sciences

Poster Number: 7316 :: Life Sciences

College of Science

Confirmation and Analysis of Small Nucleotide Polymorphisms in Ixodes scapularis Ticks from Northeastern and Midwestern states

Author:

Sarah Komanapalli

Abstract:

The black-legged tick Ixodes scapularis is a vector of multiple pathogens that cause diseases including Lyme disease and granulocytic anaplasmosis. Insecticide resistance has made it difficult to control ticks and the diseases they transmit, necessitating further research to discover new methods of vector control. Studying the genome of hard ticks is an important strategy being used to identify new targets for the development of insecticides, and for improving understanding of tick biology and mechanisms of pathogen transmission. Here we analyzed the genetic variation in populations of I. scapularis ticks collected from eight geographic locations across north America. Small nucleotide polymorphisms (SNPs) predicted using bioinformatics software in the genome of I. scapularis WIKEL strain were confirmed in DNA prepared from individual ticks using the technique of Polymerase Chain Reaction (PCR). Briefly, primer pairs were designed to amplify SNPs predicted in multiple I. scapularis genes potentially associated with tick parasitism or identified as under positive selection pressure. Following PCR amplification, amplicons were analyzed and purified on 1.5% agarose gel, and excised bands were gel purified and sequenced. Sequences were aligned against the WIKEL strain (IscapW1) reference assembly maintained at VectorBase using ClustalOmega software. The SNP predicted in a hypothetical protein gene was confirmed in ticks collected from Indiana, Massachusetts, and New Hampshire suggesting the software used to predict the SNP was accurate, the hypothetical protein gene contains little heterogeneity between ticks from multiple states, and that this SNP is fixed in ticks from these states. Identification of these SNPs allows for a better understanding of genetic variation and structure between tick populations in North America and the identification of genes that may facilitate parasitism and pathogen transmission by the tick and processes that could be targeted to achieve control of ticks and tick-borne diseases.

Research Mentor: Catherine Hill, Entomology

Poster Number: 7072 :: Life Sciences

College of Science

Identifying the effects of lung cancer exosomes on non-tumorigenic human bronchial epithelial cells

Authors:

Hana Kubo

Sean Humphrey

Sarunya Kitdumrongthum

Humna Hasan

Feng Tian

Sarah Allen

Andrea Kasinski

Abstract:

Lung cancer is the leading cause of death from cancer in most industrialized countries and many lung cancer patients remain undiagnosed until the development of locally advanced or metastatic lung cancer. Despite extensive research, universal biomarkers for the early diagnosis of lung cancer remain elusive, and therapies for treating lung cancer patients remain ineffective and unfocused. This makes the identification of new diagnostic biomarkers and therapeutic targets for the treatment of lung cancer a critical need for patients. Exosomes, nanovesicles secreted by a variety of cell types, are known to transfer bioactive molecules such as proteins and nucleic acids that induce physiological changes in recipient cells. Exosomes secreted by cancer cells have been shown to promote tumor initiation, progression, and metastasis in various cancer types, but have been understudied in lung cancer. Our study aims to identify the effects lung cancer secreted exosomes may have on non-cancerous cells of the tumor microenvironment by assessing their tumorigenic effects on normal lung epithelial cells. To that end, we treated normal lung epithelial cells with exosomes derived from a panel of human non-small lung cancer cell lines. Treated cells acquired the ability to invade and migrate. As a proxy for metastasis, cancer exosomes are also being assayed for their ability to permeabilize a monolayer of normal lung epithelial cells. Further assessing the molecules within cancer exosomes critical for promoting these oncogenic behaviors in non-tumorigenic cells could lead to the discovery of potential diagnostic biomarkers and therapeutic targets for inhibiting tumor growth in affected patients.

Research Mentor: Andrea L. Kasinski, Biological Sciences

Poster Number: 7174 :: Life Sciences

College of Science

Studying Adipogenesis In Pre-Adipocytes from Brown and White Adipose Tissue

Author:

Kevin Lee

Abstract:

Adipose tissue or fat, is a loose connective tissue composed primarily of adipocytes and is a main source of energy storage within the body. Adipose tissue can be categorized as either brown adipose tissue or white adipose tissue. Brown adipose tissue is composed of several small lipid droplets and contains large amounts of both mitochondria and tiny blood vessels, which enables to the fat to be broken down quickly and released as thermal energy. White adipose tissue is composed of a single lipid droplet and contains less mitochondria and tiny blood vessels that brown adipose tissue. Therefore, the body metabolizes white adipose tissue slower and relies on white adipose tissue as the primary source of energy storage. We extract brown and white adipose tissue from mice and use the adipose tissue to culture pre-adipocytes. We are studying the process of adipogenesis to understand the mechanisms that dictate whether pre-adipocytes become white or brown adipose tissue.

Research Mentor: Shihuang Kuang, Animal Sciences

Poster Number: 7197 :: Mathematical/Computational Sciences

College of Science

Force Exertion Prediction

Authors:

JaeJoong Lee

Lingjun Chen

Andy Gao

Abstract:

This research aims to address gaps in objectively measuring high force exertions (a significant injury risk factor), by developing an innovative technique that is 1) non-intrusive to the workers, 2) widely accessible to ergonomists as no specialized equipment are needed beyond video recordings, and 3) automated using computer vision and machine learning techniques. The innovative approach of this study is to use surface (e.g., facial features) and sub-surface (e.g., blood flow) properties of the face to consistently classify high force exertions for tasks commonly observed in the workplace. Previous work integrating computer vision to ergonomics has shown that computer vision can estimate repetitive hand movements. Moving beyond current work sensing kinematics (i.e., repetitive movements), we hypothesize that force exertion levels can be predicted using an innovative computer vision approach that detects facial feature and sub-facial physiology. This approach can provide the foundation for a novel tool that can easily be translated and implemented by ergonomists across work environments. Using videos of force exertion as an input, this paper explains how to predict force exertion level, 0%, 50% and 100% using machine learning.

Research Mentor: Vaneet Aggarwal, Industrial Engineering

Poster Number: 7335 :: Life Sciences

College of Science

Effects of Biostimulant on Adventitious Rooting in Cuttings of Basil, Tomato, and Chrysanthemum

Author:

Hye Su Lee

Abstract:

Recently, biostimulant, a formulated product of biological origin, has been proposed as an innovative tool to improve plant productivity by enhancing nutrition efficiency, abiotic stress tolerance, and quality parameters for crop production. Cutting propagation is a common method for the commercial production of many greenhouse crops, with auxin being the main rooting hormone. The objectives of this study were to determine the effects of biostimulant on adventitious rooting of cuttings and to identify its optimum concentration for the maximum rooting responses of cuttings. A biostimulant ‘Quik-Link’ containing lignosulphonate and protein hydrolysates derived from legume seeds was used in the cuttings of three different plant species, basil, tomato, and chrysanthemum. Unrooted cuttings of the plant species were either purchased from a commercial source or taken from stock plants grown in the greenhouse. For each plant species, 10-20 replicates were treated with either biostimulant at four different concentrations (0, 0.1, 5, and 10 g/L), or rooting hormone ‘Dip’N Grow’ at four different concentrations (0, 100, 300, and 500 ppm) for comparison. The cuttings were then planted in a propagation tray filled with soilless media and placed under intermittent mist where optimum temperature, humidity, and lighting were provided for rooting. Maximum rooting occurred in 2 to 3 weeks and percentage of rooting, root growth, and shoot growth were measured. The results showed that biostimulant exhibited auxin-like and gibberellin-like activities, markedly enhancing both root and shoot growth. It significantly increased root length and volume, and root dry weight, as well as stem length and shoot dry weight. In general, plant cuttings treated with 5 g/L of biostimulant showed the maximum effectiveness in adventitious rooting. The results suggest that the treatment of unrooted cuttings with biostimulant can significantly improve adventitious rooting in basil, tomato, and chrysanthemum. Interestingly, it was also found that, unlike auxin, the biostimulant can noticeably enhance shoot development of plant cuttings.

Research Mentor: Hye-Ji Kim, Horticulture and Landscape Architecture

Poster Number: 7393 :: Life Sciences

College of Science

PRL2 overexpression involves autophagy process

Author:

Seunghee Lee

Abstract:

Phosphatase of Regenerating Liver (PRLs) are small dual-specificity phosphatases within the Protein Tyrosine Phosphatases (PTPs) superfamily, which are involved in cancer development and progression. Autophagy is highly regulated process that targets proteins and damaged organelles for lysosomal degradation to maintain cell metabolism and cell survival. Although there are indications that the PRLs play role in autophagy, their mechanistic insights as well as their substrates are not clear. In this study, we found that overexpression of PRLs promotes autophagy in Hela cells. In addition, PRLs increases the number of LC3 (marker of autophagic structures) puncta. Furthermore, we found that PRLs promotes autophagy through binding of ATG4B.

Research Mentor: Li Qinglin, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 7326 :: Physical Sciences

College of Science

Preferential Drug Loss of Physically manipulated abuse deterrent (AD) opioid products prepared for nasal insufflation studies

Author:

Jiawei Li

Abstract:

Opioid products are widely used for relieving pain. Due to its active pharmaceutical ingredient –oxycodone's structural similarity to heroin, opioid products have strong addictive character. Because the availability through doctor's prescription, oxycodone has even higher mortality than heroin. Mainway of drug dependent user intake oxycodone is intranasal. Two aims of this projects are: 1. Whether milled products (powders) could maintain the drug abuse deterrent properties. 2. To improve general principles for evaluating the abuse deterrence of milled opioids products (nasal route). Milling machine was used to mille oxycontin tablets. Electric microscopy, and dissolution tester were used to evaluate oxycodone containing powder's morphology and controlled release ability. The experiment result shows that: 1. Oxycodone was lost during milling process. 2. API concentrated in small size powders (< 45 µm). 3. Milled powder still have part of sustained drug release properties.

Research Mentor: Tonglei Li, Industrial and Physical Pharmacy

Poster Number: 7101 :: Life Sciences

College of Science

Using a Styryl Dye to Track Nutrient Sensing in the Small Intestine

Author:

Kun Lin

Abstract:

The identity and concentration of the food stuff in the lumen of the GI tract is of paramount importance, as they can be used to coordinate food consumption, secretion of digestive enzymes, gut motility, and expulsion of potentially toxic substances. However, unlike the lingual taste transduction system, little is known about how these substances are detected by sensory cells and how the information is transmitted from the GI tract to the brain. Identification of α-gustducin (a subunit of the G protein associated with taste sensation) and specific chemical receptors (e.g., T1R2 + T1R3 for sweet receptors) both key components of the lingual taste transduction pathway, suggests that a similar chemosensory transduction is conserved in the GI tract. Taking advantage of the activity-dependent uptake of the fluorescent styryl dye, FM1-43, we aim to track the activity of different elements in the pathway when the villi come into contact with nutrients, and the different players that transmit the nutrient information to other target cells. The luminal surface is stimulated with nutrient solution in the presence of dye, and then collected and processed to be imaged with a fluorescent microscope. Initial experiments show some candidates and the potential of this dye. The current focus is to optimize the procedure and determine the generalizability to other macronutrient classes. And more importantly, explore the compatibility of the dye with other labeling techniques to facilitate the identification of other candidates that may be involved in the signal transduction pathway.

Research Mentor: Ed Fox, Psychological Sciences

Poster Number: 7061 :: Life Sciences

College of Science

Characterization and removing the off-target activity of a novel gene-editing tool

Authors:

Arren Liu

Kok Zhi Lee

Kevin Solomon

Abstract:

CRISPR/Cas9 has revolutionized genome engineering by making precise gene editing simpler, more efficient, and widely accessible. Recent studies propose that a new family of proteins, which we term ASGARD proteins, functions similarly to the Cas9 endonuclease as a DNA-guided endonuclease. More importantly, ASGARD proteins can target DNA sequences without the prerequisite of a specific adjacent nucleotide sequence or protospacer adjacent motif (PAM). Here, we use phylogenetic analysis to identify a new subclass of ASGARD family proteins that are active at mesophilic conditions relevant to many model organisms including humans. Domain analysis reveals that this subclass of ASGARD proteins is defined by an uncharacterized repA domain. We demonstrate that this repA domain is responsible for a significant amount of non-specific cleavage activity that can be removed without impairing targeted cleavage and gene-editing. I will also discuss our other approaches to remove random off-target activity guided by comparative protein-modelling and rational design. These findings suggest that, with optimization, ASGARD has the potential to be utilized as a gene editing tool that is more flexible than current CRISPR/Cas9 approaches, and allow for robust and precise gene manipulation.

Research Mentor: Kevin V. Solomon, Agricultural & Biological Engineering

Poster Number: 7165 :: Life Sciences

College of Science

Pathology of the Blood-Tumor Barrier in Brain Metastasis of Lung Cancer

Author:

Amanda Ludwig

Abstract:

Approximately 40% of people with non-small-cell lung cancer will develop brain metastasis during the course of the disease. Despite this high incidence, prognosis and life expectancy following diagnosis remains poor. One of the major hurdles that treatment of brain metastasis presents is difficulty in effectively delivering drugs necessary for treatment across the blood-brain barrier (BBB), a selective barrier that protects the brain from neurotoxic compounds. Upon brain metastasis, however, the BBB shifts to the blood-tumor barrier (BTB).

In this study, we aim to evaluate differences in the pathology of the BBB as it undergoes brain metastasis. It was hypothesized that as metastasis persists, there would be a change in the pathology of the BBB into the BTB. To address this hypothesis, athymic nude mice were given an ultrasound-guided intracardiac injection of brain-seeking human non-small cell lung cancer cells, and brain metastasis validated via bioluminescence imaging. Six weeks after the injection, the mice were sacrificed and their brains were harvested. Using immunofluorescence staining, we analyzed the components of the BBB and BTB. Our preliminary findings demonstrated that capillaries in BTB are diluted and tortuous. The organization of tight junction proteins changed in the presence of brain metastasis. These findings will allow us to facilitate effective delivery of chemotherapeutics to treat metastases and improve patient survival.

Research Mentor: Tiffany Lyle, Comparative Pathobiology

Poster Number: 7147 :: Innovative Technology/Entrepreneurship/Design

College of Science

Cell-instructive Polymer/Bioactive Glass Composite-Based Scaffolds for Bone Regeneration

Author:

Helena Lysandrou

Abstract:

Every year in the United States, over 500,000 patients need bone defect repairs, which include bone-grafting procedures. Current bone grafts involve autografts and allografts that are constrained by limited supplies and donor site morbidity. Scaffold-based bone tissue engineering has emerged as a prospective strategy for bone regeneration to overcome these limitations by using biomaterials, cells, and growth factors such as bone morphogenetic proteins (BMPs). However, the clinical utility of BMPs is hindered by supraphysiological dose requirements and ectopic ossification. Therefore, there exists a great need for the development of novel biomaterials-based therapies to promote bone healing without high doses of BMPs. In this study, a three-dimensional (3D) porous scaffold system was sintered from composite microspheres containing biodegradable poly(lactide-co-glycolide) (PLGA) and an ion-releasing novel bioactive silicate glass (BSG). Such a composite combines both the benefits of PLGA mechanical properties with the bone-bonding bioactivity of BSG. The composite scaffolds were optimized to mimic structural and mechanical properties of natural bone and evaluated for bioactivity and cellular responses of human mesenchymal stem cells (hMSCs). Mechanical testing revealed that the optimized composite scaffolds had a compressive elastic modulus in the range of trabecular bone. Cell attachment and viability on the composite scaffolds were validated using confocal microscopy. During a 3-week cell culture, the composite scaffolds significantly promoted osteogenic differentiation of hMSCs leading to enhanced mineralization as compared to control PLGA scaffolds, which further confirmed the osteoinductive potential of the signaling ions provided by the BSG. Additionally, scaffolds were evaluated for their tissue regeneration capacity in vivo using a rabbit femoral defect model. By demonstrating osteoinductive properties and bioactivity, our composite scaffolds are a step closer towards developing next-generation bone graft substitutes. There is also great potential for applying this biomaterial system for treating osteoarthritis and osteochondral defects, which affect articular cartilage and the underlying bone. Future work includes the applicability of these composites in combination with 3D printing towards the repair of osteochondral defects.

Research Mentor: Meng Deng, Agricultural & Biological Engineering

Poster Number: 7098 :: Mathematical/Computational Sciences

College of Science

Using Boosted Regression Trees to Predict Invasive Species Richness

Authors:

Namaluba Malawo

Gabriela Nunez-Mir

Abstract:

Invasive species have become a major problem in the US, but our understanding of invasion patterns and key drivers are still limited. Using a powerful tool in predictive biogeography, Boosted Regression Trees (BRTs), we created models which can predict exotic species distribution for the Eastern United States at a high resolution. BRTs build on binary decision trees and combine them to create a linear combination of many trees. This leads to a more accurate model of invasion prediction and allows us to better identify key underlying variables that drive the observed patterns. Ultimately, we were able to create a model with many trees and low deviance that could predict invasive plant species richness patterns for the Eastern United States. The data measures 38 different variables, including soil characteristics, biotic variables, and anthropogenic drivers. The results of our work will help us better understand drivers of invasion by quantifying the relative contribution of each variable. Additionally, the results from our studies can then be used by policy makers and practitioners to manage invasions of species with more proactive measures and preventative actions. This presentation builds on work previously presented. This work is supported by NSF grant DMS #1246818.

Research Mentor: Songlin Fei, Foresty and Natural Resources

Poster Number: 7062 :: Social Sciences/Humanities

College of Science

How anxiety about Donald Trump influences news reporting

Author:

Prateek Malik

Abstract:

Do journalists who mention Donald Trump as their primary source of professional anxiety write about terrorism and climate change differently than journalists who do not experience this anxiety? Journalists say that their credibility is being threatened in unprecedented ways. In this paper, we examine whether journalists who feel pressure from the Trump administration report on hot-button issues in ways that are consistent with the Trump administration's position. Social scientists argue that news reporting is sensitive to external threats, but journalists reject this argument. We recruited a sample of journalists from a major journalism conference and asked them to report their primary source of anxiety before writing a hypothetical news story. The findings of this paper will help us understand the factors that influence reporting news about politicized issues.

Research Mentor: Aaron Hoffman, Political Science

Poster Number: 7055 :: Mathematical/Computational Sciences

College of Science

Big Data Visualization: HoloLens Transforms Users to Data Scientists

Author:

Dylan Martin

Abstract:

Large amounts of data are created and stored daily, and it is no wonder that scientists are seeking innovative, meaningful mediums through which to display their impactful analyses. Data scientists are now asked to find new ways to visualize large quantities of data in ways that engage an audience and effectively inform without overwhelming them. In this research, I intend to explore the developing technology of Augmented Reality through the Microsoft HoloLens as a means to display heterogeneous datasets that vary in size, variety, and formats. I will construct an application for the HoloLens that acts as a framework to embed various analyses of datasets in a three-dimensional environment. Such a framework will more easily enable visualization of statistical models on large datasets. Visualization is the process of transforming disparate, often complex data into a visual representation that is easy to understand. Users will be able to manipulate statistical analyses at will, encouraging deeper understanding and inspiring an interest in data analysis and visualization. This material is based upon work supported by the National Science Foundation under Grant No. 1246818.

Research Mentor: Vetria L Byrd, Computer Graphics Technology

Poster Number: 7395 :: Life Sciences

College of Science

Size-controlled CpG-Lipid Nanoparticles for Bladder Cancer Immunotherapy

Author:

Joshua Mazur

Abstract:

Bladder carcinoma is the most expensive tumor type to treat on a cost-per-patient basis from diagnosis to death. Treatment with Bacillus Calmette–Guérin (BCG) instillations is the only approved immunotherapy in clinics for remission of superficial bladder carcinoma. However, frequent relapses, high local morbidity and a risk of systemic mycobacterial infection limits BCG's performance as a bladder cancer treatment. It is well known that BCG utilizes an adhesin protein known as fibronectin attachment protein (FAP) for binding to the fibronectin (FBN)-rich extracellular matrix of bladder tumor. Previously, we have shown that multivalent FAP-targeted liposomes promote FAP-FBN-Integrin microaggregation and internalization by a caveolae-dependent mechanism with a strict ≤70 nm size cutoff. Utilizing the potential of microfluidics in formulating limit size nanoparticles, we have developed a sub-70 nm lipid-based delivery system for effective delivery of CpG oligodeoxynucleotide. CpG oligonucleotides have shown to activate cells (such as human plasmacytoid dendritic cells and B cells) that express Toll-like receptor 9 (TLR 9) to mount an innate immune response characterized by the production of Th1 and proinflammatory cytokines. However, TLR 9 receptors are located at intracellular acidic compartments, such as endosomes and lysosomes, making it challenging for negatively charged CpG oligonucleotide to reach its site of action in a biologically active state. The capability of these size-controlled FAP-targeted lipid nanoparticles to attach specifically to tumor microenvironment, cross cell membrane, and then destabilize in acidic endosomal compartments, ultimately delivering functional CpG payloads in close proximity to TLR 9, makes them a low-risk, highly efficient alternative immunotherapy to BCG.

Research Mentor: David Thompson, Chemistry

Poster Number: 7320 :: Life Sciences

College of Science

Identifying the Structural and Mechanistic Changes at the PLCε RA2-RAP1A Interface

Author:

William Mbongo

Abstract:

The phospholipase Cε (PLCε) subfamily is of great interest due to its critical role in regulating cardiovascular function. PLC enzymes hydrolyze phosphatidylinositol-4,5-bisphosphate (PIP2) to produce inositol-1,4,5-triphosphate (IP3) and diacylglycerol (DAG), which are key second messengers in cellular signaling. IP3 and DAG increase intracellular calcium concentration and activate protein kinase C. Under basal conditions, PLCε has low activity and is localized in the cytoplasm. The stimulation of G protein coupled receptors (GPCRs) activates the guanine exchange factor EPCAC which in turn activates Rap1A. Rap1A binds directly to PLCε and increase its lipase activity while translocating the G protein–PLCε complex to the membrane. It has been proposed that activated G proteins release autoinhibition within PLCε and/or increase the affinity of its active site for membrane attack. PLCε possesses two Ras association (RA) domains at its C-terminus and the RA2 domain is thought to be the primary G protein binding site. This project aims to characterize the interactions between PLCε and the small G protein Rap1A as its dysregulation contributes to hypertrophy and heart failure. Crystals of a Rap1A–PLCε RA2 complex have been obtained and await optimization prior to structure determination via X-ray crystallography. Site-directed mutagenesis and biochemical assays will later be used to confirm the contributions of residues at the molecular interface. These studies will provide the first insights into the mechanism by which Rap1A interacts with and activates PLCε.

Research Mentor: Angeline Lyon, Biological Sciences and Chemistry

Poster Number: 7259 :: Physical Sciences

College of Science

Variability Analysis of Historic Flood Depth Returns in Coastal Louisiana

Author:

Mikaela Meyer

Abstract:

Estimates of the probability distribution of flood depths associated with storm surge depend upon the underlying frequency of storms and the joint distribution of storm parameters (e.g., intensity, landfall track). Though we learn more about these parameters annually as more data becomes available, uncertainty about their true values persists. It is important how sensitive flood depth distributions are to this uncertainty and to understand how estimates may change as the small sample size of historical storm data grows over time. This presentation examines this problem in the context of flood risk in coastal Louisiana. A historical data set of storms impacting the area was truncated to end in years ranging from 1980 to 2015. An existing flood risk model of the current Louisiana landscape was then used to calculate flood depth distributions by updating either the frequency, the relative likelihood of storm parameters, or both measures using the truncated data sets. The median estimates of the flood depth distributions produced by the truncated data and update procedure were compared to estimates calculated using historical storm data updated through 2016, at various return periods (e.g., “100-year” or “500-year” flood depths). The results indicate that there is no clear geospatial pattern in the way in which the depth estimates are affected by each update method. However, flood depth distributions in areas protected by levee systems exhibit greater variability over time than areas that are unprotected, where estimates are more stable.

Research Mentor: David Johnson, Industrial Engineering and Political Science

Poster Number: 7183 :: Life Sciences

College of Science

Modulation of Neutrophilic Response with microRNAs during Zika Virus Infection

Author:

Ramizah Mohd Sabri

Abstract:

Zika (ZIKV) is an emerging Flavivirus that is capable of causing the severe brain malformation, microcephaly. Customarily upon infection, neutrophilic inflammation acts as the first line of defense. While attempting to protect the body, they can also cause collateral damage and drive immunopathology. In some cases, they can facilitate spreading of pathogens inside hosts. However, careful evaluation of the role of neutrophils in the pathogenesis of ZIKV is currently lacking. Whether neutrophils facilitate the spreading of ZIKV in the infected person or directly cause tissue damage is not known. To elucidate this, we will inject various amounts of ZIKV into the blood stream of zebrafish larvae then follow the location of neutrophils, tissue damage, and size of the developing brain. Additionally, an important non-coding RNA molecule in neutrophils called microRNA, specifically miR-722, functions to regulate gene expression that affects neutrophil behavior during infection. Thus, to dissect how ZIKV infection alters gene expression and how immune modulation involving miR-722 can increase host resistance to ZIKV infection, we will perform transcriptome (entire collection of RNA sequences in a cell) analysis of both neutrophils and the entire Zebrafish larvae. Characterizing neutrophil-ZIKV interaction and the role of neutrophilic inflammation during viral infection will therefore, facilitate the development of novel therapeutics for associated defects while effectively clearing the virus.

Research Mentor: Qing Deng, Biological Sciences

Poster Number: 7005 :: Physical Sciences

College of Science

Emissions of Water Vapor from Indianapolis and Washington, D.C. in Winter

Author:

Kristan Morgan

Abstract:

For decades, urban areas have been shown to modulate humidity levels relative to the natural surrounding landscapes. Urban-rural humidity gradients have been linked to differences between urban and rural moisture sources and energy balance. Cities are generally expected to be drier than rural areas, however, our study focuses on instances when cities are relatively more humid. Anthropogenic emissions of heat and moisture via combustion and industry have been implicated as contributors to instances of elevated urban atmospheric moisture levels compared to rural areas. Understanding the magnitude and impact of urban emissions of water vapor (H2Ov) is important because H2Ov is responsible for approximately 2/3 of the greenhouse effect, and urban emissions of heat, aerosol, and H2Ov have been shown to influence regional cloud cover, water cycling, and the liquid water content of aerosols, a climate-relevant property. Elevated H2Ov mole fractions were occasionally observed downwind of Indianapolis, IN and the Washington, D.C.-Baltimore, MD, (D.C.-Balt.) area during airborne mass balance experiments conducted during winter months between 2012 and 2015. Past studies have reported elevated urban H2Ov concentrations from tower site or surface-mobile measurements, however, this study represents the first reported observations and quantification of citywide enhancements in H2Ov mole fractions during daytime. Simultaneous measurements of CO2 and CH4 mole fractions during the airborne experiments, allow us to evaluate impacts of elevated urban CO2, CH4, and H2Ov concentrations on the intensity of the urban heat island. The wintertime airborne case studies around D.C.-Balt. and Indianapolis show significant urban emissions of H2Ov that result in elevated H2Ov mole fractions downwind of the urban area relative to nearby rural H2Ov mole fractions. On flight days where an elevated H2Ov signal was observed, the emission rate of excess urban H2Ov ranged between 1.6 (±0.66)x104 -1.7 (±0.81)x105 and 2.1 (±1.2)x104 -3.5 (±1.4)x104 kg/s for D.C.-Balt. and Indianapolis, respectively. The emissions of excess urban H2Ov contributed between 1.5% and 8.4% to the total flow of atmospheric boundary layer H2Ov out of the urban areas. Radiative transfer modeling indicates elevated urban H2Ov and other greenhouse gas concentrations do not have a significant impact on urban heat island intensity, but urban H2Ov emissions could have other local-scale impacts which will be discussed.

Research Mentor: Olivia Salmon, Chemistry

Poster Number: 7294 :: Mathematical/Computational Sciences

College of Science

Comparing economic damage and risk estimates at the grid cell and structure levels

Author:

Roshini Mudunuru

Christina Dantam

Abstract:

Given rising sea levels, flood risk in coastal Louisiana is projected to increase, and quantifying it requires knowledge of the inventory and characteristics of the structures exposed to that risk. However, data sets needed to estimate risk precisely are often obsolete or summarized using average values at, for example, the census block level. This study utilized structure-level data for single-family residences in two Louisiana parishes to determine whether aggregating structure-level information to coarser resolution biases estimates of risk. The factors considered included local ground elevations as well as structural characteristics such as the height of a home's foundation, its square footage, and its valuation. The differences between risk estimates based on structure-level data were compared to estimates produced using an existing flood risk model at its native resolution in order to test the hypothesis that spatially-averaged characteristics may lead to underestimates of risk. An investigation was also performed into which structural characteristics contribute the most to these differences. The results reveal tradeoffs between the resolution of modeling and accuracy of risk estimates. They also have implications on needs for additional data collection regarding the kinds of structural, geographical, and environmental data that could better predict exposure to economic damage from coastal flooding.

Research Mentor: David Johnson, Industrial Engineering and Political Science

Poster Number: 7246 :: Life Sciences

College of Science

Prediction from Evolutionary Game Theory: Competition Changes Stomatal Density

Author:

Kiersten Nelson

Abstract:

Stomata are small cellular pores located on plant leaf surfaces that open to allow for the uptake of carbon dioxide and close to limit water loss. Thus, the density of stomata on leaves can affect the efficiency of photosynthesis. Stomatal responses are thought to be controlled and regulated by environmental signals which allows plants to adapt to their surroundings with the goal of optimizing their own fitness. Biotic interactions, such as competition, among plants can influence a plants overall fitness dependent upon the density and frequency of these interactions. These biotic interactions and their influence on fixed and plastic traits can be predicted by models using ecological game theory. Here, we sought to better understand how stomatal development was influenced by competition. To explore these ideas, we analyzed stomatal densities in 10 year old American Chestnut (*Castanea dentata*) trees subjected to interspecific and intraspecific competition at different densities and different heights within the canopy. Based upon the concepts behind game theory as it applies to plant ecology, we hypothesized that the plant would adjust their own stomatal density in the presence of competition to optimize their personal fitness and essentially win the “game”. In our study, we found that only the height at which the leaves were taken within the canopy played a significant role in influencing stomatal densities. Thus, we suggest further research should be conducted in order to understand specifically what role competition plays in predicting changes in stomatal densities.

Research Mentor: Gordon McNickle, Botany and Plant Pathology

Poster Number: 7401 :: Life Sciences

College of Science

Modification by Mutagensis of the Rate-Limitation in Non-Cyclic Electron Transport

Author:

Jillian Ness

Abstract:

Under conditions otherwise optimal, electron transport with a kinetic limitation of a few milliseconds, can be rate-limiting under growth conditions that include the projected higher (> 400 ppm) CO2 levels. It is proposed to use information derived from the 2.5 Å crystal structure of the cytochrome *b*6*f* complex (PDB 4OGQ) to modify the rate-limiting step in the electron transport chain by site-directed mutagenesis. The rate- limiting step in the non-cyclic electron transport chain involves the diffusion of plastoquinol from the photosystem II reaction center to the *b*6*f* complex, and H+ coupled electron transfer at the site of interaction of quinol and [2Fe-2S] protein in the *b*6*f* complex. On the basis of structure studies of the *b*6*f* complex, it has been inferred that a major factor in the rate limitation results from the diffusion or directed movement of plastoquinol/quinone through the quinol/quinone entry pore. We have studied (a) the structure of the iron-sulfur protein, and (b) the entry-exit portal of the quinone/ol in the *b*6*f* complex. In contrast to the cyt bc1 complex, the function of the *b*6*f* complex is insensitive to mutation changes in the hinge region that increased or decreased hinge flexibility.

Quinol oxidation at the p-side of the *b*6*f* complex occurs at the end of an 11 Å portal that terminates near the 2Fe-2S cluster. A structure-based rate limitation of plastoquinol oxidation is proposed to be a consequence of the required passage of the quinol/quinone passing through this narrow portal. The portal is bounded by the TM F α- helix of subunit IV. Proline residues conserved at positions 105 and 112 in cyanobacteria, the green alga *C. reinhardtii*, and plants, define positions of kinks in this helix. These 2 Pro residues, 105 and 112 in the sequence, cause a bend in the F-helix of the SuIV subunit, away from the C-helix in the cyt b subunit, and contribute to the aperture of the portal that leads to the Qp site for electron-proton donation to the [2Fe-2S] center.

Site-directed mutagenesis in *Synechococcus* PCC7002 is being utilized to (I) enlarge this channel by changing the position of the two proline residues in the F-helix, or (II) by replacing an upstream amino acid with a proline. Pro 105 and/or Pro 112, which are changed to a small residue Ala. The latter change is predicted to cause removal of the bend of the F-helix, and a decrease in size of the Q-portal and the over-all rate of non- cyclic electron transport.

Research Mentor: William Cramer, Biological Sciences

Poster Number: 7093 :: Mathematical/Computational Sciences

College of Science

A Look at Correlations between Precipitation and Crop Yields

Authors:

Tyler Netherly

Elizabeth Bell

Madison Trout

Abstract:

Our poster focuses on whether or not publicly available rainfall data from National Oceanic and Atmospheric Administration can be used to predict crop yields in a meaningful and useful way. We do this by using data from the US Department of Agriculture to find correlations. We will look at whether the amount of rain or the frequency of rain is a better predictive factor. We work under the Purdue Open Ag and Technology Systems center (OATS). Our research relies on open source software including R and Python; our larger research goal is to promote the mission of bringing open source to agriculture. This material is based upon work supported by the National Science Foundation under Grant No. 1246818.

Research Mentor: Dennis Buckmaster, Agricultural & Biological Engineering

Poster Number: 7318 :: Innovative Technology/Entrepreneurship/Design

College of Science

Optimizing Hydrocephalus Treatment with Smart Catheters

Author:

Barnabas Obeng-Gyasi

Abstract:

Hydrocephalus is a common neurological disorder in newborns. The underlying disease mechanism involves excess cerebrospinal fluid (CSF) enlarging the ventricular space with concomitant increasing pressures on the brain parenchyma. Currently, treatment involves conventional shunts of which 40% fail within the first year. Furthermore, 85% of patients undergo at least 2 replacements surgeries in the first year. The purpose of this project is to create a self-clearing, self-monitoring smart catheter using magnetic microactuators with an integrated pressure sensor for hydrocephalus treatment. 14 porcine models were used in this study. The subjects were divided into three groups—smart catheter, conventional, and no treatment group. CSF was measured using OsiriX, a medical imaging processor. Preliminary data showed the smart catheters were more effective in removing excess CSF compared to the conventional catheter group and the no treatment group. Future studies will be conducted on transitioning this device to human subjects in clinical trials.

Research Mentor: Hyowon Lee, Biomedical Engineering

Poster Number: 7228 :: Life Sciences

College of Science

Sublethal Effects of Poly- and Perfluoroalkyl Substances on Amphibians

Author:

Allison O'Brien

Abstract:

While many anthropogenic chemicals have been shown to have negative environmental effects, the rapid pace of chemical discovery and implementation makes it difficult to assess these potential effects prior to widespread usage. My research will examine the ecotoxicology of poly- and perfluoroalkyl substances (PFASs), which are emerging environmental contaminants. These chemicals are widely used in aqueous film forming foams and common goods such as carpet, paper, and other textiles. Recent research has shown contamination of drinking water with PFASs can pose risks to immune, metabolic, and endocrine health of consumers (Hu et al. 2016). Moreover, these chemicals are highly water solubility and persistent in the environment. Of particular concern for exposure to PFASs are amphibians. Amphibians have thin, permeable skin, making them extremely susceptible to many environmental toxins. My research will use laboratory experiments to calculate bioaccumulation curves for two PFASs in several amphibian species. These results will be combined with on-going research in our group to determine toxicity reference values for amphibians and help establish environmental risk assessments for aquatic systems.

Research Mentor: Jason Hoverman, Forestry and Natural Resources

Poster Number: 7339 :: Life Sciences

College of Science

Biochemical Analysis of Isoprenylcysteine carboxyl methyltransferase during binding with S-Adenosyl methionine in Saccharomyces cerevisiae

Author:

Alex Piroozi

Abstract:

Isoprenylcysteine carboxyl methyltransferase (ICMT) is an integral membrane protein located in the membrane of the endoplasmic reticulum of eukaryotic organisms. ICMT plays a major role in the correct function of K-Ras, a Caax Box Protein that requires isoprenylation, proteolysis, and methylation to be localized to the plasma membrane for proper function. ICMT carries out the final step of this process by methylating the carboxyl group of the C-terminus of K-Ras. This information is critical when K-Ras becomes mutated, causing an oncogenic signaling pathway. Mutated K-Ras is responsible for approximately 90% of pancreatic cancers and 30% of all cancers. In our research, we perform various biochemical techniques, including site-directed mutagenesis, subcloning, immunoblotting, and radioactive activity assays to determine how individual residues within the binding site of ICMT interact when it binds to its substrate, S-Adenosyl methionine (SAM). We plan to use this data to develop a 3-dimensional model of ICMT that can be used to help create novel therapeutics against cancers affected by the K-Ras oncogenic pathway.

Research Mentor: Christine Hrycyna, Chemistry

Poster Number: 7148 :: Life Sciences

College of Science

Antibiotic Interactions with Parasite Host Dynamics in Freshwater Ecosystems

Author:

David Prather

Abstract:

Antibiotics in the water supply are becoming more prevalent as the use of pharmaceuticals increases, particularly from hospitals and agriculture. These antibiotics may have unintended consequences for the aquatic organisms that live in these water bodies. We investigated the effect of antibiotic exposure on host-parasite dynamics in the freshwater Daphnia dentifera-Metschnikowia bicuspidata system. In a series of experiments, antibiotics were introduced to either the host or the parasite, followed by exposure of D. dentifera to M. bicuspidata. We hypothesized that the antibiotics would either allow the host's immune system to allocate its resources to combat M. bicuspidata infection, reducing rates of infection, or interfere with D. dentifera metabolism, increasing rates of infection. Antibiotics tested include tetracycline and sulfadimethoxine. Infection rates among surviving hosts were measured to identify how antibiotics influence infection frequencies. Most trials in this study showed insignificant results where antibiotic exposure did not significantly influence host-parasite dynamics. However, an experiment investigating the exposure of tetracycline to the host showed that M. bicuspidata infections were less prevalent when tetracycline was introduced ($p<0.05$). In a subsequent trial, exposure of tetracycline directly to M. bicuspidata did not alter infectivity, suggesting that this reduction in infection was due to effects of the antibiotic only with the host. This effect appears to be exclusive to tetracycline and was not seen in sulfadimethoxine. Subsequent experiments are planned to enhance our understanding of the role antibiotics play in host-parasite dynamics. Through these studies, we hope to gain a better understanding of how the advancements of mankind and their practices influence disease in natural communities.

Research Mentor: Catherine Searle, Biological Sciences

Poster Number: 7262 :: Life Sciences

College of Science

Targeted Delivery of Peptides to Fracture Sites

Authors:

Neal Ramseier

Rahul Hadap

Elena Konrath

Nicholas Young

Abstract:

Our research focuses primarily on healing bone fractures by targeting bone therapeutics directly to the fracture site. By conjugating bone anabolic agents to bone targeting molecules, we can repair bone fractures with minimal side effects. Targeting the drug allows it to be administered subcutaneously—which is minimally invasive, especially compared to the administration of similar drugs, which requires local application during invasive surgeries. Other scientists have previously developed targeting methods involving bisphosphonates and tetracycline for the purpose of treating osteoporosis; however, we have found that short acidic peptides, such as aspartic acid decamers, can be targeted to bone fractures with higher selectivity and lower toxicity than bisphosphonates and tetracyclines. The carboxylic acid side chains allow for the chelation of multiple calcium ions in the hydroxyapatite component of the bone and provide high affinity towards the bone fracture site. The hydroxyapatite component of bone is normally not exposed to the bloodstream, because it is covered by the endosteal and periosteal cell linings. However, in the incidence of bone damage, these linings are ruptured and expose the hydroxyapatite, which allows for the attachment of our ligands. We have demonstrated the ability and specificity of these acidic peptides to target bone with numerous small molecules linked through labile linkers. We have also shown that they can be used to target peptides of numerous chemical classes including hydrophobic, neutral, cationic, anionic, short, and long. To test this ability, six different peptide payloads representing each of those different chemical class payloads were linked to the targeting molecules. These payloads were P4, CTC, Ck2.3, ODP, F109, and PACAP. The ability to target peptides is very useful, due to the fact that many bone anabolics are derived from growth factors and are peptidic in nature. We have found that our targeting ligands have better persistence at the site of the fracture than bisphosphonate-targeted therapeutics do. We have also seen that the increased size of the targeting ligand, such as D20 over D10, has increased the selectivity for the fracture site over that of the healthy bone. Future studies can help determine which peptides offer the best therapeutic effects on bone fracture healing and targeting specificity to the fracture site.

Research Mentor: Jeffery J Nielsen, Medicinal Chemistry and Molecular Pharmacology

Poster Number: 7386 :: Life Sciences

College of Science

Comparison of Agrobacterium-mediated and Ensifer-mediated Genetic Transformation of Arabidopsis thaliana

Author:

Caleigh Roleck

Abstract:

Agrobacterium tumefaciens is a plant pathogen that, in nature, is capable of causing crown gall disease by transferring a piece of DNA known as T-DNA into the plant. Agrobacterium has been used as a tool for agricultural biotechnology, in which the T-DNA is designed to transfer genes of interest into plants for the purpose of genetic engineering. Ensifer adhaerens, another species of soil bacteria, neither has a pathogenic relationship with plants nor naturally transfers DNA to plants, but Ensifer, when transformed with a plasmid containing virulence genes and T-DNA, like those found in Agrobacterium, is capable of genetically transforming plants. A strain of A. tumefaciens that lacks a transformation plasmid and E. adhaerens were transformed with the same plasmid, pCAMBIA 5105, which contains a T-DNA with a GUS reporter and a hygromycin-resistance gene. Different ecotypes of wild type Arabdopsis were infected with the two bacterial strains to compare overall ability to genetically transform plants. Additionally, different Arabidopsis mutants were infected to determine whether certain plant proteins work to prevent or assist in Agrobacterium or Ensifer-mediated genetic transformation. Transient transformation efficiency was assessed using a GUS gene assay, and stable transformation efficiency was assessed by determining the ability of roots to form calli in the presence of hygromycin. Current results indicate that Ensifer overall does not transform plants as well as Agrobacterium, but tends to follow the same pattern of efficiency at transforming different Arabidopsis ecotypes. Additionally, the Arabidopsis flagellin-receptor fls-2 appears to assist in both Agrobacterium and Ensifer-mediated transformation.

Research Mentor: Stanton Gelvin, Biological Sciences

Poster Number: 7091 :: Life Sciences

College of Science

Slowing the progression of Pulmonary fibrosis by changing the M2 macrophages to M1 macrophages

Author:

Sasmita Rout

Abstract:

Idiopathic Pulmonary fibrosis is a chronic fibrotic lung disease associated with a survival rate of two to three years. Over two thirds of IPF patients are over sixty years of age and it is the most common cause of death by progressive lung disease. Macrophages which are a type of white blood cells associated with engulfing and digesting foreign substances play a pivotal role in fibrosis. Macrophages in fibrotic diseases possibly belong to the M2 subtype. Based on the commonly held belief that M2 subtype macrophages are pro fibrotic and M1 subtype of macrophages are anti fibrotic, we expect that our drug, Compound A will significantly slow down the progression of Pulmonary fibrosis by converting the pro- fibrotic M2 macrophages to the anti-fibrotic M1 macrophages. Our hypothesis that Compound A will significantly slow down the progression of Pulmonary fibrosis by converting the pro- fibrotic M2 macrophages to the anti-fibrotic M1 macrophages is supported by several in-vitro studies with fibroblasts, where biomarkers such as TGF beta and CCL 18 were used to illustrate the conversion of M2 macrophages to M1 macrophages. Further in vivo studies and clinical trials in in this area could help us find a potential and effective treatment for Idiopathic Pulmonary fibrosis.

Research Mentor: Philip Low, Chemistry

Poster Number: 7096 :: Life Sciences

College of Science

Secreted NS1 Aids in Dengue Virus Entry by Binding Heparan Sulfate

Author:

Morgan Schafer

Abstract:

A large portion of the world's population lives in an area where they are at risk of contracting Dengue Virus (DENV). While infection with DENV can result in a wide range of clinical manifestations, from flu-like symptoms to hemorrhagic shock, vascular leakage, and even death, no treatments currently exist. Previous studies have shown that higher levels of viral non-structural protein 1 (NS1) in the blood of infected patients correlate with more severe disease symptoms. NS1 has been shown to play many roles in the viral lifecycle, but the mechanisms by which NS1 executes these functions are unknown. Preliminary findings suggest that NS1 facilitates DENV entrance into the cell and previous studies have shown that secreted NS1 binds to heparan sulfate on the surface of cells, but these processes are not well understood. In this study a region of NS1 was identified that may be important for binding the cell surface through interactions with heparan sulfate and thus facilitating virus entry. Single and double charge reversal mutations in this region reduced cell binding and virus attachment. These results suggest that this region is important for NS1's ability to bind the cell surface and facilitate virus attachment and entry. Furthermore, the mutants characterized in this study can be used to study the mechanisms by which NS1 aids in Dengue pathogenesis.

Research Mentor: Richard J. Kuhn, Biological Sciences

Poster Number: 7313 :: Life Sciences

College of Science

Heterologous Expression of the Mevalonate Pathway from Anaerobic Fungi in E. coli for Sustainable Drug Production

Authors:

Evan Shank

Ethan Hillman

Adrian Ortiz-Velez

Abstract:

Many crucial drugs such as anticancer and antimalarial therapeutics are unsustainably sourced from natural plant products that cannot be made synthetically due to their large structures and stereochemistry. However, fungi can naturally produce precursors to these compounds that can be used for drug production. Our fungal isolate, Piromyces indianae, is an anaerobic fungus that was isolated from the gut of a donkey in Independence, IN. Piromyces indianae possesses the enzymes of the mevalonate pathway, a pathway that produces steroids and terpenes precursors needed for drug production. Using colony PCR, we have isolated and cloned from anaerobic fungi for the first time the three enzymes of the mevalonate pathway. We have demonstrated strong expression of these proteins by metabolically engineering the mevalonate pathway in E. coli and are beginning to test their activity to produce an important mevalonate precursor. Expressing these enzymes in a well-characterized system like E. coli allows us to study the activity of these enzymes and potentially obtain higher yields of this precursor. After co-expression of the pathway genes (acetyl-CoA C-acetyltransferase, hydrogen-sulfide S-acetyltransferase, and hydroxymethylglutaryl-CoA reductase) from a pETM6 plasmid in E. coli, high titers of mevalonate may be efficiently produced. Being able to express genes from our fungal system into E. coli cells allows us to explore unengineered microbes for genes that produce terpenoid precursors more effectively. Ultimately, producing mevalonate in E. coli cells will make the production of anticancer and antimalarial drugs less expensive.

Research Mentor: Kevin Solomon, Agricultural & Biological Engineering

Poster Number: 7073 :: Life Sciences

College of Science

Optimization of Elastin-like Polypeptide Liquid-Liquid Extraction from E. coli Cells

Author:

Mollie Shinkle

Abstract:

Elastin-like polypeptides (ELP) are a class of protein often utilized in biomedical applications such as drug delivery due to their biocompatible nature and low toxicity within the body. In the past, ELP have been purified by taking advantage of their intrinsic lower critical solution temperature (LCST). While significantly faster and more effective than traditional purification methods, this process still presented limitations. Recent advancements have shown the ability to purify ELP by organic solvent extraction from E. coli using mixtures of short chain alcohols. Though this new procedure allows for a more efficient procurement of pure protein, it exhibits a bottleneck in residual organic solvent. This work describes the screening and optimization of liquid-liquid extraction and back extraction conditions to remove excess organic solvent without denaturing ELP. Several different ratios and compositions of non-polar organic extractants were studied as well as order of addition and other cosolvent additives in the back extraction process. Data was collected through SDS-PAGE, UV-Vis and visual inspection for precipitated protein, and functionality of ELP was tested through heating and measuring LCST.

Research Mentor: David H. Thompson, Chemistry

Poster Number: 7037 :: Life Sciences

College of Science

Amphibian Physiology

Author:

Hannah Smith

Abstract:

Perfluorinated compounds (PFCs) are synthetic chemicals present in everyday products (e.g., nonstick cookware, stain-resistant fabric, firefighting foam). PFCs are an emerging contaminant of concern due to potential effects on the health of humans and wildlife via endocrine-disrupting effects. We have previously demonstrated that PFCs can reduce growth and delay development of larval amphibians. The goal of this study is to develop a simple analytical method using enzyme-linked immunosorbent assay (ELISA) to measure thyroid hormones (T3 and T4) in metamorphosing amphibians exposed to PFCs. We will determine (1) the relationship between amphibian developmental (i.e., Gosner) stage and thyroid hormone concentrations, and (2) whether this relationship is affected by exposure to PFCs. Therefore, this method will assist in linking endocrine disruption of thyroid hormones to sublethal effects of PFCs observed in our previous experiments.

Research Mentor: Maria Sepulveda, Forestry and Natural Resources

Poster Number: 7133 :: Life Sciences

College of Science

The Role of Ovarian Hormones in Activity Based Anorexia

Authors:

Alexander Stanley

Savannah Mick

Abstract:

Anorexia Nervosa (AN) is a devastating condition in which patients severely limit caloric intake, and often develop hyperactivity. AN has the highest mortality rate of psychiatric disorders, and high comorbidity with depression and other anxiety disorders. Most patients diagnosed with AN are female, and diagnosis generally occurs after the onset of puberty, thus it has been hypothesized that changes in ovarian hormones during adolescence may play a role in the onset and maintenance of AN. Activity-based anorexia (ABA) is a rodent model of AN. ABA in adolescent female rats increases anxiety-like behavior and stress reactivity in adulthood, and these effects are absent in males. Further, ABA in adolescent females decreased expression levels of estrogen receptor β (ERβ), collectively suggesting a role for ovarian hormones in ABA. We hypothesized that estradiol replacement during adolescent ABA would decrease the severity of anorexia and hyperactivity induced by the model. Female rats were ovariectomized (OVX) prior to puberty and anxiety-like behavior was assessed in adulthood. In a second experiment, female rats were OVX prior to puberty. ABA and control rats received estradiol replacement or vehicle, and experienced two bouts of ABA during adolescence. Despite estradiol replacement, weight loss and activity levels were similar to those in vehicle treated rats. Further, there were no differences in long-term anxiety-like behavior between groups. Collectively, these data suggest that ovarian hormones may play a role in aspects of ABA, however the short-and long-term behavioral consequences of ABA in adolescent females are not mitigated by estradiol replacement.

Research Mentor: Kimberly Kinzig, Psychological Sciences

Poster Number: 7190 :: Life Sciences

College of Science

Characterizing Opioid Neuropeptide Binding Domains for Fluorescent Sensor Design

Authors:

Ashwin Sunderraj

Stevie Norcross

Abstract:

Parkinson's Disease is the second most common neurodegenerative disorder in the world, and presents with restricted movement and a hallmark resting tremor. A dysregulation of opioid neuropeptide signaling has been implicated in the development of Parkinson's Disease. Monitoring the progression and eventual emergence of this signaling imbalance may reveal further insights into the pathophysiology of Parkinson's Disease. Genetically encoded fluorescent sensors can be used to study the development of neurological disorders at the molecular level in real time. One design approach for these sensors consists of a dedicated sensing domain with an inserted fluorescent protein. We are developing a genetically encoded neuropeptide sensor that operates using a "Venus Flytrap" mechanism, where a neuropeptide sensing domain binds a specific neuropeptide, which induces a conformational change from an open to a closed state. Ultimately, this conformational change leads to a change in the fluorescence emission, which can be used as a readout for the spatial and temporal signaling of the neuropeptide. The purpose of this project is to identify neuropeptide sensing domains that bind opioid neuropeptides and retain functionality under physiologically relevant conditions. Three candidate sensing domains have been identified: BsAppA, ScOppA2 and TmOppA. We optimized the expression of these sensing domains in E. coli and prepared purified protein for further characterization. We report on our progress characterizing these sensing domains using fluorescence anisotropy-based competition assays to measure binding affinities and circular dichroism temperature ramps to determine pH and temperature sensitivity.

Research Mentor: Mathew Tantama, Chemistry

Poster Number: 7094 :: Life Sciences

College of Science

Defining the Destruction Box: Understanding How the APC Recognizes Its Substrates

Authors:

Hana Maldivita Tambrin

Abstract:

Cell division is the process by which mother cells give rise to two genetically identical daughter cells. All cells have protein networks to ensure that cell division is completed correctly because mistakes during cell division may cause diseases. The Anaphase-promoting complex (APC) is an important regulatory enzyme that ensures successful completion of cell division. It acts by removing inhibitors of chromosomal segregation and cytokinesis, as well as other important regulators. Existing chemotherapies, like taxol, act by indirectly inhibiting APC function. This makes APC a potential target for new cancer chemotherapies. However, designing APC inhibitors is challenging because how APC interacts with its substrates is not fully understood. For example, APC recognizes a short linear amino acid sequence containing R-x-x-L, called the destruction box (D-box), in its substrates. A D-box is needed for efficient proteolysis of most APC substrates, but what makes a functional D-box is still unclear. The goal of my project was to define the minimal functional D-box using an artificial reporter substrate containing the known D-box motif from the budding yeast APC substrate Fin1. To accomplish this goal, reporter expression plasmids were mutated and the stability of the mutant proteins was measured and compared using a cycloheximide chase assay. Mutations that impair D-box function caused slower decay in the immunoblotting signal for the reporter substrate after protein synthesis was terminated. The results obtained from the experiment showed that the first three amino acids of a novel D-box element we have named the “D-box extension”, or DBE, are essential for efficient substrate degradation. Thus, by defining the minimal functional D-box, we have advanced our understanding of APC-substrate interactions, potentially helping the future development of chemotherapy drugs to kill cancer cells.

Research Mentor: Mark C. Hall, Biochemistry

Poster Number: 7193 :: Life Sciences

College of Science

A triumvirate approach to Alzheimer's disease using in vitro microglial analysis

Author:

Dawn Tilley

Abstract:

Alzheimer’s Disease (AD) is a neurodegenerative disorder that affects more than six million people worldwide. It is caused by the accumulation of amyloid-beta (Aβ) peptides in the brain that leads to neuroinflammation and neurotoxicity. Microglia are the resident immune cells of the brain responsible for the phagocytosis of the toxic Aβ plaques under healthy conditions but lose their phagocytic capacity during the progression of AD. Previous attempts to formulate a treatment or cure for AD have focused on targeting a single protein and have failed in clinical trials. Targeting more than one protein or mechanism may be a better method to develop multi-targeted therapeutics for AD. Using computational tools developed by our group, we have identified compounds to reduce neurotoxicity, reduce microglial nitric oxide (NO) production and enhance microglial phagocytic capacity using in vitro models. Mouse microglial cells called BV-2 cells are activated using LPS to secrete NO in culture and the compound’s ability to reduce the NO production is evaluated using a Griess assay because decreased NO production signifies decreased neuroinflammation. The toxicity of the compounds is assessed using the Cell Titer Blue viability assay. Thus far, Auranofin and Dexamethasone show significant decrease in NO production in BV2 cells, but Auranofin also shows increased toxicity in other cell lines. Further studies are underway to find compounds with synergistic effects on primary microglia and neurons, and additional assays will be utilized to improve the accuracy of our data and to choose the most active compounds for future in vivo testing.

Research Mentor: Gaurav Chopra, Chemistry

Poster Number: 7317 :: Life Sciences

College of Science

Inhibition of Migration in Aggressive Breast Cancer Cell Models by 1,25-Dihydroxyvitamin D

Author:

Shelby Tucker

Abstract:

Current treatments for breast cancer have a high 5-year survival rate of nearly 99% when tumors are still localized to the mammary tissue at time of diagnosis , however once the cancer has metastasized to secondary organs, this survival rate decreases to 26%. Therefore, determining successful preventive strategies against cancer cell metastasis is vital in prolonging the life of breast cancer patients. Previous studies have shown an inverse relationship between mortality rates and vitamin D status in breast cancer patients, which may suggest that the active metabolite of vitamin D, 1,25-dihydroxyvitamin D (1,25(OH)2D), plays a preventive role in metastasis of breast cancer cells. Evidence from our laboratory shows that 1,25(OH)2D inhibits breast to bone metastasis in a 3D cell culture model and that dietary vitamin D intake inhibits metastasis of 4T1 breast cancer cells to the lung in an animal model. In addition, increased fatty acid synthesis and triacylglycerol accumulation is a hallmark phenotype in aggressive breast cancer models. Results from our laboratory show that 1,25(OH)2D decreases triacylglycerol accumulation in metastatic cells, suggesting a mechanism by which the metabolite inhibits metastasis. The enzyme pyruvate carboxylase (PC), which catalyzes the carboxylation of pyruvate to oxaloacetate in the TCA cycle, plays a role in regulation of fatty acid synthesis, and is overexpressed in breast cancer cells. Results from our laboratory show that 1,25(OH)2D reduces triacylglycerol accumulation through downregulation of the expression of PC. To determine if down-regulation of PC is the main factor by which 1,25(OH)2D inhibits metastasis, cell migration assays were performed on 4T1 PC knock-down (PC KD) and scrambled control cell lines. No significant difference in migration was seen between 4T1 PC KD and scrambled cells. To further explore possible mechanisms of 1,25(OH)2D inhibition of metastasis, migration assays were conducted on metastatic metM-WntLung cells, which preferentially metastasize to the lungs when injected into mice, and non-metastatic M-Wnt cells in 4 mM and 2 mM glutamine. The metM-WntLung cells exhibited a decrease in migration following 24 hour 1,25(OH)2D treatment relative to vehicle in both normal conditions and low glutamine environments. The M-Wnt cells did not show a significant change with the same treatment in either normal conditions or low glutamine conditions. Migration of M-Wnt cells was not affected by 1,25(OH)2D or 2 mM glutamine culturing conditions. Identifying targets of vitamin D will contribute to recommendations to preventing breast cancer metastasis, and reducing deaths from this devastating disease.

Research Mentor: Dorothy Teegarden, Nutrition Science

Poster Number: 7287 :: Life Sciences

College of Science

Comparative Studies of Zika and Dengue Virus NS1

Author:

Ena Tully

Abstract:

Although the first case was isolated about 70 years ago, Zika virus became a major epidemic in 2015 with the first cases of Guillain-Barré syndrome in adults and severe congenital microcephaly in infants born to mothers infected with the virus. Zika virus is a type of flavivirus, a family of viruses that contain a positive-sense RNA genome which encodes a single viral polyprotein composed of three structural proteins and seven nonstructural proteins. Of these ten proteins, nonstructural protein one (NS1) has significant roles in viral pathogenesis with functions in replication, host immune evasion, membrane association, and polyprotein packaging. These functions can be best understood with the structure of NS1, which exists as a membrane-associated dimer and a secreted hexamer. A hydrophobic face of the dimer is what allows the protein to associate with membranes and comprises the center of the hexamer. The other side of the dimer and the outer face of the hexamer contains glycosylation sites and is hydrophilic which in turn permits interaction with the host immune system. Current literature reveals the importance of NS1 in the functions mentioned above, however little is known about the molecular mechanisms NS1 uses to accomplish these tasks. NS1 from dengue virus, another flavivirus, has high sequence identity with Zika virus NS1. Using this information, chimeras of dengue and Zika NS1 were designed and generated as a way to probe NS1 function in these viruses. Results from assays using the NS1 chimeras will hopefully reveal novel information on NS1's function in the flavivirus lifecycle.

Research Mentor: Richard Kuhn, Biological Sciences

Poster Number: 7002 :: Mathematical/Computational Sciences

College of Science

A Real Variable Equivalence of the Riemann Zeta Hypothesis Using Step Functions

Author:

Jack VanSchaik

Abstract:

Prime numbers are an important concept in both applied and pure math. In 1859, Bernhard Riemann published a paper hypothesizing that prime locations are related to the zeros of a certain analytic function, the Riemann zeta function. This idea, now referred to as the Riemann hypothesis, has evolved into perhaps the most famous unsolved problem in mathematics. As mathematicians, we must be willing to look at the Riemann hypothesis through a different lens. We introduce a class of real step functions, which will lead to several identities linking staircase functions to the Riemann zeta function in unexpected ways. We discuss a reformulation of a real variable equivalence of the Riemann hypothesis: the Nyman-Beurling density statement. The density of step functions in the context of Nyman-Beurling is discussed, leading to some new insights.

Research Mentor: Steven Bell, Mathematics

Poster Number: 7324 :: Life Sciences

College of Science

Engineering Fluorescent Biosensors

Author:

Sarah Varney

Abstract:

The objective of this research is to develop a new fluorescent protein with an emission spectrum sensitive to reactive oxygen species. Inspired by the natural sensitivity of green fluorescent proteins to reactive oxygen species, this research aims to link a green fluorescent protein with a red fluorescent protein to create biosensors for studying Parkinson’s disease in mitochondria and cytoplasm simultaneously. DNA constructs encoding these sensors were designed, then transformed into bacteria which used the constructs to express the desired protein for testing. After testing the emission spectra of the proteins, it was found that Förster-type resonance energy transfer between the green fluorescent protein and the red fluorescent protein was approximately 30% efficient. Although this efficiency is low, it is being increased. This research creates a new generation of fluorescent biosensors which can be improved for future use in studying causes of Parkinson’s disease.

Research Mentor: Mathew Tantama, Chemistry

Poster Number: 7283 :: Life Sciences

College of Science

Functional Studies of the Central Noradrenergic System with Optogenetics

Author:

Kendra Wang

Abstract:

Fragile X Syndrome (FXS) is an inherited intellectual disability and a form of autism. Many of the associated phenotypes and abnormalities such as increased pupil dilation, hyperarousal, and hyperstimulation of FXS fit well with the function of norepinephrine (NE). NE is released from a small noradrenergic nucleus, the locus coeruleus (LC), to various brain regions. Therefore, we hypothesize that there will be an increase in NE release in the LC of FXS rodent model. We seek to understand the role of LC mediated NE release and its influence on behavior and the control of pupil size. In this study, we utilized optogenetics, an experimental system designed to use light to control the activity of specific neurons. LC infected with a virus containing blue light sensitive optogenetic protein channelrhodopsin-2 (ChR2), allowed the neurons to become excited when light stimulation was applied to them. A transgenic mouse expressing Cre recombinase under the tyrosine hydroxylase (TH) promoter was used to specifically express Cre in brain nuclei responsible for catecholamine biosynthesis. This allowed for the specification of adeno-associated virus (AAV) in the LC. AAV Cre-dependent ChR2 was injected into the LC of both brain hemispheres in a TH-Cre transgenic mouse. Optical fibers were then implanted above the LC in these animals, allowing for optogenetic stimulation of LC neurons with blue (473nm) light. Using this experimental system, we will perform pupillometry recordings and open field behavior assay in awake mice during LC stimulation to determine the role of NE on hyperactivity. We expect the results of these experiments to broaden our understanding of the central noradrenergic system. In the future, we plan to breed Th-CRE mice with FXS mice to investigate the role of the adrenergic system in hyperactivity in FXS mice.

Research Mentor: Alexander A. Chubykin, Biological Sciences

Poster Number: 7347 :: Innovative Technology/Entrepreneurship/Design

College of Science

Framework For Visualizing Symptom Clusters of Systemic Lupus Erythematosus

Author:

Lauren Washington

Abstract:

Finding a method to better understand symptom clusters in chronic illnesses is critical for the advancement of diagnostic technology. This research aims to find an effective way to visualize the symptom clusters of lupus. A symptom cluster is when a group of symptoms occur concurrently, and these clusters can sometimes have important clinical implications. Systemic Lupus Erythematosus (SLE), a chronic autoimmune disease, is notoriously difficult to detect. The illness can involve and affect nearly any organ, often resulting in a wide range of symptoms, which can often lead to it being mistaken for many other illnesses before the true diagnosis of SLE is reached. A literature review of papers pertaining to the symptoms of SLE was conducted to collect heterogeneous data about lupus symptom clusters. Heterogeneous data is data that may contain many different kinds of data, and often needs to be standardized before usage. A method of interactive visualization was developed using D3 (Data Driven Documents) which is a JavaScript library that allows users to build robust interactive visualizations more easily. The data was comprised of several forms of data including nominal, discrete, and binary. This data had to be standardized and formatted to be used in the interactive visualization. This document is based upon work supported by the National Science Foundation under Grant No. 1246818.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 7304 :: Life Sciences

College of Science

Kinetic And Structural Parameters Governing Regulation Of The Unfolded Protein Response By Fic-Mediated Adenylylation/AMPylation

Author:

Ben Watson

Abstract:

Fic (filamentation induced by cAMP) proteins regulate diverse cell signaling events by post-translationally modifying their protein targets, predominantly by the addition of an AMP (adenosine monophosphate). This modification is called Fic-mediated Adenylylation or AMPylation. We previously reported that the human Fic protein, HYPE/FicD, is a novel regulator of the unfolded protein response (UPR) that maintains homeostasis in the endoplasmic reticulum (ER) in response to stress from misfolded proteins. Specifically, HYPE regulates UPR by adenylylating the ER chaperone, BiP/GRP78, which serves as a sentinel for UPR activation. Maintaining ER homeostasis is critical for determining cell fate, thus highlighting the importance of the HYPE-BiP interaction. Here, we study the kinetic and structural parameters that determine the HYPE-BiP interaction. By measuring the binding and kinetic efficiencies of HYPE in its activated (Adenylylationcompetent) and wild type (de-Adenylylationcompetent) forms for BiP in its wild type and ATP-bound conformation, we determine that HYPE displays a nearly identical preference for the wild type and ATP-bound forms of BiP in vitro. Further, adenylylation does not alter BiP's ability to interact with UPR proteins, PERK and IRE1. Finally, using in vitro adenylylation assays and molecular docking models, we show that while BiP's Thr366 is preferentially adenylylated in vitro, its Thr518 appears to be the structurally and likely physiologically preferred site of adenylylation. This is the first such analysis and offers critical insights into the substrate specificity and target recognition of the HYPE-BiP interaction.

Research Mentor: Seema Mattoo, Biological Sciences

Poster Number: 7312 :: Life Sciences

College of Science

Fluorescent Tagging of Yellow Fever Virus Structural Proteins

Author:

Hunter Wieczorek

Abstract:

Flaviviruses are enveloped, positive-strand RNA viruses that currently pose a major health risk worldwide. Well known representatives include Zika virus (ZIKV), dengue virus (DENV), West Nile virus (WNV), and yellow fever virus (YFV). These viruses use arthropod vectors for transmission to human hosts. Once inside the cell the genome is released and translated by host cell machinery. At the ER interface the structural proteins C, prM, and E form the viral particle through an in-budding event involving both viral and host proteins as assembly machinery. The particle then undergoes processing and maturation in the trans-Golgi network. Real-time localization of structural components during assembly could illuminate a more precise molecular mechanism of early particle formation. Fluorescent tagging of the structural proteins of YFV was attempted to better understand particle assembly, as well as maturation and trafficking of the virus. Insertion sites were selected by a two-fold approach: residue sequence conservation, as well as structural data were considered to increase the odds of particle stability in spite of the large structural insertion. The fluorescent protein mCherry was inserted into the cDNA vector containing the full length YFV genome. The insertion was confirmed by sequencing, RNA was generated and subsequently cells were transfected via electroporation. The results were then characterized by fluorescent light microscopy and molecular methods. Fluorescently tagged flavivirus will provide a useful tool to investigate the molecular mechanism of assembly.

Research Mentor: Richard Kuhn, Biological Sciences

Poster Number: 7041 :: Innovative Technology/Entrepreneurship/Design

College of Science

Bridging User Research and Interface Design Through Information-Driven Conceptual Modeling

Author:

Elliott Williams

Abstract:

The significance of user research in usability analysis, and the role it plays in a properly-executed design process, is a well-studied aspect of human-computer interaction. Yet user research does not directly translate to the organization and architectural knowledge necessary for design. A conceptual model of information alignment and access, oriented toward modeling information flows and knowledge architecture, connects the needs identified in user research to the structure and visualization of the design. I conducted information architecture and website redesign efforts for both a small-scale university research group and a distributed STEM outreach organization. By comparing these efforts, I identify how conceptual models change in response to organization size, user needs, hierarchy, and knowledge scope. I reassert the significance of conceptual models for bridging user research to design, and identify how changes in the model signify changes in the design.

Research Mentor: Barrett Caldwell, Industrial Engineering

Poster Number: 7282 :: Life Sciences

College of Science

Regulation of Early Breast Cancer Cell Viability by Pyruvate Carboxylase and Glutamine

Author:

Katie Wong

Abstract:

Breast cancer is the second most common cause of cancer deaths in US women, killing over 40,000 women each year. In addition, the five-year survival rate for breast cancer drops from 99% in Stage I to 22% in Stage IV once the cancer has metastasized. Therefore, it is necessary to identify safe and non-toxic methods to prevent early metastatic behavior as well as later metastasis from occurring. One hallmark of cancer progression is the ability of cancer cells to survive unattached to extracellular matrix (ECM), termed anchorage independent growth, as normal cells require attachment to the ECM to avoid cell death. Anchorage independent cancer cells must also find unconventional ways to regulate their energy metabolism due to changes in the environment and the status of the cell. Pyruvate carboxylase (PC) is an enzyme important in energy metabolism that converts pyruvate, a product of glucose metabolism, to oxaloacetate (OAA), supporting the energy producing TCA cycle. Work in our laboratory shows that inhibition of PC decreases cell viability in transformed breast cancer cells, in part due to preventing glucose from entering the TCA cycle and reducing energy availability in the cell. However, glutamine has been shown to replenish the TCA cycle when the cell is deprived of glucose. Therefore, we hypothesize that the presence of glutamine will rescue PC depleted cells. The purpose of this study is to investigate the role of PC and glutamine in cell viability of stably transfected MCF10A-ras cells, a model of early breast cancer, expressing doxycycline-inducible shRNA targeting PC to reduce its expression in the cell in an ultralow attachment environment. We tested the effect of glutamine on cell viability using an MTT assay, in the presence or absence of PC. In the presence of glutamine, normal cells exhibited a significant increase in cell viability, while PC knockdown cells did not, suggesting the presence of PC is important for glutamine rescue. Once the mechanisms by which PC plays a role in cell viability are better understood, prevention strategies can be explored to target this pathway to affect cell viability and prevent early breast cancer metastasis.

Research Mentor: Dorothy Teegarden, Nutrition Science

Poster Number: 7377 :: Life Sciences

College of Science

Importance of Nuclear Localization of an Agrobacterium Virulence Effector Protein for Transformation

Author:

Eder Xhako

Abstract:

VirE2 is an Agrobacterium protein that has many important functions in bacterial gene transfer to plants. Previous experiments showed that VirE2 has single-stranded DNA binding activity and that it is very important for Agrobacterium-mediated transformation. However, some roles for VirE2 in transformation are controversial. One of these controversies is whether VirE2 remains cytosolic or goes into the nucleus, and how this affects T-DNA intracellular trafficking and integration. My experiments compared the transformation efficiency of two sets of transgenic plant lines, one that expresses VirE2 and one that expresses VirE2-NLS, a VirE2 protein that is forced to enter the nucleus. The levels of transient transformation were measured and the results showed that when VirE2 is forced into the nucleus, transformation levels are significantly lower than that of plants overexpressing wild-type VirE2. These results suggest that VirE2's role in transformation occurs in the plant cytoplasm and not in the nucleus. I am now running control experiments to further support my conclusion that VirE2's role in transformation is cytoplasmic.

Research Mentor: Stanton Gelvin, Biological Sciences

Poster Number: 7199 :: Physical Sciences

College of Science

Quantifying Groundwater Flowpaths and Contributing Areas of Perennial Springs in Owens Valley Using Trace Elements

Authors:

Hannah Yee

Abstract:

Owens Valley is an extensional basin located northeast of the city of Los Angeles, California between the Sierra Nevada and the White-Inyo Mountains. Much of the water from Owens Valley is diverted and piped to the city of Los Angeles. Natural springs still exist in the mountains surrounding Owens Valley, and a few perennial springs still emerge along the mountain-front and in the basin itself. The contributing areas and flowpaths that sustain perennial flow in these springs are important in understanding regional groundwater patterns and sources of recharge. However, it is difficult to quantify the spatial variability of these processes due to the geological and tectonic complexity present in the region. The geology, namely rock types and mineral assemblages, is often a major control on the presence of trace elements in groundwater which can be used as tracers to quantify groundwater flow paths. In order to increase current understanding of groundwater flow in this area and recognize how these complex aquifer systems will respond to a rapidly changing climate, springs from Owens Valley were sampled and analyzed for general chemistry (standard cations and anions) and trace elements. Principal Component Analysis (PCA) was then used to determine if a correlation exists between 1) trace metal concentrations, 2) the extrusive volcanic (mafic and felsic), plutonic granitic, and carbonate rocks that host the groundwater flowpaths, and 3) the landscape placement of springs. Initial results indicate that trace metals can explain additional information that general chemistry does not provide. Springs with high traces of lithium, boron, vanadium, arsenic, and tungsten can indicate extrusive volcanic flowpaths. Springs with high traces of uranium and titanium could be the result of granitic plutons. Samples with high barium concentrations can indicate weathering of basaltic rocks (mafic extrusive rocks). When combined with general chemistry, trace metals provide supplementary insight into the flowpaths of the perennial springs of Owens Valley and provide additional insight into flow characteristics of springs (e.g., diffuse seeps versus high volume discharge from bedrock).

Research Mentor: Marty Frisbee, Earth, Atmospheric, and Planetary Sciences

Poster Number: 7150 :: Mathematical/Computational Sciences

College of Science

Comparison of Statistical Procedures to Identify Technicians with Terminal Digit Preference in Blood Pressure Measurements

Author:

Amber Young

Abstract:

Reducing systemic error is essential in any experiment to produce accurate and repeatable results. However, error is intrinsic to any measurement taken by humans. In a recent experiment involving the effect of diet on blood pressure, a quality control procedure was sought to ensure that the technicians taking the blood pressures did not show any error or bias in their measurements. In particular, the procedure would focus on the terminal digits of the blood pressure measurements to determine if any of the technicians showed a terminal digit preference (i.e. consistent rounding off to zero). An expert on the project created an algorithm to identify technicians with serious digit preference based on the percentages of each terminal digit. To guarantee identification of these technicians, the proposed algorithm was compared with other statistical tests. Properties of the tests considered in this comparison were type I error, type II error, power, and sensitivity to sample size. These test properties were analyzed using both the previously mentioned data and a simulation created to generate terminal digit data from its probability distribution. This project discusses which test – or quality control procedure – would minimize errors, maximize power, and be accurate with a small sample size.

Research Mentor: George McCabe, Statistics

Poster Number: 8198 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

The Path of Accounting and the Effects of Artificial Intelligence

Authors:

Jessica Bennett

Abstract:

Will artificial intelligence replace accountants? This question at one time seemed ridiculous, but with each passing day, the possibility grows. As a student majoring in this field, the idea of my future career being wiped out by a computer is alarming. This poster will consider the effects of artificial intelligence on the profession. Before exploring the future of accounting, we must look at the beginning.

The poster starts by following how accounting began in early societies with their primitive forms of technology. Then it will consider the involvement of computer programs in current accounting practices. The profession has changed throughout the years, leading society to the prospect of computers replacing humans. I have read various articles about the path of accounting, and interviewed an employee from one of the top accounting firms to gain insight into the situation. Once I provide the background and current technology of the industry, I will discuss some effects of artificial intelligence such as the functions, costs, and benefits of using a computer to complete the work. What is lost or gained by removing the human element from the process? The accounting profession has been evolving since the early societies, so let the business world face this intimidating possibility, keeping in mind that accounting has always been changing.

Research Mentor: Susan Watts, Management

Poster Number: 8021 :: Social Sciences/Humanities

Krannert School of Management

Increasing Awareness of Study Abroad Opportunities Within the Krannert School of Management

Author:

Margaret Berkemeyer

Abstract:

The purpose of this project was to focus on the main reasons why undergraduate students in the Krannert School of Management do not study abroad. The goal of this research was to dispel the myths that are associated with studying abroad. This was done by sending out a qualitative multiple-choice survey to undergraduate students focused on demographics and exposure to study abroad. After gathering 132 responses, we analyzed the reasons why students do not want to study abroad. The main reasons students gave why they did not want to study abroad were; they could not graduate in four years, it is too expensive, and there are few Krannert courses offered for direct credit. By addressing the main myths of study abroad, Krannert can more effectively market study abroad to current students.

Research Mentor: Ilana Stonebraker, Libraries

Poster Number: 8139 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

Technology in Community Banking

Author:

Megan Hawkins

Abstract:

Technology is rapidly changing the way business is conducted, in no industry is this more prevalent than the banking industry. As more Americans depend on an application to complete their banking needs, banks have had to modify their long-term strategic initiatives. The ability for banks to compete depends on their capability of producing or purchasing new technology, which leaves small, community banks at an extreme disadvantage. This research aims to discover how community banks are adapting to keep their customer base and how this impacts the bank's financial performance, customer demographics, and overall long-term goals. To conduct this research, one local community bank was used as the main subject, but viewpoints of employees from large consumer banks and credit unions were taken into account. The goal of this research is to determine if community banks are capable of adapting into the modern world.

Research Mentor: Melissa Evens, Management

Poster Number: 8163 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

Differences in Social Media Usage for Fashion vs. Mass Retail Consumers

Author:

Briana Jenkins

Abstract:

With the rise of new business tools and techniques, businesses are approaching the way they operate differently than compared to twenty years ago. This led to the initial question of “how are new marketing and analytical tools being used?” The fashion/retail industry is one of the most competitive industries today so it would be interesting to apply this question to this specific industry. To narrow the focus, the researcher focused on 2 types of stores (general and fashion-forward) within the fashion/retail industry and social media as both a marketing and analytical tool. In this field, there hasn’t been any public research comparing the two types stores and platforms being used, as well as how different consumers engage with them. This is the new knowledge that is hoped to be created. To investigate this question, a mixed methods approach (empirical/interpretive) was used that included conducting a survey related to the preferences for different types of stores and usage of the platforms. The survey questions were sent out to people ages 18-29 and 30+. The survey results were then analyzed using a statistical, cross-tabulation, and interpretive analysis. The primary results show that there may be a connection between gender and the type of store preferred and that there is a strong connection between age and the type of social media being used.

Research Mentor: Chad Allred, Management

Poster Number: 8097 :: Mathematical/Computational Sciences

Krannert School of Management

An Investigation of Feature Engineering Approaches and Strategies

Author:

Andrew Lentz

Abstract:

This focus of this study is to test the effectiveness of several feature engineering approaches and strategies on multi classification datasets. The motivation for this investigation is to determine if specific feature engineering approaches are beneficial for a variety of modeling techniques. Understanding best practices for feature engineering can help professionals and researchers alike extract the most out of their data in classification settings. We will set up a workflow to systematically test the effect of 5 feature engineering approaches on 19 multi classification datasets using 5 predictive modeling techniques. The workflow will be done in R using the h2o package to control the variability in the models an parallelize the workload. After preprocessing the data, a loop will be run to test each model on each data set in a controlled setting followed by applying each feature engineering approach to each data set and testing the models again in the same environment. We will then assess the effectiveness of each engineering approach on each predictive modeling technique. We propose this method will allow us to generalize “industry standard” approaches for specific feature engineering approaches on specific predictive models.

Research Mentor: Matthew A. Lanham, Management

Poster Number: 8004 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

Capturing NAFTA's Impact on the United States Automobile Industry using the Cobb-Douglas Production Function

Author:

Andrew Marshall

Abstract:

Having been in place for little over 20 years, the North American Free Trade Agreement, or “NAFTA” for short, represents, along with the European Economic Community and later the European Union, one of the largest trade liberalization agreements in the world. Coming into effect in January 1994, NAFTA aimed to spur trade and efficiency gains between the agreeing nations of the United States, Mexico, and Canada. However, NAFTA has been a contentious issue politically, with many, including current President Donald Trump, blaming it for the decline of American manufacturing. With the U.S. under President Trump flirting with leaving the agreement and threatening tariffs on member nations, this paper examines the effect of NAFTA’s trade liberalization on one of the more publicized sectors of manufacturing, the automobile industry, and additionally provides insight on potential outcomes the implementation of a tariff would have on the industry. Focusing on NAFTA’s removal of the U.S.’s 2.5% tariff on Mexican-assembled vehicles, the Cobb-Douglas production function was used to map the changing labor and capital conditions on overall domestic automobile industry, as well as determining which channel, labor or capital, the tariff (and later lack thereof) acted primarily through. The tariff was found to have functioned as an additional cost for firms, and a significant one through the labor channel. Knowing that the tariff worked within the labor channel encouraged additional econometric analysis on relevant labor variables such as employment and wages. NAFTA’s trade liberalization, when controlling for growth of the United States economy and technological growth, decreased total productivity in domestic automobile manufacturing, yet had little to no significant effect on employment and average wages.

Research Mentor: Ralph Siebert, Economics

Poster Number: 8089 :: Social Sciences/Humanities

Krannert School of Management

Digital-Fuelled Disrespect: A Predictive Approach to Help Online Discussions Become More Productive

Authors:

Madison McDonough

Lawrence Baryoh

Danielle Bresich

Libby Gonzalez

Abstract:

This study focuses on how to make online discussions more productive, respectful, and beneficial using predictive analytics. The motivation for this investigation is that as technology becomes more prevalent in our everyday lives, and society continues to interact more via online discussions for educational and social purposes, is there a way to make these interactions more beneficial for the users? Over the last decade it has been a challenge to decipher what content might be considered destructive and figure out how to make discussions more productive for everyone involved. With the rise in big data analytics and machine learning to improve all areas of business and society, we believe a predictive model could be developed to facilitate this problem. In our study we investigate Wikipedia comments that have been labeled by various levels of toxic behavior by human raters. Each comment has different attributes ranging from hateful speech to insulting language. We develop a classification predictive model using R that would allow future comments to be potentially flagged for removal based on their content. We posit that our proposed solution could be extended to other online discussion forums to improve interactions by making them more productive, respectful, and beneficial for the community as a whole.

Research Mentor: Matthew A. Lanham, Management

Poster Number: 8085 :: Mathematical/Computational Sciences

Krannert School of Management

Upgrade with Uplift: Gaining More Accurate Predictive Models with Uplift Modeling

Authors:

Katarina McGuckin

Josh Chan

Norah Alwalan

Andrew Moolenaar

Daniel Yang

Abstract:

This study focuses on understanding how marketers can leverage uplift models to better predict consumer behaviors compared to traditional response models. Our focus is to find the best uplift modeling method based on specific characteristics for each dataset. The motivation for this investigation is to improve conventional predictive modeling methods through the utilization of uplift modeling techniques. Using these uplift modeling techniques, we can identify the most relevant variables for any business problem. These methods are important from a marketing standpoint because they allow us to identify specific consumer behaviors that otherwise would not have been noticed. In comparison, uplift modeling has been shown to regularly outperform conventional methods. We compare a variety of popular uplift modeling techniques used in the industry on the same data set. This includes the different proposed techniques for reducing the number of features, creating different branches for decision trees, and eventually ending with a variety of models. Afterwards, we score each of these models on a testing set provided and after tuning each one under their corresponding criteria, submit them to Kaggle to see how well our solution performs compared to expert uplift modelers. After seeing how each model performs, we compare the model performance by discussing the prediction accuracy, implementation difficulty, and time complexity.

Research Mentor: Matthew A. Lanham, Management

Poster Number: 8083 :: Mathematical/Computational Sciences

Krannert School of Management

XGBoost - A Competitive Approach for Online Price Prediction

Authors:

Joshua McKenney

Yuqi Jiang

Junyan Shao

Abstract:

This study generates price prediction suggestions for a community-powered shopping application using product features, which is a recent topic of a Kaggle.com competition sponsored by Mercari, Inc. As Ebay acquired Canadian data analysis firm Terapeak, the importance of using “big data” and machine learning to improve pricing decision-support in business has been rapidly increasing. By obtaining a solution for price prediction via product features for B2C and C2C online retailers, it will be easier for sellers to sell, and enlarge the selling-shopping community of such user-based marketplaces. It could also be a great competitive advantage for companies or individual sellers having highly accurate pricing decision-support. The authors used R and Kernels to perform text analysis to generate features from the unstructured product features, then used XGboost and Multiple Linear Regression to dynamically predict product price. After doing some exploratory data analysis, we created text features with above/below average prices for the most important features in the dataset. XGBoost was able to handle the over 2,000 brands data while Multiple Linear Regression was not able to. XGBoost achieved the best performance, with a 0.513 test set RMSLE.

Research Mentor: Matthew A. Lanham, Management

Poster Number: 8192 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

Behind Their Eyes

Author:

Mason McLary

Abstract:

The goal of most research is to reach a definite conclusion, but what if the research is aimed towards finding which questions to ask? That was the purpose of creating Behind Their Eyes. Alvin Toffler coined the term “future shock” for the psychological repercussions of technology that progresses faster than the society can comprehend. To create a realistic depiction of future shock, I reviewed science fiction works of great artists in decades past. In researching how these pieces envision the future, I evaluated how closely our present is following their path. Visionary works such as “Blade Runner” and “Alien” use their cybernetic technology as both an allegory and a warning of how technology will affect humanity. Their iterations of cyborgs are cold, standardized, and efficient, and are almost always shown rebelling against humanity. So, it would make sense that, if they were made in our world, society would be skeptical of their true intentions. In fabricating a world where these cyborgs desperately try to cling onto their humanity, I discovered the question is not will these cyborgs be created, but rather how will our society react to them?

Research Mentor: Amy Lynn Budd, Visual and Performing Arts

Poster Number: 8084 :: Mathematical/Computational Sciences

Krannert School of Management

What is Your Home Worth? Predicting Housing Prices Using Regularization and Meta-Modeling

Authors:

Nathan Mehringer

Jeremy Anderson

Eric Wilens

Will Coffey

Katie Shatkus

Abstract:

This study uses descriptive and predictive analytics techniques to identify the key drivers of home value, and develop an accurate prediction for the price of a home once on the market. The motivation for this investigation is to estimate a fair price for both buyers and sellers in the housing market. Taking into account the wide array of components that affect a home's value and then having to set a fair market price can be a difficult task. Purchasing a home is often one of the largest investments a person or family will make in their lifetime. Thus, listing the home at the right price with minimum error can be key in combining the right buyers and sellers, and allow the home to sell more quickly. Moreover, knowing the major factors that affect a home's value can provide decision-support to sellers in how they might want to invest in home improvement projects before they sell their home. Using 1460 homes purchased between 2006 and 2010 in Ames, Iowa that measured 81 different features about these homes, we identify the key drivers of a home's value. We show that using regularization techniques such as least absolute shrinkage and selection operator (LASSO) can help easily identify those key descriptive drivers of home value. We then show that combining multiple predictive models in an ensembled fashion via meta-modeling can lead to a better prediction than using one predictive model in isolation.

Research Mentor: Matthew A. Lanham, Management

Poster Number: 8104 :: Social Sciences/Humanities

Krannert School of Management

2018 Community Bank Case Study Competition

Author:

Qi Meng

Abstract:

Banks are actively looking to technologies as a way to gain competitive advantages, increase product diversifications and cut cost. For community banks who have smaller internal IT team and smaller capital compared to commercial banks, effective use of third-party vendors is essential to control expenses, gain access to greater expertise and devote human capitals which are in short supply to their core business.

This research project aims to provide insights into how community banks are utilizing technologies within day-to-day operations. We conducted interviews with Security Federal Bank and focused on the use of third-party vendors, how the bank manages its relationships and risks associated with third-party vendors, as well as challenges faced with community banks and how they prepare to solve them in the future.

Research Mentor: Melissa Evens, Management

Poster Number: 8086 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

Where's Fido? Using Machine Learning to Classify Images of Dogs

Authors:

Junan Pan

Shengwen Huang

Hyerin Kim

Xuanye Guo

Wanying Zhou

Theerakorn Prasutchai

Abstract:

This study investigates sophisticated image classification software and predictive models to accurately predict a dog's breed. As dog breed identification falls into the category of fine-grained classification, its applicable to fields such as bio-diversity studies and has potential in facilitating auto-tagging and image search as well. Image recognition has a vast number of applicable industries ranging from national security to marketing. From a marketing perspective, it creates a vast new knowledge base about consumers' identities, brand preferences, shopping habits, and more that every marketer could use to better serve their customers via more intelligent targeting and recommendations. In our study, we perform image classification using various machine learning models on 120 different dog breeds and compare the accuracy of each model to predict any breed within the 120 given breeds. Using TensorFlow with Inception model in Python we found that a Convolutional Neural Network (CNN) developed by Google researchers performed the best with a predictive accuracy around 80%. We tried other popular machine learning algorithms and compare those to the CNN model and discuss why we believe the CNN model performs so well compared to the other techniques we investigated.

Research Mentor: Matthew A. Lanham, Management

Poster Number: 8080 :: Mathematical/Computational Sciences

Krannert School of Management

Does Your Analytics Masters Degree Fit the Bill? Predicting Placement Rate and Starting Salary

Authors:

Jayana Patel

Ersin Nurkic Kacapor

Matthew Bottorff

Tyler Richards

Graham Cason

Naveen Ellappan

Abstract:

This study builds predictive models that try to estimate two key performance measures (i.e. placement rate, starting salary) of all masters programs in analytics and data science. The motivation for this investigation is that these measures are particularly important to the students in these programs, as well as future students considering which school to attend. Having the ability to identify the key factors that drive program success as we define it, will allow universities to strategically modify their content or program design to recruit better students and improve these KPIs. Our study focuses on both prediction accuracy and estimation/inference as programs would like to be able to predict how well students will be placed and how much they will make on average, but also must understand how each factor contributes to placement and salary so better decision-support is available when making admissions decisions. To answer these research questions, we collected data from every university and college in America that has a masters program in Analytics or Data Science. There are many features ranging from admitted student demographics, courses offered, program design, experiential learning opportunities, to financial considerations. We use traditional linear regression to show the effects these features have on the KPIs, and try a few machine learning techniques to try and increase predictive accuracy.

Research Mentor: Matthew A. Lanham, Management

Poster Number: 8082 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

Caret Versus Scikit-learn: A Comparison of Data Science Tools for Predictive Modeling

Author:

Michael Roggenburg

Simon Jones

Chris Root

Theerakorn Prasutchai

Zhengho Ye

Zhuoheng Xie

Abstract:

The objective of this study is to give a comprehensive comparison of functionality, runtime, and model performance between the R caret library and Python scikit-learn library in a classification framework. We provide a workflow that compares and contrasts the functionality of each tool so that others have a better understanding of what is available in the predictive modeling process. The motivation for this study is that the R and Python programming languages continue to be among the top tools in the data science and analytics space. While there are many libraries to perform predictive modeling tasks, the caret package from R, and scikit-learn from library from Python are two of the most popular. Thus, having a working proficiency and understanding of the ins-and-outs of both can be very advantageous to an analytics professional. The summary of our proposed workflow is based on professional and academic papers, as well as the documentation provided for both packages. We used the WSDM-KKBox's Churn Prediction Challenge dataset from a recent Kaggle competition as our classification modeling example. The data was run through ten separate models using the various available functions to clean, impute, pre-process, partition, and evaluate the models. While this study provides model results for this particular dataset, the focus in on comparison among the libraries.

Research Mentor: Matthew A. Lanham, Management

Poster Number: 8132 :: Mathematical/Computational Sciences

Krannert School of Management

Developing a Breadth Versus Depth Category Management Strategy by Estimating Product Substitution

Authors:

Michael Roggenburg

Guanzhu Mou

Juan Pablo Bustamante-Paez

Abstract:

This study investigates multi-classification predictive models to estimate product substitution among a set of grocery items in order to provide a better breadth versus depth category strategy. The motivation for this investigation is to help categorical managers better understand their customers purchasing behavior and preferences, so they can make better assortment decisions for their categories. Category management requires having a strategy that balances breadth and depth of products offered while satisfying financial and space constraints. On one end of the spectrum, one could provide extensive breadth and have many different products with few substitutes, while on the hand, one could offer a few products but have a wide depth of substitutes (e.g. different colors, different brands, etc.). In collaboration with a national grocery retailer, we build multi-classification predictive models on one category of products. These products were sold at various stores and are similar in that they are the same food item, but are different based on product attributes and brands. We investigated Multinomial Logistic Regression, Naive Bayes, Deep Learning and Gradient Boosted Machine models and show how predictions from these models can be used to devise a category strategy to maximize sales.

Research Mentor: Matthew A. Lanham, Management

Poster Number: 8346 :: Social Sciences/Humanities

Krannert School of Management

Financial analysis of Security Federal bank

Author:

Isaac Tang

Abstract:

My submission is the financial analysis of the Security Federal bank of Indiana I have done for the CSBS case competition. In my analysis, I have concluded the bank is fundamentally sound with consistent income flow and a healthy balance sheet. Assets are growing organically through retained earnings and amount of debt is low.

Research Mentor: Melissa Evens, Management

Poster Number: 8081 :: Mathematical/Computational Sciences

Krannert School of Management

To Stock or Not to Stock: Forecasting Demand in Grocery Stores

Authors:

Tony Ye

Andrew Lee

Yixuan Shi

Yidan Gao

Abstract:

This study utilizes predictive data analysis to solve a common problem faced by many retail companies worldwide: how to accurately forecast demand for grocery items? Specifically we are look at accurately predicting sales forecasts for grocery items to ensure that the right amount of any given item is delivered for any given store. Understanding how to predict grocery demand has been investigated by many, because they understand the importance that accurate demand forecasts having on business planning for brick-and-mortar grocery stores. Overpredict demand a little bit and grocery store chains are stuck with overstocked items and potentially lost perishable goods. Under predict demand and you have the potential to miss out on maximizing profit and having upset customers. In our solution we first identified which factors had the greatest impact on inventory turnover. We then built classical multiple linear regression models, and more sophisticated machine learning neural network and XGBoost models to predict demand.

Research Mentor: Matthew A. Lanham, Management

Poster Number: 8210 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

A Research Study on Use of Technology in Community Bank

Author:

Ruoxuan Zhao

Abstract:

In a time that technology is rapidly updating, the way that firms conduct business is constantly affected. Of all industries, the banking industry is one where the use of technology is polarized depending on the size of the bank and its targeted customers. This research study focused specifically on the use of technology in community bank in its daily operation and services provided to customers. It looks at the use of technology in Security Federal Savings Bank from both an internal and external perspectives, as well as its maintenance and safety related issues concerning technology.

Research Mentor: Melissa Evens, Management

Poster Number: 8345 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

Management & Technology in Community Banking

Author:

Tiffany Zheng

Abstract:

Security Federal manages customer relationships, which have been impacted with the adoption of technology, in various ways. While larger banks generally have a larger demographic and geographic spread of consumers, Security Federal is limited to the local community. With a smaller, more localized audience, the bank is able to incorporate the element of versatility into the options it provides to its customers.

The common theme of pliancy within the service offerings of a community bank extend to other areas of strategic planning, particularly in the marketing sector. Security Federal adapted to the introduction of technology by reevaluating the methods by which its customers receive information in the digital age and adjusting to the local community's specific needs. For certain customers, the traditional method of radio and newspapers are accepted; for others, online advertisements are the preferred method of information exchange. Certain customers prefer the traditional method of going to a brick-and-mortar branch to do their banking, while others are more of "drive-thru" customers that prefer to perform their banking online or remotely, away from the physical banks. The variance in methods due to technology's influence create a paradox of benefits and disadvantages.

While Security Federal has already begun the integration of banking technology over the last few years, it plans to continue to introduce new technologies. Current plans for new technology include the implementation of mobile payment and digital wallet services such as Apple Pay, Samsung Pay, and Google Pay. Security Federal is also working to develop a payment portal, which will benefit business customers by their accepting online payments, on the bank's current website. The portal may also be integrated with late payment notices and include an email notification system. Additionally, the bank plans on introducing a debit access card for home equity lines of credit, online consumer loan applications, and the capability to open new accounts online. Security Federal predicts that while the assimilation of new technological advances will positively influence customer relations and the bank as a whole, the exact measures of the impact of technology will be difficult to forecast. An annual technology and project plan is updated to measure the efficiencies provided by technology, but precise predictions are impacted by variables such as: vendor integrations, costs, and the timing of implementation. The primary metric used by the bank to measure the benefits of technology involve the tracking of all electronic services on a monthly basis to maintain familiarity with customer utilization and costs incurred by the technology introduced.

In the execution of strategic decisions, the upper management of Security Federal predominantly uses software programs that enable the bank to model scenarios that may impact growth strategies. The bank is particularly concerned with models that forecast the impact that changes in interest rates will have on the value of assets and liabilities held on the balance sheet as well as the ultimate impact on the overall capital of the bank. The software is also capable of running assumptions to changes in delinquency rates, specifically when considering growth in a loan type that may be of higher risk to the bank. The deliverables of the software program are fully considered in the strategic development of Security Federal's growth operations.

Research Mentor: Melissa Evens, Management

Poster Number: 9349 :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Applications of Robotics in Construction Education

Author:

Monique Barnes

Abstract:

The implementation of robotics in education has provided many benefits. By having a more hands-on approach like robotics, students gain a better understanding of the material that is learned in class. Because of this, students become more interested in the topics being discussed. Robotics has also started gaining popularity in the construction industry and is continuing to expand. By incorporating robotics in construction, there have been improvements in efficiency, safety, and cost. However, there are some drawbacks with the types of robots. The main issue is that the robots are not "people friendly," the robot is programmed to do its work autonomously as to not endanger the surrounding construction workers. This makes it more difficult for workers to catch any errors that the robot may be creating. A solution to this would be to incorporate collaborative robots that work with humans. Essentially, the robots are used for precision while the workers are there for perception. For instance, if the worker sees an error in the robot's production, they would be able to safely correct the inaccuracy. This symbiotic method of work prevents more errors that would happen if a robot or human were working alone. With collaborative robots, there needs to be an educational balance of construction and robotics. Although robotics in education is extremely helpful to students learning about subjects and robotics in construction is becoming more popular, there is a lack of research on the application of robotics in the process of construction education. The purpose of this study is to bridge the gap between robotics in education and the growing field of robotics in construction. This research will first have a brief review of the application of robotics in education as well as the application of robotics in construction. The research then investigates construction tasks and will indicate the tasks that can be performed using collaborative robots. It will then identify the tasks that can be performed using a light-weight single-arm collaborative robot with the capability to be used in construction education classes. This will then lead to the prototyping of a collaborative robotic arm to be integrated into construction education courses performing certain construction tasks.

Research Mentor: Kereshmeh Afsari, Computer Graphics Technology

Poster Number: 9114 :: Social Sciences/Humanities

Polytechnic Institute

Evaluating Effects of Income on Eating Habits

Author:

Benjamin Carpenter

Abstract:

Eating healthy should be an important goal for the residents of Indiana to have. In this research, data visualization will be used to explore the eating habits of Indiana residents relative to their household incomes to learn why people eat differently at different incomes. Knowing how income rates impact the eating habits of people living in Indiana could provide insight into how resources could be better managed for increasing efficiency and improving life satisfaction in the observed populations. Some locations could suffer from high cost and low income, or a low availability of affordable healthy eating options. To solve this issue, I would like to start with collecting data about costs and earnings across Indiana counties to visualize the differences on a map. Doing so could yield results that allow for more widespread healthy options or eating habit influences. Hidden trends or results could potentially be uncovered to help secure a healthier future for Indiana.

Poster Number: 9209 :: Social Sciences/Humanities

Polytechnic Institute

A Closer Look The Social Influences Behind Unsafe Drinking Habits

Author:

Andrew Deeter

Abstract:

If you have followed the news over the past few years, you have probably noticed there has been an increased amount underage college students that have been killed by consuming an unsafe amount of alcohol. With students coming to college for the first time, they are often looking for the stereotypical college experience – attending parties, meeting people, and for some, living on their own for the first time. Unfortunately, some of these experiences end up in injury or even death for far too many people. I have taken an in depth look at several data sets based around the consumption of underage drinking compiled by The Substance Abuse and Mental Health Services Administration. Using surveys from different US areas, I've developed a comprehensive data set that provides a more accurate representation of the data than any individual survey. Overall, I anticipate seeing a lower trend of truthful responses, due to people not wanting to admit to an illegal activity. I expect to see that despite results, students will still believe that they are consuming a safe amount as well as social pressure being one of the leading causes of binge drinking. If my expectations are true, this data will show more insights about the social surroundings associated with the causes of drinking rather than the amount of drinks itself. As I continue to look into and visualize this comprehensive dataset, I will be able to draw even more conclusions than what I expect to see at this time.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 9019 :: Social Sciences/Humanities

Polytechnic Institute

STEM Children's Reading and Perceptions

Author:

Marlee DeSplinter

Abstract:

The research being completed is investigating elementary school students’ perceptions of different STEM fields. As a teacher I have noticed that many students seem to think that boys are more qualified for the STEM fields than girls. This research will look at these perceptions and investigate if these perceptions are already in place for children at the elementary school level. At the first visit to the school the researchers will give all of the students a pre-test to gauge their knowledge of, and connection to, each of the four different components of STEM (science, technology, engineering, and math). Over the course of the next six weeks, the researchers will be traveling to these classrooms and reading books from the National Science Teachers Association TOP STEM BOOKS list. After going to the different schools and reading to them for six weeks the students will be given a post test. This test will allow the researchers to identify if reading the STEM books to students changed their perception of the STEM fields and who has the ability to work in each one. By reading the books to the students the researchers hope to open the minds of all students allowing them to recognize that anyone can pursue a career in the STEM field. The two main research questions the team is attempting to answer are: What are primary children’s perceptions of STEM fields and careers and What changes, if any, occur in primary children’s perceptions of STEM fields and careers as they are exposed to STEM children’s literature? These two questions will be observed and presented on in further detail.

Research Mentor: Scott Bartholomew, Technology Leadership and Innovation

Poster Number: 9167 :: Innovative Technology/Entrepreneurship/Design`

Polytechnic Institute

Using Data Visualization Tools and Analytics to Understand Drug Interactions and Side Effects While Taking Multiple Prescription Medications

Author:

Jackalyn Dodson

Abstract:

The purpose of this project is to identify patterns and possible links between common symptoms and the medications used to treat various diseases. Using a medical database that contains an index of human disease and medications, an interactive visualization is developed using Cytoscape, an open source software for visualizing interaction networks, to show links between symptoms, ailments, the pharmaceutical drugs used to treat them as well as side effects that can occur when taken in combination with other prescribed drugs. According to the Mayo Clinic, nearly 70 percent of Americans take at least one prescription drug, and 20 percent of Americans take 5 or more prescription medications. The combination of drugs increases the risk for an adverse health effect. Previous efforts, described in the literature, to visually represent medication side effects involve static representation of the data. This project uses networks to show relationships between drug side effects and will show how multiple drugs are linked to the same specific side effect. This research provides valuable information to those who want more insight into patterns between various diseases or symptoms, as well as anyone that will be prescribed more than one prescription drug at a time.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 9116 :: Social Sciences/Humanities

Polytechnic Institute

Recycling Rates and Economic Well-Being in the United States

Author:

Oluwadara Fasipe

Abstract:

Recycling is very pivotal to the preservation of the environment and reducing pollution. The growing accumulation of trash has led to more damaging chemicals being released into the environment and the destruction of natural habitats. Through recycling we are also able to reduce landfill sites because when we recycle, these materials are reprocessed into new products. Often these environmental preservation efforts are said to be a waste of time and government investment by certain groups. I wanted to investigate and see if there was either a positive, negative, or no correlation between recycling rates and economic well-being. To that end, data visualizations were created to show the relationship between recycling rates and economic well-being using Tableau, a data visualization program. I chose to utilize US Median Household income and GDP as my measures of economic well-being. My study has utilized publicly available data from EPA databases, environmental agencies, and databases that report economic data. The expected results are that there will be a positive correlation between recycling rates and economic well-being. What I actually found was that there is a positive correlation between recycling rates and GDP, but no correlation can be drawn from Median Household Income and recycling rates. In light of these results, further work to needs to be done to investigate the exact nature of the relationship between recycling rates and GDP, taking into account any confounding variables. Considering that the data falls between 2006 -2014, one may have to take into account the recession in 2008.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 9119 :: Social Sciences/Humanities

Polytechnic Institute

Geographic and Demographic Analysis of Mental Health Insurance Claims in Indiana

Author(s):

Bin Han

Abstract:

Mental health issues, such as anxiety, depression, and schizophrenia, have displayed pervasive and increasing patterns in the United States, leading to the results of rising emotional and psychological destruction and decreasing levels of social well-being. According to the annual report by U.S. Substance Abuse and Mental Health Services Administration in 2015, 12.2% percent of adolescents had a depressive episode; 4.8% of adults had serious mental illness and 4.1% of adults had thought of committing suicide. With concerns about negative impacts of mental health issues, my research conducts geographic and demographic analysis about mental health insurance claims in Indiana, aiming to provide insights about health care accessibility in the measurement of geospatial distribution. I gathered three medical insurance claims data sets from Indiana Management Performance Hub (MPH) and applied data visualization techniques to investigate them. The claims by provider are visualized to understand the geographical allocation of mental healthcare resources. For the sake of educating the public and enhancing awareness, demographic analyses are provided with respect to age, gender, and race. No conclusion has been drawn yet as the research is in progress. It is expected that the total number of mental health claims is larger in cities where there are condensed population since people are under greater pressure. Rural areas are expected to have fewer or no mental healthcare resources.

Research Mentor: Vetria Byrd, Computer Geographic Technology

Poster Number: 9043 :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Effects of Virtual Prostheses in Head Mounted Virtual Reality

Author:

Anna Hardy

Abstract:

Virtual reality (VR) technology shows great promise not only in entertainment domains but can also be a powerful tool for treatment of PTSD, phobias, and other mental health issues. Unfortunately, many users of VR report nausea, headaches, and dizziness — a phenomenon known as simulation sickness — when using the technology, thus limiting its potential as a therapeutic aid. This study examines the extent to which inserting a digital prosthetic, in this case, a nose, into the first-person view in a VR simulation will reduce the intensity of simulator sickness symptoms. University students of varied ethnicities and genders will be tested to help reduce systematic bias. An experimental group will experience a VR simulation with a digital nose, and a control group will experience the same VR simulation without the digital nose. Upon completion of the simulation, subjects will be administered the Simulator Sickness Questionnaire (SSQ). Responses between the two groups will be collated and statistically analyzed. This study will provide evidence indicating the extent to which placing a digital prosthetic (nose) between the subject's eyes in a VR simulation effects the severity of observed simulation sickness symptoms.

Research Mentor: David Whittinghill, Computer Graphics Technology

Poster Number: 9172 :: Social Sciences/Humanities

Polytechnic Institute

Examining Environmental Factors Influencing Phishing

Author:

Gowri Hassan

Abstract:

A few months ago, a student from Purdue University was lured into a scam that involved a fraud posing as an employer in the university that he was enrolled in. This individual e-mailed the student to his university assigned email address offering a job that looked legitimate considering the individual's 'credentials'. The individual offered to write a check for $700 in return for buying office supplies for his companies. The student only realized this was a scam only once the check was bounced from his account. As we see more and more people fall victim to social engineering attacks I thought it would be interesting to examine Environmental Factors that influence Phishing attacks.

This study will examine whether environmental factors such as geography, middle and high school environment, technology exposure at home, exposure to environments with high security postures at work, affect individuals' ability to recognize phishing attempts. The research questions that will be studied are (1) Do environmental factors affect individuals' knowledge of phishing? (2) Do environmental factors affect individuals' recognition of phishing attempts? (3) Do environmental factors affect individuals' exposure to phishing attempts?

Research Mentor: Ida Ngambeki, Computer and Information Technology

Poster Number: 9049 :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Exploring the Use of Unmanned Aerial Systems (UAS) for Hardwood Tree Inventory

Author:

Evan Hockridge

Abstract:

Family-owned forests are, on average, less than 30 acres in the United States. Despite the small size, family-owned forests lands make up 36% of the nation's total forest area. The proportion of private ownership is greater in the state of Indiana at 85%. Even though about 50% of private forest property owners harvest their trees, only 3% of them have any forest management plan. A lack of stand-specific geospatial data is a major contributor why the small forest owners do not have any management plan, leading to economic and environmental inefficiencies in forestry operations. This study discovered that unmanned aerial systems (UAS) could discern the two most fundamental forestry metrics, diameter at breast height (DBH) and tree height (H), needed for stand-specific timber stocking data. By developing the first methodology for extracting this information from hardwood forests via UAS, informative geospatial data could be collected economically by forestry operations of all sizes. Through drone orthophoto mosaics and digital surface models, measurements for tree height and crown width, a predictor for DBH, were compared to ground field measurements. It was concluded that the drone captured height measurements were as reliable as ground measurements. Also, drone measured crown width was a better predictor of DBH than traditional ground measurements. The finding of this preliminary research suggests that UAS, on account of low costs and greatly reduced survey time, could pivotally change the forest survey methods beneficially to family forest owners in the Midwest Hardwood Region.

Research Mentor: Guofan Shao, Forestry and Natural Resources

Poster Number: 9212 :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Virtual Reality Applications in STEM Education

Author:

Alfredo Karduss

Abstract:

Access to virtual reality (VR) hardware and software applications, simulations, and gaming solutions grows exponentially every day. The potential impact of VR software and hardware, particularly on kids and youth through gaming, compared to the role of formal, traditional educational approaches is significant. This technology presents an unprecedented opportunity for STEM educators, however, a significant challenge remains in sorting through the available products, their applications, and their usefulness in STEM educational settings. This review of literature examines existing studies of immersive learning technologies and their applications, specifically in STEM education, and analyzes potential challenges they present in everyday classroom applications. The study also highlights the importance of empirically exploring the potential of VR to transform education while considering the limitations inherent in such an approach.

Research Mentor: Mesut Akdere, Technology Leadership and Innovation

Poster Number: 9113 :: Social Sciences/Humanities

Polytechnic Institute

Great Lakes Think Alike: Trump and Trumpism in the Midwest

Author:

Ferdinand Macatangay

Abstract:

For many reasons, the election of Donald Trump as President was historic. His victory hinged on the Midwestern "Rust Belt," Great Lakes states that once hosted America's factories before they moved overseas. Just eight years ago, Democrat Barack Obama had won all the Great Lakes states, even reliably-Republican Indiana. With a populist economic message that called for industry to return to America and stricter limitations on immigration, Trump swept the Midwest. Only Illinois and Minnesota voted for Clinton. This project will track how his cultural and economic appeal in the Midwest has changed from election day to the end of his first year in office, and why Midwesterners, some former Democrats, decided to pull the lever for Trump.

Examining Midwest polling data from the past year will answer this. A common media narrative to explain his victory has been economic anxiety of the "white working class," Midwestern voters negatively affected by international trade. This theory posits a shift in voting patterns. My project will examine if this was caused by Trump's personal appeal, his Republican policies, or both. Polling data on President Trump's favorability is compared to his job approval the key Midwestern states of Michigan and Wisconsin. Wisconsin public opinion on the attempted healthcare overhaul is also examined.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 9007 :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

An Experimental Investigation of the Integration of Smart Building Components with Building Information Model (BIM)

Author:

Emily Maneke

Abstract:

Building Information Modeling (BIM) is a methodology that utilizes a set of software tools and processes for facilitating the creation and use of the digital representation of the physical and functional characteristics of a building. BIM models are intelligent data-rich sources of building data that can be used through the lifecycle of a building. In addition, smart technologies can be embedded in building spaces and components with smart objects to enhance the performance of the building. Smart Building Solutions is an intelligent automated system to create a comfortable environment that helps operate buildings efficiently. However, there is a lack of studies on how BIM can represent smart objects within the design and construction of smart buildings. There is a need to develop BIM use cases to indicate how smart components can be modeled within the BIM model.

This research investigates how BIM can contribute to the development of smart buildings and how smart components can be embedded in the BIM model. The objective of this study is to investigate how data properties of smart components can be integrated in BIM models and to develop BIM models of selected buildings as a data set to implement the embedded smart components.

This research was undertaken in three phases in the Smart Building Innovation Lab at Purdue University. (1) Study: the first phase entailed categorization and digital development of the types of smart devices that can be added to the selected building located in Purdue campus. This was achieved by investigating smart technologies as well as capabilities of the selected site. (2) Modeling: in the second phase, virtual mockups of the building were modeled and developed using a BIM application i.e. Revit. Also, smart devices were embedded within the BIM model by adding required data properties. (3) Visualization: in the third phase, digital mockups of the building were developed. The BIM model was exported to a visualization platform to test the data visualization capabilities of the developed model. Also, using 3D printers, a physical model of the site was created.

Several smart components were modeled with attributes and parameters to enable their accurate representation and data capabilities. Future research should evaluate the effectiveness of the smart components created in this project. BIM is currently a static methodology which does not lend itself to depicting smart devices that are constantly evaluating their environment. As such, future research should also turn toward simulation and investigate how to integrate sensors to activate and deactivate the smart device attributes. Additionally, future research should look toward integrating computer science disciplines and if/then rule principles into the BIM frameworks that already exist through Revit and other software.

Research Mentor: Kereshmeh Afsari, Construction Management Technology and Computer Graphics Technology

Poster Number: 9115 :: Social Sciences/Humanities

Polytechnic Institute

Food Deserts and Their Effect on the Rate of Obesity

Author:

Edith Mauro

Abstract:

One of America's most recognizable traits includes being the most obese country in the world. One of the most influencing factors on the rate of obesity is the excessive consumption of unhealthy food. America's obesity rate is a significant issue, and has continued to increase since 1990. If this continues, the average life-expectancy rate will decrease by at least ten years. A method of combating the obesity crisis includes identifying reasons why the crisis is occurring in the first place. The focus of this research is finding a correlation between the rate of obesity and food deserts. Food deserts are communities located outside a one mile radius to suppliers of fresh whole foods. In other words, these communities are only being exposed to processed foods that are usually high in fat, sugar, and carbohydrates. Data on obesity and food desert communities was extracted from the Centers for Disease Control and Prevention (CDC) and the United States Department of Agriculture Economic Research Service (USDA). Using data on Indiana, a state with both a high obesity rate and contains a large percentage of food deserts, visualizations will be created using Tableau software in order to determine a correlation. These findings will hopefully insight Americans to be more aware of the importance of nutritional food, and encourage the food industry to have more healthy food conveniently located.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 9219 :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Pulsed Die Lube Spray

Author:

Tyler McDonald

Abstract:

In industry it is common to utilize continuous spraying of HPDC (High Pressure Die Casting) molds with a die lube suspension and water to both cool the cavities as well as add a protective coat on their surface between each heat. This study approached different methods of improving efficiency of these nozzles by altering the spray timing to reduce cost and improve the amount of thermal stress at the surface of the dies. With past research it has been found that pulsed spraying imitates cooling patterns of continuous spraying. By using pulsed spray, you can significantly reduce the amount of liquid used each cycle. When moderating the amount of fluid, you are also reducing cost per cycle and amount of wasted runoff. During testing of the pulsed spray using specific frequencies and duty cycles, research found that a combination of air pulses can reduce waste up to 50%. The most efficient ranges for this system were around the frequency of about 100 Hz due to the reductions in temperature fluctuations even though surface temperatures are similar to those systems using continuous spraying. The pulsed spraying was found much less efficient at lower frequencies such as 2 and 10 Hz; therefore they are not recommended in large setups. The lower frequencies caused much more thermal cycling at the surface of the die and over time this can have some severe consequences for the quality of parts run off the die. By finding this new model of die cooling, further research has been placed on different lube types to find the most efficient form to ensure quality parts without causing problems with the surface of current dies.

Research Mentor: Qingyou Han, Mechanical Engineering Technology

Poster Number: 9160 :: Social Sciences/Humanities

Polytechnic Institute

Predicting future interaction between predators and decoys in an online conversational environment.

Author:

Kanishka Misra

Abstract:

In an increasingly computer mediated world, it is may be easier to start conversations with people online than it is in the real world, making it easy to build trust. This encourages people with malevolent intentions to take advantage of the trustful youngsters by means of various internet based messaging platforms. This poster presents results from applying classification methods on a corpus extracted from conversations between an online predator and a decoy. The Support Vector Machines algorithm is used to classify a predator as somebody who may or may not physically show up to meet their victim(decoy in this case). The features used in this study are word and character n-grams from the chat sessions. A 10-fold cross validation is used to evaluate the performance of the classifier. The preliminary results indicate that the method can be used as a triage mechanism to help law enforcement.

Research Mentor: Julia Rayz, Computer Information Technology

Poster Number: 9118 :: Social Sciences/Humanities

Polytechnic Institute

Categorical Variances of YouTube Trends

Author:

Hunter Moore

Abstract:

YouTube, a site where a user used to share videos for the sake of sharing videos, has created a platform where content creators can make a living off their videos. Due to this, the Site has evolved. There are channels dedicated to News, Comedy, Gaming, Music, Entertainment, and so much more.

The motivation behind this project is to understand how certain content of varying categories generates views on the site. When we understand the trends on the site, we gain insight into the interests of the general public. This is an important concept that is vital to content creators and advertisers, alike. While one can easily see the views generated by a YouTube Video, it is not immediately apparent how prevalent that type of content is on the site

Making use of publicly available analytics of different YouTube Channels, we can compare views, subscriber count, and estimated revenue on a day-to-day basis.

Expected results favor Music and Sports categories as the top generators on the site. However, the results will vary channel-by-channel – with larger names in one category outshining personalities in other categories.

What we hope to gain from this information is a greater understanding of what people like to see on the internet, and the revenue that generates.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 9117 :: Social Sciences/Humanities

Polytechnic Institute

HIV/AIDS Trends throughout the United States

Author:

Pablo Moore

Abstract:

HIV (human immunodeficiency virus) and AIDS (acquired immunodeficiency syndrome) are viruses that result in the failure of the immune system and often death if left untreated. According to the CDC, there are nearly 40 thousand people in the United States diagnosed with HIV; however, fewer people know exactly how HIV/AIDS has spread over time. This study aims to visually document the spread of HIV/AIDS throughout the United States with the purpose of uncovering possible patterns and predicting where future outbreaks may occur in hopes of preventing them from happening. This study will accomplish this through the analysis of public datasets provided by the Center for Disease Control (CDC), the US Census, and the Health Resources & Services Administration (HRSA). These datasets will be analyzed using data visualization software to more easily display significant trends. It is anticipated that the areas with the highest concentration of HIV/AIDS will be areas with a high population, and high density of young adults, as they are the most rapidly spreading carriers of the virus, though this is subject to change according to the data. Regardless of where there is a high concentration, action must be taken to stop this. More resources should be allocated to these areas to better educate the public of the dangers of HIV/AIDS and the ways it can be spread. By ending the stigma and spreading knowledge, we can prevent future generations from suffering from HIV/AIDS.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 9035 :: Physical Sciences

Polytechnic Institute

Guitar String Testing

Author:

Caleb Morin

Abstract:

The fret locations on a guitar neck are calculated using an idealized equation and the locations of the saddles are selected to minimize average error between the actual frequencies produced by the strings and the ideal ones. Calculations show that some small changes in the nut location and the locations of the first two frets can further reduce frequency errors. While this scheme works subjectively, it is difficult to measure the resulting differences in the frequencies produced by the guitar.

Efforts to measure note frequencies on an electric guitar showed variations in frequencies that were not predicted by the mathematical descriptions used to design the instrument. The dynamics of the neck seem to have enough of an effect on the system stiffness to obscure the effect of subtle design changes on the note frequency. Performing the tests on a heavy wood fixture didn’t solve the problem.

To match ideal conditions as closely as possible, several guitar strings were tested on a heavy steel fixture using a laser Doppler vibrometer. Each end of the string was supported by sharp edges and clamped in place by steel blocks. The results showed that for these end conditions, the string not only vibrated at the frequencies expected from theoretical models for real strings, but also at frequencies much closer to those predicted by the idealized string equation. This deviation was observed primarily at frequencies above the 11th harmonic. This is thought to have occurred because the sharp edges allowed the string to vibrate differently in the horizontal and vertical planes. Understanding how these theoretical models reflect in the real world can improve the position of guitar frets, and therefore the sound of guitars.

Research Mentor: Mark French, Mechanical Engineering Technology

Poster Number: 9110 :: Social Sciences/Humanities

Polytechnic Institute

Microbrewery vs “Big Beer” impact on Alcoholism in a region by Earnings and Population

Author:

Rylie Nichol

Abstract:

In 2016, small craft brewers sold 130.4 million barrels of beer. In contrast, that same year had “Big Beer”, a group of the largest mass production breweries in the United States, sell 1.4 billion barrels of beer. These organizations make a profit on the selling of their product to the consumer, however, despite governmental regulations and warnings those affected by alcoholism find it easy to procure due to two factors availability and price. In these categories, “Big Beer” out paces microbreweries by a large margin. Federal law requires that craft breweries sell no more than 6 million barrels of beer per year, while during the same time period “Big Beer” can sell up to 125 million barrels of beer per year. The aim of this study is to determine if a higher priced, lower production business has an effect on the percentage of individuals suffering in an area where both types of brewer interacts. As alcohol consumption is more prevalent in high income areas, a higher income leads to more ability to spend which leads to more ability to abuse. It is the goal of this study to analyze the effects of the interactions in two high brewery density areas, Northwest Indiana and the Tampa Bay region.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 9145 :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Purdue Airport Hangar Renovation: Easing the Transition from Instruction to Industry

Authors:

Jose Nieves

Nathaniel Hill

Christian Venzlauskas

Joshua Campbell

Abstract:

The renovation team, comprised of the members above, selected a hangar renovation project that would establish a work environment for students of the Aeronautical Engineering Technology (AET) program that more closely resembles a world-class, professional maintenance facility. The issue faced was that students in the program were currently being exposed to an environment that did not reflect such standards. Contributing factors included insufficient work space, redundant equipment, unspecified walkways, and poor brightness/visualization; these factors all diminished the safety factor of the lab in one or more different ways. To begin the improvement process, the renovation team and their sponsor decided that a redesigned floor plan, renovated floor coating, and new brighter lights would all be design solutions for the aforementioned problem. Utilizing lean manufacturing concepts, the renovation team performed a 5S audit of equipment on the first floor area of the power plant hangar. The audit was conducted to determine what unnecessary equipment should be removed or repurposed to design a new, more efficient floor plan. Additionally, surveys were conducted on current AET students for opinions on hangar space layout; this data would be used for comparison after the final layout has been implemented. Lastly, several vendors were contacted to develop quotes for renovation work. The contract was then bid out and one vendor for each system was selected. At the time of the due date, the renovation team delivered a lighting and flooring work order, a proposed floor plan layout, and list of red tagged items for removal or relocation. Once implemented, the work orders and floor plan restored the power plant hangar to a state that is safer and more visually accommodating. Going forward, the renovation team suggests conducting a routine 5S audit of the hangar during the summer session every other year.

Research Mentors: Sergey Dubikovsky, Aviation and Transportation Technology, J. Michael Davis, Aviation and Transportation Technology

Poster Number: 9120 :: Social Sciences/Humanities

Polytechnic Institute

Military Triple Threat: United States vs. Russia vs. China - By the Numbers

Author:

Epifanio Sadural

Abstract:

There are three countries of the world that simply, never fail at making newspaper headlines. They are, the United States, Russia and China – the “military triad”, and most of the times, the news is not positive. These newspaper headlines tend to draw emotionally-charged reactions, ranging from fear, anger, pride, arrogance and annoyance. There have been countless numbers of movies and video games dedicated towards the issue, as to how a hot conflict between the three would look. So of these three, who comes out on top as the number one military power, and how much of a threat are these titans when pitted against one another or global stability? In this comparison of the world's top three military giants, I intend to expose the reality of the situation by comparing each country's military by the numbers.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 9171 :: Social Sciences/Humanities

Polytechnic Institute

Psychological Wellbeing and Job-Related Stress of Audio, Video, and Image Forensic Analysts/Technicians

Author:

Kyle Schnetzler

Abstract:

Almost every criminal investigation involves more than one form of digital evidence, such as smartphones, laptops, global positioning systems, and internet artifacts. In some cases, digital forensic examiners are needed to enhance audio, video, or image evidence to identify the actors or clarify the context of the situation, which may involve heinous acts (e.g., homicide, child sex abuse, torture). To date, no research has examined the psychological wellbeing, job-related stress, or availability of mental health services for audio, video, and/or image forensic analysts/technicians. In addition, it is unknown as to whether these examiners are required to attend mandatory psychological evaluations or whether mental health services are provided, but not required. Finally, this study aims to understand the coping mechanisms and job-related stressors for audio/video/image forensic analysts/technicians. An anonymous internet-based survey was hosted on Qualtrics and sent to members of the audio/video/image forensics community through various organizations, such as the Scientific Working Group on Digital Evidence (SWGDE). Respondents, who completed the survey, were redirected to a separate webpage in order to provide an email to which a $10 amazon.com e-gift card was sent as a “thank you.” Overall, the main objective is to provide recommendations on mental health services and to address or support individuals working as audio/video/image forensic analysts/technicians. Preliminary results will be discussed as well as suggestions for future research.

Research Mentor: Kathryn Seigfried-Spellar, Computer and Information Technology

Poster Number: 9070 :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Compressible Flow Through Lithium Battery Caps

Author:

Zachary Schreiber

Abstract:

Lithium ion batteries have grown in popularity in recent years due to their high energy density, however they pose a safety risk. When failure occurs, these batteries can heat up suddenly resulting in generation of toxic and flammable gases. In some cases, high pressure in the cells will cause a pressure relief valve in the battery cap to open, releasing these gases to the surrounding space. The objective of this project is to analyze the venting process to get a basic understanding of the fluid mechanics taking place. This will include measuring the pressure at which the vents open, the mass flow rate of the fluid exiting the vent, and the repeatability and consistency of venting. A pressure vessel has been designed and fabricated to study the compressible flow through battery relief valve. Using the experimental results, we will create models to predict flow rates of vented gases in different battery systems.

Research Mentor: Jason Ostanek, Engineering Technology

Poster Number: 9134 :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Industry Inspired Learning

Authors:

Will Seltenright

Daryk Brekke

James Simon

Weihang Zhong

Abstract:

The F-109 turbofan engine laboratory assignment is the cornerstone of the Gas Turbine Technology II course in Purdue’s Aviation Technology Department. On average the assignment takes 4 weeks, or 60-man hours to complete, making it the longest in the class. During the initial project analysis, the team completed the original F-109 assignment and discovered shortcomings and opportunities to create a better learning experience.

After the problem statement was developed, the group used Lean Six Sigma DMAIC methods to propose a solution. Tools utilized included an affinity diagram to establish needs, a House of Quality to measure solutions and their applicability, and a FMECA to evaluate possible failure modes and their impact. The group determined the main measure of success for the project is to improve individual student understanding of gas turbine maintenance and overhaul procedures.

The group created a baseline process map showing how the original lab assignment was conducted which showed very little opportunity for students to problem solve or make critical thinking decisions. An improved process map was then developed which introduced choices that students must make in order to complete the assignment. This forces the student to become more engaged, utilize more reference materials, and improve their learning as a result.

The deliverables for this project will include both hardcopy, and electronic versions of updated and standardized maintenance job cards, electronic maintenance manuals, and pre lab assignments that will allow students to reflect on the work they completed. Although the project covers only a small portion of the AET curriculum, it can be thought of as a system to improving other Purdue gas turbine laboratory assignments. The processes, improvement tools, and all collected data used to complete this project will be documented and submitted to Dr. Davis, the faculty advisor.

Research Mentors: Sergey Dubikovsky, Aviation and Transportation Technology, J. Michael Davis, Aviation and Transportation Technology

Poster Number: 9036 :: Innovative Technology/Entrepreneurship/Design

Polytechnic Institute

Improving Education: Radial Engine Implementation and Operation

Authors:

Megan Shaffer

Juliana Baluh

Nicholas Steffen

Joseph Sawicki

Abstract:

Students in the School of Aviation and Transportation Technology enrolled in the plan of study for Aeronautical Engineering Technology (AET) Bachelor's Degree program at Purdue University require additional resources, exposure, and lab equipment related to radial engine functionality, maintenance, and operations. During the initial project assessment, many factors were considered for an updated teaching aid- an operational radial engine test stand was selected using a Lean Six Sigma decision matrix.

The group utilized Lean Six Sigma DMAIC methodologies to define, measure, analyze, implement, and control the key aspects of the project. Tools such as: House of Quality, FMEA, process maps, SIPOC, and more were used to analyse the project. The main measurable for success was determined to be improving student understanding and knowledge of radial engine maintenance and operation thus producing better educated graduates for industry. A baseline of 32% knowledge retention was assessed in Phase I testing through a survey of 7 FAA Power plant questions relating to radial engines; after implementing the radial test stand, the goal target improvement was set to 70% retention resulting in more than double the current knowledge level. These Lean Six Sigma tools along with a statistical analysis of an independent T-test will confirm the benefits of this project to the AET program, Purdue, faculty members, prospective students, Fuels Research lab, and the Aviation industry.

The School of Aviation and Transportation Technology is the overall governing body for this project as well as our sponsors - Dr. Davis and Dr. Dubikovsky. Key deliverables include the operational Rotec radial engine stand, startup checklist, statistical analysis of success, and a final project report.

Research Mentors: Sergey Dubikovsky, Aviation and Transportation Technology, J. Michael Davis, Aviation and Transportation Technology

Poster Number: 9060 :: Social Sciences/Humanities

Polytechnic Institute

Revising Maintenance Publications for an Instructional Setting

Authors:

Adrianne Swanson

Maxwell Webber

Joseph Masset

Abstract:

Student aircraft technicians struggle with transitioning information from technical documents to procedural application. Current aircraft maintenance manuals are written for use by technicians who have prior knowledge of aircraft and their procedures. As a result, students attempting to utilize current manuals as instructional tools are unable to navigate the technical terminology and advanced content. At Purdue University, students are presented various types of aircraft documentation, including maintenance and operational manuals, at intervals within the Aviation Technology Department. The Aeronautical Engineering Technology (AET) program exemplifies this with the practical use of aircraft maintenance manuals beginning in the Fixed and Rotary Wing Assembly course (AT 267). This course is not only essential to the curriculum, but also fosters technical skills that are required for A&P certification. The focus of AT 267 is to develop skills that are essential to expanding into advanced procedure applications as the AET program progresses. Students in this course demonstrate difficulty in the transition from manual language to performance, and the resulting lack of procedural instruction leads to an ineffective learning and unsafe working environment.

Using the current manuals, pre and post survey results, and observable measurement criteria, a new procedure is to be written for the removal and re-installation of the rudder and vertical stabilizer on the Cessna 150J aircraft in Hangar 1 at Purdue University's airport. Along with the procedure, a new parts kit is to be created and provided. Pre and post surveys have been created to assess inexperienced students technical experience, understanding of procedures based upon current manual specifications, and identify areas of lacking or incomplete information within the manual, lending to difficulties in process application. Lean Six Sigma techniques as well as observations (such as questions asked and time taken on each procedure step) and survey results will be used to create a new procedure and measure its success. Through these testing means we hope to achieve a 50% decrease in opportunities for failure during use of our new procedure.

As a result of the creation of an improved procedure for removal and re-installation of the the rudder and vertical stabilizer, students will gain not only success in this process, but a growth in technical prowess and the resulting increased level of confidence in their abilities. Benefits to the University include increased class reputation, class sizes, and instructor satisfaction.

Research Mentors: Sergey Dubikovsky, Aviation and Transportation Technology, J. Mark Thom, Aviation and Transportation Technology

Poster Number: 9048 :: Social Sciences/Humanities

Polytechnic Institute

Identifying Contributing Factors to the Opioid Abuse in Indiana Using Visual Analytics

Author:

Ian Williams

Abstract:

Opioids are drugs prescribed to dull pain, however within the past years more people have become addicted in Indiana causing an epidemic. This research project will address the following questions: What are the contributing factors to opioid abuse in the state of Indiana? What unknown patterns exist in the data that could recommend solutions to the epidemic? What is the most effective way to visually represent these findings in a way that informs but does not overwhelm?

A data set on the opioid crisis was provided by the Indy Big Data Challenge available to the public which will be used in this research as the primary data set while also pulling specific data from the Indiana State Department of Health. The data sets will be used to find insights by utilizing the seven stages of data visualization: acquire, parse, filter, mine, represent, refine, and interact.

The contributing factors to the opioid abuse in the state of Indiana are socio economic status, mental illness, high untreated pain levels, individuals under high stress, and other contributing addictions. Visual analysis of the data revealed some unknown patterns that exist in the data. Our results indicate the most common race with opioid overdoses tend to be Caucasian while the gender most affected by opioid overdoses are males. These and other findings are visually represented using Data Driven Documents (D3) which allows for interactive visualizations.

Research Mentor: Vetria Byrd, Computer Graphics Technology

Poster Number: 9112 :: Social Sciences/Humanities

Polytechnic Institute

Analysis and Visualization of Environmental Causes on Automobile Accidents in Dense Traffic Float Areas

Author:

Qiuhan Zhang

Abstract:

Driving has become one of the most efficient ways of commute in past decades. Yet, there are over 3,200 fatalities caused by car accidents each day. Our society tends to blame the factors of these casualties on individuals - speeding, not paying attention to the road, and drowsy driving. However, possible exterior causes of car accidents were often overlooked. Horrible road conditions, confusing road signs, baffling weather and occasionally, pedestrians crossing the street in the driver’s right of way can all be crucial exterior factors of a car accident. In this study, I am going to examine major exterior environmental causes of car accidents, such as road surface conditions and light source, in dense traffic float cities inside the United States. I reviewed different academic studies on factors of car accidents in the related area and compared it with my results from visualized data analysis to achieve a more transparent insight of these accidents.

The results I got are relatively different from my hypothesis. We can make a safe assumption that lighting conditions and road surface does affect the driver's decision making and performance, but the weather does not have a significant impact. Although the cause of single vehicle and same direction rare ending accidents are not consistent, we can hypothesize that although environmental conditions to make a slight impact, drivers have to cause all time to avoid future fatalities at best.

Research Mentor: Vetria Byrd, Computer Graphics Technology

THEMATIC CATEGORIES' TOP ABSTRACT

Life Sciences

Effects of Biostimulant on Productivity and Quality of Lettuce and Tomato

by Goatian Zhu (Oral Presentation at 10:05am in STEW 214-A)

Social Sciences/Humanities

Adaptive Behavior Skills Deficits in Early Development of Children with Neurogenetic Disorders

by Madison Brewer, Amber Swint, and Ziyuan Zhang (Poster #4623)

Physical Sciences

The Response of Schwann Cells to Weak DC Electric Fields

by Alexander Lai (Poster #3299)

Mathematics/Computational Sciences

Variational Methods Applied to Crossed Field Devices

by Adam Darr (Poster #3108)

Innovative Technology/Entrepreneurship/Design

Using Data Visualization Tools and Analytics to Understand Drug Interactions and Side Effects While Taking Multiple Prescription Medications

by Jackalyn Dodson (Poster #9167)

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