2021

PURDUE UNDERGRADUATE RESEARCH CONFERENCE

APRIL 12-19, 2021

West Lafayette, Indiana

THEMATIC CATEGORIES' TOP ABSTRACTS

Life Sciences

"I was working out daily prior to COVID": Impact of the COVID-19 Pandemic on the Physical Health of Purdue Graduate Students by Lauren Heniff (Talk #52)

Social Sciences/Humanities/Education

Abandoned Sentinels: An Analysis of the Past, Present, and Future of Former Armed Forces Institutions by Jacob Slater (Poster #272)

Physical Sciences

Examining the Geologic History of Mercury's Caloris Basin using Mapped Faulting Patterns within Superposed Volcanic Flows by Evan King and Aubrey Bennett (Talk #89)

Mathematics/Computational Sciences

Food Classification by Robert Sego, Cole Stecyk, Aryan Tyagi, Prekshaa Veeraragavan, Alexander Vives, Tiffany Yu, and Alex Dufour (Poster #96)

Innovative Technology/Entrepreneurship/Design

Development and Optimization of a Thermal Transfer System for Simulating Lunar Temperatures and Possible Scenarios by Nathan Stonitsch (Talk #39)

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SPECIAL APPRECIATION TO THE CONFERENCE PLANNING COMMITTEE'S UNIT DELEGATES FOR ORGANIZING THIS EVENT

ORAL PRESENTATIONS

Presentations arranged by the academic unit judging the presentation and by the first author's last name.

Oral Presentation Abstract Number: 1 :: Life Sciences

College of Agriculture

Epigenetic Factors Involved in Photoreceptor Survival

Author(s):

Kimaya Bakhle, College of Agriculture

Abstract:

By studying how factors involved in gene expression regulate neuron survival, we can better understand the underlying causes of neurodegenerative diseases, such as age-related eye diseases. In the Weake lab, we are interested in understanding how gene expression regulates survival during aging in photoreceptor neurons. Drosophila melanogaster shares about 60% of their genetic material with humans, making it an ideal model for studying the epigenetic mechanisms of these diseases. In this project, the crosstalk between chromatin and transcription changes during aging, as well as their role in photoreceptor survival is investigated. A preliminary RNA interference (RNAi) screen was carried out to identify regulators of histone methylation necessary for photoreceptor survival throughout aging. Optic neutralization was used to visually assess retinal degeneration in flies aged D10 to D40. From the results, it will be determined whether loss of these genes cause retinal degeneration. To account for phenotypes that could arise from expression of the RNAi machinery necessary for tissue-specific expression of the transgenes Dcr-2 and Gal4, an RNAi line was used that targets the mCherry, a gene not present in the fly genome. A fly line overexpressing LacZ will serve as a negative control for fly lines overexpressing a mutant form of the transcription factor Clock.

Mentor(s):

Vikki Weake, College of Agriculture, Biochemistry

Juan Jauregui, Purdue University

Oral Presentation Abstract Number: 2 :: Life Sciences

College of Agriculture

Behavioral traits associated with thermoregulatory responses and reproductive success in maternal-line gilts

Author(s):

Kristen Cleaver, College of Agriculture

Abstract:

Heat stress (HS) negatively impacts reproductive efficiency in pigs and identifying traits that predict HS sensitivity and future reproductive success under HS conditions may improve productivity. This study evaluated whether behavior and thermoregulatory responses to HS could identify pigs that would have reduced reproductive success under HS conditions. Ninety-six replacement gilts (108.8± 10.4 kg BW; 8 repetitions; 9d/repetition) were tested. Pigs were housed (2/pen) in thermoneutral (TN; 22.6± 1.6ºC) conditions and behavior was recorded for 5 d. On d 6, gilts were subjected to open field and novel object tests as indicators of coping style. After behavior testing, all gilts were weighed, vaginally implanted with monitors to measure body temperature (TB), and individually housed in an environmental room. From d 7 to 9, all gilts were exposed to cyclic HS (28.2 ± 0.97°C nighttime to 36.9 ± 1.9°C daytime; 46 ± 15.4% relative humidity). Ad libitum feed intake was recorded daily. During the HS challenge, respiration rate (RR) was recorded every 2 h from 0800 to 2000 h. Gilts were then transported to the Purdue University swine farm and bred under summer HS conditions (253±29 d of age) to evaluate litter characteristics. A linear increase in RR ($P<0.05$; $R=0.20$) and hours to max TB ($P=0.02$; $R=0.25$) versus time to approach the novel object was observed. Piglets weaned decreased quadratically ($P<0.01$; $R=0.45$) as vocalizations during the open field test increased. In conclusion, pigs that responded better to HS took longer to contact a novel object and displayed more desirable litter characteristics.

Mentor(s):

Jay Johnson, College of Agriculture, Animal Sciences

Luiz Brito, Department of Animal Sciences, Purdue University

Brooklyn Bitting, Department of Animal Sciences, Purdue University

Jeremy Marchant-Forde, USDA-ARS Livestock Behavior Research Unit

Oral Presentation Abstract Number: 3

Withdrawn.

Oral Presentation Abstract Number: 4 :: Life Sciences

College of Agriculture

R-loops and DNA damage in Aging Photoreceptor Neurons

Author(s):

Alyssa Easton, College of Engineering, Honors College

Abstract:

Abstract redacted.

Mentor(s):

Hana Hall, College of Agriculture, Biochemistry

Oral Presentation Abstract Number: 5 :: Life Sciences

College of Agriculture

Effect of Rising CO2 Emissions on Tomato Immunity Relationship with Endophyte

Presentation can be found under Poster Abstract # 277.

Oral Presentation Abstract Number: 6 :: Life Sciences

College of Agriculture

Investigation into The Structural and Functional Effects on Phage Proteins based on Cross-Genome Differences/Mutations

Author(s):

William Hadjis, College of Agriculture

Autumn Denny, College of Engineering

Julia Mollenhauer, College of Engineering

Abstract:

Phages, viruses that infect bacteria, act as naturally occurring models in genomics and protein studies due to their small genomes and overall simplicity. Understanding phage genetics is a promising pursuit that opens new opportunities and applications in medicine, food processes, and agriculture. Phages have genomes that are dense in encoding genes, so they provide ample data for studying the relationship between genetic material and protein synthesis. The association between the structures and functions of proteins is observed across all living things; even small changes to a can significantly alter the shape of the encoded protein. Our investigation aimed to examine the relationship between genetic mutations and their resulting polypeptides in phages. To do this, we implemented computational methods to locate cross-genome differences in comparison to a phage, Giraffe, before modeling and compared their respective amino acid outputs using the PyMol molecular modelling program. The amino acids that result from any mutations are compared to determine changes in polarity; polarity of the different amino acids have notable effect on the folding of a protein. We predicted that mutations affecting the first two base pairs in a codon will more often result in nonsynonymous amino acid substitutions and significantly impact the structure of a protein.

Mentor(s):

Lauren Novak, College of Agriculture, Agricultural and Biological Engineering

Kari Clase, College of Agriculture, Agricultural and Biological Engineering

Oral Presentation Abstract Number: 7 :: Social Sciences/Humanities/Education

College of Agriculture

Connecting Communities with the Shoreline

Author(s):

Megan Hedges, College of Agriculture

Abstract:

This research project seeks to determine the most ecologically sustainable and culturally beneficial location for a new cycleway from Chesterton to Porter Beach at the Indiana Dunes National Park. This trail is located along the shoreline of Lake Michigan, a dune landscape which represents the most ecologically diverse area in the state. The study area includes coastal dunes and remnants of the Great Marsh. Three major highways bisect this landscape and currently separate locals from accessing the beach. This new trail allows residents to safely cross highways and travel to the shoreline without using the currently over-trafficked road. Through working with the Indiana Dunes National Park, Indiana Dunes State Park, and members of the communities of Porter and Chesterton this project will develop into a community and environmentally focused pedestrian cycleway that merges with existing plans for this region. Methods include the use of GIS data to take inventory of wetlands, slope, and hydrology to determine the best location for a cycleway that avoids disturbance of sensitive habitats. A community analysis of population, neighborhoods, and economic centers was included to determine where community members would benefit most from new trail connections near their homes. The result is a new trail plan for the towns of Porter and Chesterton, which bisects existing highways safely, and connects to neighborhoods and town centers. After crossing highways, locals experience the dune landscape through boardwalks that bring them to scenic spots and educational opportunities as they approach the beach.

Mentor(s):

Aaron Thompson, College of Agriculture, Horticulture & Landscape Architecture

Oral Presentation Abstract Number: 8 :: Life Sciences

College of Agriculture

Changes in sow milk lipidome across lactation occur in fatty acyl residues of triglycerides and phosphatidylglycerol, but not in plasma membrane phospholipids

Author(s):

Sarah Luecke, College of Agriculture

Lea Logan, College of Agriculture

Abstract:

Sow milk fat content is crucial to neonatal survival, as it is utilized for thermogenesis and nutrition. However, fat is the most variable component of milk in concentration and lipid species. Characterizing lipid changes across the course of a sow's lactation may help identify molecules or systems to target to help enhance milk fat quality and quantity for neonatal survival and growth. Percent fat variation is greatest in colostrum, the first milk. Little is known regarding colostrum synthesis, other than it accumulates in the gland beginning in mid-late pregnancy, which is prior to the initiation of fatty acid synthesis in lactocytes. The objective of this study was to characterize changes in lipid composition of milk across the course of lactation and determine if there was a relationship between fat percent and lipid species in colostrum and mature milk. Milk was collected from 9 multiparous sows on days 0, 3, 7, and 14 relative to birth. Percent fat was determined by creamatocrit, and found to be different ($p<0.05$) between day 0 ($12.36 \pm 5.90\%$) and day 3 ($16.22 \pm 3.65\%$) but not between day 7 ($13.13 \pm 2.19\%$) and 14 ($12.13 \pm 2.45\%$). Fat was extracted from milk using the Bligh-Dyer method and profiled using multiple reaction monitoring. Amounts of lipid species were calculated relative to standards and data analysis was performed using Metaboanalyst 4.0. Principle component analysis revealed lactation day had a significant effect on distribution of fats. Triacylglycerides (TAG), phosphatidylglycerol (PG), and plasma membrane lipids were modified from colostrum to mature milk, with a significant increase in PGs and TAGs across the course of lactation. Correlation analysis of percent fat with lipid concentration indicated strong relationships ($p<0.05$; $|r| >0.80$) with eight lipids. No differences are found in the abundance of plasma membrane phospholipids, sphingomyelin, or cholesterol esters across lactation days.

Mentor(s):

Theresa Casey, College of Agriculture, Animal Sciences

Aridany Suarez-Trujillo, Purdue University

Oral Presentation Abstract Number: 9 :: Life Sciences

College of Agriculture

Metabolite-gene relationship discoveries offer many insights of pathways associated with amino acid-derived secondary metabolism.

Author(s):

Caroline Marks, College of Agriculture

Abby Sipes, College of Agriculture

Caden Tuinstra, College of Agriculture

Grace Charpentier, College of Agriculture

Abstract:

There are many intermediates within amino acid pathways. These metabolite intermediates are clear to see, but what is not clear is how these metabolites react in production when fed a labeled amino acid. There are many metabolites than can be observed in just one pathway. In order to see exactly what takes place in relevance to each amino acid, one-by-one we will feed a labeled amino acid. This will lead us to information about the amino-acid derived metabolites' biosynthesis. Although, we not only want to identify the production of metabolites, but the relationship that the metabolites and genes have together. The purpose of this experiment is to identify metabolite-gene relationships in metabolites derived from amino acids. In discovering these relationships, we will open a new realm of information when thinking about how amino acids affect production of certain amino acid-derived metabolites. We will be able to take this information and learn more about how these pathways function as we connect them to specific genes. In order to identify these metabolite-gene relationships, we will combine liquid chromatography, mass spectrometry, isotope-labeling, and a computational pipeline to identify amino acid-derived metabolites (Wang et al., 2018). The connection of these metabolites to a gene is found using GWAS. Major findings will offer insights into the metabolites and genes related to amino-acid derived metabolites.

Mentor(s):

Clint Chapple, College of Agriculture, Biochemistry

Jeffrey Simpson, Purdue University

Oral Presentation Abstract Number: 10 :: Life Sciences

College of Agriculture

Low-cost user-friendly biosensors for bovine respiratory disease based on loop-mediated isothermal amplification (LAMP)

Author(s):

Ana Pascual-Garrigos, College of Agriculture, Honors College

Abstract:

Bovine Respiratory Disease (BRD) is estimated to cost $1 billion in the North American animal agriculture industry every year. This is due to medication, loss in weight and deaths among other factors. Usually, the diagnosis of this infection involves a physical examination of cattle. However, this is not enough to determine the causative pathogen given that infection by several bacteria or viruses can result in symptoms. Nucleic acid-based diagnostics, like polymerase chain reaction (PCR), identify BRD pathogens by amplifying species-specific genes present in samples. However, PCR-based approaches require lab equipment and extensive sample processing making the process lengthy and expensive. The absence of cheap and rapid diagnostics for BRD leads to a treatment that is based on trial-by-error antibiotic usage. As a result, our work develops a loop-mediated isothermal amplification (LAMP) assay that detects the presence of bacterial pathogens (*Pasteurella multocida, Mannheimia haemolytica*, and *Histophilus somni*) for bovine respiratory disease in crude nasal samples. LAMP offers an accurate, inhibitor-resistant approach to detecting BRD pathogens in a point-of-care format. We anticipate these results to be the starting point for the development of a cheap, fast, and portable device capable of identifying any causative agent for BRD and recommending the most appropriate treatment.

Mentor(s):

Mohit Verma, College of Agriculture, Agricultural & Biological Engineering

Oral Presentation Abstract Number: 11 :: Life Sciences

College of Agriculture

Viral Deubiquitinases could be Key for PBCV-1s Antiviral Suppression in its Host

Author(s):

Mauri Isabella Prislusky, College of Agriculture, Honors College

Abstract:

The Paramecium Bursaria Chlorella Virus (PBCV-1) is a plaque forming dsDNA virus that attacks green algae, *Chlorella variabilis*. It is currently unknown how PBCV-1 is evading cellular immune defense and is able to survive in *C. variabilis*. One hypothesis suggests that these viruses have evolved to make their own deubiquitinases (DUBs) in order to hijack the host's ubiquitin system and suppress the algal immune response. PBCV-1 has been found to contain two enzymes, A105L and M137L, that might be acting as deubiquitinases and invading the host's ubiquitin system. A105L and M137L have been shown to have sequence similarities to cysteine protease, specifically USP DUBs such as USP8. This study goes further into comparing A105L and M137L sequences to known DUBs in hope to gain insight on how they might function. A possible catalytic triad for both A105L and M137L has been deduced from our bioinformatic structural comparisons. Furthermore, A105L was chosen as the test enzyme to conduct biochemical assays wherein the residues comprising the potential catalytic triad were mutated in order to confirm our prediction. The activity of wild type A105L and the selected catalytic mutants will be analyzed via well-established assays for deubiquitinases like the ubiquitin-propargylamide assay and di-ubiquitin cleavage assays. These biochemical experiments along with our bioinformatic analyses will help shed light on how these viral enzymes might be acting as deubiquitinases and interacting with the host ubiquitin system.

Mentor(s):

Shalini Iyer, College of Science, Chemistry

Chittaranjan Das, Purdue University

Oral Presentation Abstract Number: 12 :: Life Sciences

College of Agriculture

Deciphering the Role of a Putative Amino Acid Transporter in Arabidopsis thaliana

Author(s):

Wenyi Ran, College of Agriculture

Abstract:

Nitrogen is an essential macronutrient in plants, and it is an important building block for molecules like amino acids and chlorophyll. However, the factors affecting how plants assimilate nitrogen are not fully understood. Previously, we identified a gene, AVT, that might code for a transmembrane protein with homology to known amino acid transporters in plants. Moreover, this gene shows altered isoform-specific expression in response to changing nitrogen levels. Therefore, we hypothesize that AVT might be involved in nitrogen response in Arabidopsis thaliana. To test our hypothesis, we compared the physiological responses of T-DNA insertion mutants in the AVT gene and wild type plants in response to different levels of nitrogen. We found the two mutant lines had significantly different physiological responses, measured as chlorophyll content and root architecture, than wild type to different levels of nitrogen. Therefore, we concluded that this AVT gene is indeed involved in nitrogen response in Arabidopsis thaliana. We are currently using transient expression assays to determine the subcellular localization of AVT.

Mentor(s):

Ying Li, College of Agriculture, Horticulture and Landscape Architecture

Rachel McCoy, Purdue University

Russell Julian, Base5 Genomics

Oral Presentation Abstract Number: 13 :: Innovative Technology/Entrepreneurship/Design

College of Agriculture

Gary Gateways

Author(s):

Miles Romans,

Abstract:

My senior capstone project is designed to alleviate the socio-economic disparities throughout the post-industrial city of Gary by enhancing its natural systems and distribution of resources. The city's current framework is divided by a conglomeration of major transportation routes which splits a deprived downtown from its industrialized shoreline. This separation has disassembled social, economic, and environmental characteristics within the landscape for several decades. Several of the following collaborators have taken part in this project: The Indiana Dunes National Park desires greater regional connectivity and expansion, the City of Gary desires solutions to revive their economy, and residents desire a safer unified infrastructure which promotes opportunity. Areas of Gary which reside as environmental and socio-economic discrepancies were identified by collecting data through many means including G.I.S., the 2019 Gary Comprehensive Plan, precedent studies, and collaboration with residents, tourists, conservationist, activist, municipal workers and more. This data expresses the cities lack of accessibility to well-paying jobs, fresh food, and education, and shows abandoned and misused land, historical sites and connections. After compiling this data, I realized that Gary's largest stain is its deconstructed community identity and poor resource allocation. This project seeks to reallocate mistreated land to restore the unique natural ecosystem, influence better mixed-use industrial development, and grant Gary's residents more access to Lake Michigan and other significant features. The focus of the projects is to work with many collaborators to search for a well-designed framework plan for a redeveloped shoreline that recreates a thriving "steel-strong" Gary.

Mentor(s):

Aaron Thompson, College of Agriculture, Horticulture & Landscape Architecture

Oral Presentation Abstract Number: 14 :: Life Sciences

College of Agriculture

Developing Student Empathy in an Introductory Animal Sciences Course

Author(s):

Ashley Rosenkrans, College of Agriculture

Abstract:

In the agriculture industry, employers are seeking graduates with diverse backgrounds, experiences, and perspectives. Thus, graduates require the skills to work effectively in a diverse workplace. Many agricultural undergraduate programs have emphasized technical development over interpersonal skills. Recognizing this, it is important to give students the opportunity to develop the interpersonal skills that will be necessary to be successful in a diverse workplace. Developing student intercultural skills, such as empathy, is one way to prepare students for this. Therefore, the primary objective of this study is to measure empathy development in students completing intercultural learning activities in an introductory animal science course. Throughout the semester, students received five intercultural assignments, targeted to develop empathy, during their laboratory time and prepared written reflections. In order to evaluate empathy development, the Intercultural Knowledge and Competence VALUE rubric was used. After the first reflection, 3.3% of students were in level 3 on the VALUE rubric. Comparatively, the last reflection had 12% of students scoring in level 3. This study found that intercultural intervention activities in a classroom may be one way to develop empathy in undergraduate students. Students who can empathize will be better equipped in a diverse workplace to communicate more effectively.

Mentor(s):

Elizabeth Karcher, College of Agriculture, Animal Sciences

Jacey Wickenhauser, Purdue University

Oral Presentation Abstract Number: 15 :: Life Sciences

College of Agriculture

Research model of colostrum intake to study effect of colostrum bioactive factors on piglets development.

Author(s):

L. Kirsten Senn, College of Agriculture

Abstract:

Swine colostrum intake within 24 hours after birth plays a large role in determining survivability, feed efficiency, growth, and fertility. This study tested effects of feeding three doses of a homogeneous colostrum sample on 24 hour body weight (BW), rectal temperature (RT), immunocrit, and growth through postnatal day 7 (PND7). Three female piglets were selected from eight litters at birth (n=24 total; n=3/liter), and bottle-fed 10% (COL10, n=8), 15% (COL15, n=8) or 20% (COL20, n=8) BW colostrum over 24 hours. Piglet birth weights were similar between treatments (P=0.838). Piglet BW, RT, and immunocrit at 24 hours postnatal were recorded, then returned to their litter of origin. BW was recorded daily through PND7. Colostrum dose had an effect on 24 hour weight gain, RT, immunocrit, and growth through PND7 (P<0.05). Treatment, day and interaction were determined as main effects of BW and average daily gain through PND7. Post-hoc analysis showed COL20 had higher average daily gain, RT and immunocrit at 24 hours than COL10. COL15 24 hour average daily gain differed from COL10 (P<0.001), and RT differed from COL20 (P=0.017). There was no statistical difference in average daily gain between groups through PND7 (P=0.874). One piglet within each treatment was crushed before PND7. This model permits controlled studies intended to understand the level of 24 hour colostrum intake on piglet growth and development using standardized, homogenous colostrum doses.

Mentor(s):

Theresa Casey, College of Agriculture, Animal Sciences

Kara Stewart, Purdue University

Aridany Suarez-Trujillo, Purdue University

Oral Presentation Abstract Number: 16 :: Life Sciences

College of Agriculture

Tissue Analysis of the Effect of Day and Level of Colostrum Intake on Jejunum Development

Author(s):

Jocelyn Sheets, College of Agriculture

L. Kirsten Senn, College of Agriculture

Abstract:

Colostrum is the first milk and provides immunity, nutrients, energy, and bioactive factors which are essential for the survival and development of newborn piglets. The first few days after birth, the gastrointestinal (GI) tract undergoes developmental changes and rapid growth in response to bioactive factors in milk. We hypothesized that amount of colostrum a neonate consumes the first 24 h postnatal effects the development of the GI tract. The objectives of this study were to measure the histomorphic growth of the jejunum between birth (day 0, D0) and postnatal day 7 (D7) to determine the effect ingesting high versus low amounts of colostrum. Gilts were identified at birth (D0, n=6) or bottle fed a 24 h colostrum dose of 10% (COL10, n=7) or 20% (COL20, n=7) of birth body weight. Colostrum fed neonates were returned to birth sows after 24 h and allowed to nurse naturally until postnatal (D7). Gilts were dissected, jejunum removed, and placed in buffered formalin for preparation of histological sections. Tissues sections were stained with hematoxylin and eosin, and images were captured at 10 X. ImageJ software was used to measure villi length, width, stromal and epithelial area, and crypt length. There was no difference between COL10 and COL20, in any of the morphological features. Between D0 and D7 villi width and crypt length increased ($P<0.05$). GI tract showed differences in histomorphology across the first week postnatal that was not affected by level of colostrum intake in the first 24 h postnatal.

Mentor(s):

Theresa Casey, College of Agriculture, Animal Sciences

Aridany Suarez- Trujillo, Purdue University

Kelsey Teeple, Purdue University

Oral Presentation Abstract Number: 17 :: Life Sciences

College of Agriculture

The Impact of Broiler Genetics and Salmonella Exposure on the cecal Microbiome.

Author(s):

Tessa Sheets, College of Agriculture

Abstract:

A challenge that the poultry industry continues to face is the pervasiveness of Salmonella among live flocks and meat products. Broiler chickens are a competitive component in the meat market, yet infections from Salmonella still remain to have an economic impact. The objective of this study is to determine if there is a relationship between Salmonella enterica ser. Typhimurium challenge and genetic lines of selected broiler species on the cecal bacterial community. This work could assist in understanding how the intestinal microbiome interacts with immune response when the host is exposed to Salmonella, a persistent gut colonizer. Two broiler chicken breeds were used in this experiment – Ross, a conventional genetic line, and Redbro, a slow-growing breed. Chicks were separated into 24 different isolators by breed. On day 14, chicks in twelve treatment isolators were challenged with 1 x 10^8/ml Salmonella Typhimurium via oral gavage while the rest were given the saline control by oral gavage as well. Cecal contents were collected on days 7, 13, 17, 21, and 24 of the study. The samples underwent total DNA extraction, followed by PCR amplification to obtain 16S amplicons. Amplicons were sequenced with the Illumina MiSeq sequencer and the resulting data was analyzed using Qiime2 bioinformatics software. Alpha diversity measurements including Pielou-eveness, Faith-phylogenetic diversity, and Shannon were found to differ ($p<0.05$) as animals aged and due to Salmonella challenge, but not by genetic line. As the animals grew older, there seemed to be a pattern of increasing species evenness and richness of the bacterial populations in the ceca. Chicken genetic line, Salmonella challenge, and age all altered the bacterial community composition but genetic line altered the composition the least and age altered it the most with Salmonella challenge being intermediates. This may infer that the intestinal microflora between poultry breeds is similar in membership but different in species abundance. These results also indicate that microbial diversity in broiler chickens may be driven by pathogenic bacteria. In the future, it is desired to determine if birds with different microbial communities can influence Salmonella colonization in broilers.

Mentor(s):

Timothy Johnson, College of Agriculture, Animal Sciences

Carmen Wickware, Purdue University

Ashlyn Snyder, University of Maryland

Shawna Weimer, University of Maryland

Oral Presentation Abstract Number: 18 :: Life Sciences

College of Agriculture

Coupling Metabolic Source Isotopic Pair Labeling and Genome Wide Association for Metabolite and Gene Annotation in Plants

Author(s):

Abigail Sipes, College of Agriculture

Abstract:

To deepen our understanding of plant gene function, it is important that we advance our knowledge of plant genomes and metabolic activity. It is important to have a solid understanding of the genes that are responsible for the synthesis of certain metabolites. With metabolite synthesis information in hand, we will have the capability to unlock higher plant productivity, develop new strategies to protect plants from stressors, and develop new plant-based products. This project applies isotopic labeling and mutant strategies to identify amino acid-derived metabolites in Arabidopsis and then applies Genome-Wide Association (GWA) to characterize the genes responsible for their synthesis. We will identify amino acid-derived specialized metabolites in Arabidopsis by feeding wild-type Arabidopsis tissues with 13C and 12C labeled amino acids. A computational pipeline will then be used to identify metabolic features that are derived from the labeled amino acids. This project aims to classify metabolites based on the precursor-of-origin and to provide the function of annotated genes that are associated with plant metabolism.

Mentor(s):

Clint Chapple, College of Agriculture, Biochemistry

Oral Presentation Abstract Number: 19 :: Social Sciences/Humanities/Education

College of Agriculture

Enhancing Viewing Opportunities for the Sandhill Crane in Agricultural Landscapes

Author(s):

Anne Yeakey, College of Agriculture

Abstract:

The purpose of this project is to help the Jasper-Pulaski Fish and Wildlife Area rebuild and restore their existing wildlife park. This will include adding more viewing areas to observe the cranes as well as include learning opportunities for visitors. The existing site is a hub for the Sandhill Crane Migration in North-West Indiana that consists of a natural, failing wetland surrounded by farmland. The area is currently hard to navigate and doesn't have an exact entry point, however, there is an existing viewing platform for the cranes that is underused and missed by visitors. I have partnered with stakeholders from the Jasper and Pulaski Counties to compile a few needs that they think the site can benefit from. Some of the needs include pull-off viewing spots as well as bigger platforms. The site would benefit from a healthy environment for people to respectfully watch the cranes and a haven for the cranes. I am using evaluation models for the existing site that use existing and pre-existing wetland outlines along with existing trails to be able to see where the best place structurally I will be able to put these new viewing areas. This evaluation model will also be used to see where the cranes typically land and live during their migration period on the site. I used GIS to overlay this information and will use this as a guide to help me know where to put these new platforms to get optimal viewing for the majestic crane migration.

Mentor(s):

Aaron Thompson, College of Agriculture, Horticulture & Landscape Architecture

Oral Presentation Abstract Number: 20 :: Innovative Technology/Entrepreneurship/Design

College of Agriculture

Use of Bioluminescence for Monitoring of Gene Expression for Remote Educational and Process Monitoring Applications

Author(s):

Neil Zhao, College of Agriculture, Honors College

Abstract:

The project explored remotely accessible whole-cell biosensor instrumentation interfaced with miniature bioreactors for online laboratory courses. The biological element involves gene expression monitoring of the genetically-modified, bioluminescent S. cerevisiae yeast strain, which carries the vectors pBEVY-GU and pBEVY-GL. These systems are fused with the lux genes from Photorhabdus luminescens and are induced by glucose and galactose to provide a luminescence signal. Using luminescence as an output signal allows for in situ monitoring of gene expression, which can be monitored in real time in both incremental and square wave perturbations. The benefits to this dynamic system using a luminescent output includes worldwide-web remote-accessibility, real-time laboratory livestream feeds, and customization options to experiments with different metabolic conditions. Users can remotely access the automated laboratory setup to perform experiments at their leisure. The remote web-server processes internet requests to automatically begin experiments based on their input parameters. For example, multiple different inputs include, time, nutrients and substrates are available in real-time livestream. After measurements are complete, users can download generated CSV excel files for data export. The relative ease, cost effectiveness, and repetitive use is ideal for distance-learning and classroom demonstrations for both university and K-12 outreach. The developed approach will allow both flexibility and applicability to a variety fields and industries as well.

Mentor(s):

Bruce Applegate, College of Agriculture, Food Science

Oral Presentation Abstract Number: 21 :: Social Sciences/Humanities/Education

College of Education

Telehealth Parent Coaching in Naturalistic Communication Intervention

Author(s):

Alana Lorts, College of Education

Brianna Coster, College of Health & Human Sciences

Abstract:

Children with developmental disabilities often require explicit instruction to develop social interaction and communication skills. Such intentional and explicit instruction may not already be within parents' skill sets. The COVID 19 pandemic has highlighted the importance of leveraging technology to support families from a distance. Even before the COVID 19 pandemic, the use of telehealth in educational and family home settings to deliver intervention to children with disabilities was developing at a rapid rate (Tsami, Lerman, & Toper, 2019). Previous research has shown that telehealth can be successfully applied to train parents to implement social, communication, and behavioral interventions with young children with developmental disabilities. Yet very little parent training research has occurred with families of children specific subsets of intellectual disability who likely need access the most, including families of children with severe impairments or challenging behaviors that might challenge attempts to travel to clinics. The purpose of this study as to develop and evaluate a telehealth delivered parent training program for caregivers of young children with Angelman syndrome. We conducted this study with 6 parent-child dyads. All 6 caregivers reached mastery criteria for intervention fidelity and generalized their use of the communication strategies to untrained routines. Four caregivers were assessed at 4-week follow up and maintained their high levels of intervention fidelity. All participants rated their satisfaction with the telehealth approach and technology as good or excellent. On the Treatment Acceptability Rating Scale Revised (TARF-R). Caregivers reported high rates of (a) acceptability, (b) understanding of the practices, (c) enjoyment of the practices, (d) willingness to implement the practices, and € contextual fit of these practices within their homes (mean for each item was 6 on 7 point scale).

Mentor(s):

Mandy Rispoli, College of Education, Educational Studies

Eric Shannon, Purdue University

Bridgette Kelleher, Purdue University

Oral Presentation Abstract Number: 22 :: Social Sciences/Humanities/Education

College of Education

Launch the Future

Presentation found under Poster Abstract #278.

Oral Presentation Abstract Number: 23 :: Social Sciences/Humanities/Education

College of Education

Investigating the Frequency and Nature of Social Justice References in the Teacher Education Program Curriculum at Purdue University

Author(s):

Julia Pirrello, College of Education

Abstract:

During this time of heightened awareness of social injustices via the Black Lives Matter protests and the COVID-19 pandemic, it is especially important to ensure that teacher preparation curriculum includes knowledge and skills related to social justice issues in education.The purpose of this study is to investigate the ways in which social justice, diversity, and equity are addressed in the foundational courses of the Teacher Education Program at Purdue University. In this study, a report of the frequency and nature of social justice references in the program curriculum will be generated through focused, thematic analyses of the required courses' syllabi, readings, and assignments. Preliminary findings suggest the presence of explicit and implicit references to social justice and related ideas. These analyses will evolve into a report that uses curricular analyses, faculty input, and student experiences to identify the ways in which social justice, diversity, and equity are incorporated into the curricula, and also highlight productive connections that begin in the foundations courses and continue into the methods courses that are completed later in the program. With a better understanding of the current curriculum, program personnel can both enhance opportunities in their own courses, as well as capitalize on experiences offered in other courses.

Mentor(s):

Jill Newton, College of Education, Curriculum & Instruction

Oral Presentation Abstract Number: 24 :: Social Sciences/Humanities/Education

College of Education

Investigating Identity Development in Informal STEM Learning Spaces: A Case Study of Girls Excelling in Mathematics and Science (GEMS) Clubs

Author(s):

Michaela Rice, College of Education, Honors College

Abstract:

Informal learning spaces (educational environments outside of the structured classroom setting), such as Girls Excelling in Math and Science (GEMS) have been used to promote equity for women who are otherwise systematically tracked away from science and math throughout their educations. This case study is part of a larger study that investigates how informal learning spaces such as GEMS have the potential to develop girls' identities. Results are comprised of oral history data including interview, focus group, and survey responses of Amy, a past participant in GEMS. We analyzed Amy's evolving identity and in what ways GEMS might have influenced it, finding that she challenged and defied traditional gender roles and created an identity that instead makes her feel comfortable with herself. Given the historic undermining of women in STEM, Amy's case shows an example of a woman whose identity challenges traditional gender roles. Although there is a need to explore other cases, GEMS seems to be a context where girls develop their identity. More generally, this study has vast implications for promoting equality in otherwise prejudiced fields. Through the implementation of informal learning spaces, educational realms may be equipped to encourage the development of identity in women.

Mentor(s):

Jill Newton, College of Education, Curriculum & Instruction

Elizabeth Suazo-Flores, Purdue University

Oral Presentation Abstract Number: 25 :: Social Sciences/Humanities/Education

College of Education

How Different Types of Linguistic Scaffolds Increase Language Comprehension and Interactions for English Learners through Interactive Read Alouds

Presentation found under Poster Abstract #279.

Oral Presentation Abstract Number: 26 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Quantitative Assessment of Space Habitat Safety Control Effectiveness

Author(s):

Kyle Alvarez, College of Engineering, Honors College

Abstract:

Purdue's Resilient Extraterrestrial Habitat institute (RETHi) is developing technology and methods to design resilient space habitats. Resilience describes the ability of systems to react to, survive, and recover from foreseen and unforeseen events that threaten performance. RETHi evaluates resilience by considering how well the system is kept within safe operating states and how well it is kept out of hazardous states. RETHi students have identified potential disruptions and hazardous states and developed a diverse set of safety controls to prevent or mitigate the consequences of these hazards and return the system to safe operating states. Other RETHi students are developing a simulation environment that will allow us to simulate safety controls and evaluate their effectiveness. My work contributes to evaluating this control effectiveness in three ways. First, to enable a sufficiently complex disruption, hazardous states, and safety controls simulation, I developed an event sequence diagram that defines exactly what must be simulated. Second, I am developing Matlab code that will use outputs from the simulation (e.g., internal habitat temperature and pressure) to quantitatively estimate resilience, based on resilience metrics from the literature. We expect that safety controls with high control effectiveness should result in habitat designs with high resilience. Third, I am developing an index of common features shared by controls with high effectiveness, to help design more effective safety controls.

Mentor(s):

Karen Marais, College of Engineering, Aeronautics & Astronautics

Meghan Cilento, Purdue University

Oral Presentation Abstract Number: 27 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

In-Situ Parametrization and Correction of 2D Models Produced by Two Photon Polymerization

Author(s):

Fredrik Arentz, College of Engineering

Abstract:

Shrinkage of microscopic polymer structures produced by two-photon lithography is a well-documented effect caused by the relaxation of polymer chains. The shrinkage can cause the final printed structure to differ from the intended print in shape and size. Micro-Electromechanical Systems, which are microscopic structures that use electrical, optical, or mechanical input to perform different tasks, are very sensitive to small changes in geometry. Significant time is therefore dedicated to ensuring that toolpaths are optimized for the printing process. This study outlines a novel process for rapid in-situ analysis and correction of printing toolpaths using image analysis and parametric modelling.

To modify printing toolpaths, the structure is expressed as a fully parametric model that can be changed using a single function. This is combined with an algorithm that can generate new toolpaths given the parametric model. These toolpaths are realized using two-photon lithography and the specimen size parameters is estimated by comparing its image with different parametric models. The toolpath is then corrected by matching the ideal model with the realized model. To verify its accuracy, the specimens are analyzed using Scanning Electron Micrography to determine actual sizes post-processing. The results indicate that in-situ image analysis can be used to accurately predict sizes of 3D printed Micro-Electromechanical Systems and change the toolpath to account for size disparities in models.

Using fully parametric models and image analysis to correct size parameters of 3D printed Micro-Electromechanical Systems can reduce the production time while increasing its manufacturing accuracy, allowing to produce high-quality specimens.

Mentor(s):

Xianfan Xu, College of Engineering, Mechanical Engineering

Jason Johnson, Purdue University

Oral Presentation Abstract Number: 28 :: Physical Sciences

College of Engineering

SCALE Radiation Hardening of Electronics

Author(s):

Nathan Audia, College of Engineering

Abstract:

The space radiation environment at several levels of orbit varies greatly and can be difficult to predict. The cause of this prediction challenge is analogous to weather prediction - it includes known variations within the earth’s magnetic field, as well as solar particle events which follow certain cycles but also have unexpected spikes that sharply increase levels of ionizing radiation around the earth. Without proper radiation hardening, these radiation levels can quickly damage electronics which can result in major consequences such as data loss, and ultimately leading to loss of serviceability in spacecraft. The purpose of this project is to develop an understanding of the space radiation environment at various altitudes above the earth which can be applied to proper radiation hardening of electronics. It is known that shielding is a potential solution to protect from specific forms of radiation; however, it is important to have a deep understanding of the specific environment the spacecraft will be traversing to understand which material will be the most effective. To achieve this goal, we employ employ two programs to identify the radiation environment as it impacts electronics: the 1996 revision of the Cosmic Ray Effects on Microelectronics suite (CRÈME96), by the Naval Research Laboratory as well as the 2013 revision of the Stopping Range of Ions in Matter (SRIM) by James F. Ziegler. The initial focus for this study will be to understand the role of uncharged particles, particularly neutrons and gamma radiation, and heavy ions, since they have the greatest potential to travel a longer distance through most shielding materials.

Mentor(s):

Peter Bermel, Discovery Park, Birck Nanotechnology

Oral Presentation Abstract Number: 29 :: Life Sciences

College of Engineering

Effects of Combined Chemical and Mechanical Cues on Cell Movement

Author(s):

Anuhya Edupuganti, College of Engineering

Abstract:

Cell migration is essential in the development and maintenance of a multicellular organism and plays a vital role in wound healing, tumor progression and metastasis, and immune response. Understanding the characteristics and mechanisms of cell migration could advance the development of effective therapeutics and innovative biologics. Cell migration is guided by many external cues, including chemical field gradients (Chemotaxis) and mechanical stiffness gradients (Durotaxis). However, cell response is often studied in a single signal as opposed to a combination of signals due to limitations in fabricating a complex environment to study cell behavior. In this study, epithelial cell migration with chemotaxis and durotaxis has been simulated by the Cellular Potts Model using a python/XML-based software package CompuCell3D. Single epithelial cell migration was modelled in isolated chemical and stiffness gradients to match characteristics from literature. The models were merged to predict the movement of cell in response to combined and competing chemical and mechanical cues. Cell migration is quantified primarily in terms of cell speed, deviation from the straight path, and its movement with respect to the applied gradient. This model can be adapted to study additional environmental cues and their effects on collective cell migration, cell growth, and proliferation.

Mentor(s):

Bumsoo Han, College of Engineering, Mechanical Engineering

Hye-ran Moon, College of Engineering, Mechanical Engineering

Oral Presentation Abstract Number: 30 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Acoustic Membrane

Author(s):

Eugenio Frias Miranda, College of Engineering

Abstract:

Abstract redacted.

Mentor(s):

David Warsinger, College of Engineering, Mechanical Engineering

Hamid Fattahijuybari, Purdue University

Oral Presentation Abstract Number: 31 :: Mathematical/Computation Sciences

College of Engineering

Optimization of Heart Rate Calculation Algorithm for Real-Time Use

Author(s):

Akio Fujita, College of Engineering

Abstract:

According to the CDC, the number of opioid overdose deaths quadrupled in the US between 1999 and 2018. Opioid overdoses can be detected by monitoring sudden biometric changes in heart rate (HR), respiratory rate (RR), and blood oxygen saturation (SpO2). Our goal was to design a device capable of detecting these abnormalities in photoplethysmogram (PPG) data and notifying EMS to reduce the number of these deaths. To achieve this, we focused on converting previously developed HR calculation algorithms, which could only run on historic data, into real-time algorithms.

We developed two methods for calculating HR: peak-detection and Fast-Fourier Transform (FFT). For the peak-detection method, peaks were determined by calculating the differences between each local maximum and minimum. If the differences were larger than a calculated threshold value, then that peak was marked as a heartbeat. The HR was calculated by finding the time between adjacent beats. For the FFT method, the FFT was computed on the signal to extract frequency components in the PPG. Typically, the most dominant frequency would correspond to the HR. However, this was not always true since the second harmonic was often larger than the fundamental. Thus, the algorithm selected the first detected peak for the HR estimate. We compared our results to the HRs determined by visually counting the PPG waveforms.

Fast, reliable detection could provide time to alert EMS and potentially save the user’s life. While our PPG peak-detection algorithm showed promise for real-time application, further testing is necessary to statistically validate our results.

Mentor(s):

Jason Ummel, College of Engineering, Biomedical Engineering

Orlando Hoilett, Vanderbilt University

Jacqueline Linnes, Purdue University

Oral Presentation Abstract Number: 32 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Ergonomic Dashboard Design in Health Insurance

Author(s):

Magdalena Haas, College of Engineering

Abstract:

Abstract redacted.

Mentor(s):

David Williams

Oral Presentation Abstract Number: 33 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Low Noise Humidity Controller

Author(s):

Jordan Harris, College of Engineering, Honors College

Abstract:

The goal of the Low Noise Humidity Controller project is to build a humidity controller and use it to study the relationship between humidity and measured electrical properties of materials at the nanoscopic level. An Atomic Force Microscope (AFM) was used to measure the electrical properties of a substrate by analyzing interactions with the AFM tip at different levels of environmental relative humidity. An AFM uses a microscale cantilever with a sharp tip, like a microscopic record player, to scan the surface of a test specimen with atomic resolution. Physical properties are measured by recording vertical displacement of the cantilever across the surface. Electrical measurements can be taken by sending a voltage signal through this tip and measuring the specimen response. Previous literature has shown humidity affects physical properties like adhesion, but the effect of humidity on electrical AFM measurements is not well understood. In this study, a low noise humidity controller was designed and implemented into the AFM measurement system. The humidity controller utilizes two humidity sensors to measure the humidity (3-90%) of a gas flowing into the AFM and the environment inside the AFM. This system uses mass flow controllers and a bubbler to mix wet and dry gas streams in a controlled fashion. The humidity is regulated by a feedback control system and multiple data streams can be monitored: humidity/temperature data and AFM imaging data. The results of this study will aid in understanding humidity effects in applications of nanotechnology and nanoscale experimentation. Complete control of environmental humidity will allow us to understand how electrical properties of surfaces can be modified with humidity to alter specimen behavior.

Mentor(s):

Ryan Wagner, College of Engineering, Mechanical Engineering

Oral Presentation Abstract Number: 34 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Trade study for Camera and Deployment System Selection for the Full Solar Sail Analysis Option for the NASA Solar Cruiser Mission

Author(s):

Riley Harwood, College of Engineering

Rebecca Reinecke, College of Engineering

Mark Kosmerl, College of Engineering

Lindsay Rubin, College of Engineering

Nora Helou, College of Engineering

Nicholas Forkey, College of Engineering

Dylan Huntoon, College of Engineering

Abstract:

In space missions concerning exploration, propulsion systems remain the biggest limiting factor. Conducting research on alternative propulsion technologies, like solar sails, results in a better understanding of non-traditional space travel. A key tool to evaluate the performance of the sail is a three dimensional topographical map of the sail surface. Photogrammetry techniques can yield height data, but multiple images and varying depth or angle are required to generate topography.

In order to select the appropriate system to capture multiple images, a trade study will be conducted using a pool of preselected cameras and deployment systems. Using a weighted decision matrix, the trade study will select the camera and mounting system that best meets the requirements of the mission. When comparing solutions, there will be significant tradeoffs between a wider field of view and the capability to zoom in on details.

The major investigation of the expanded field of view subteam is to analyze the risk added by using a complex camera deployment system. After a selection is made, the fabrication and evaluation of a prototype will begin. The results of the trade study will impact not only the functionality of the cameras aboard NASA’s Solar Cruiser, but could also change the way that future spacecraft utilize cameras for photogrammetry.

Mentor(s):

Katherine Fowee, College of Engineering, Aeronautics & Astronautics

Alina Alexeenko, Purdue University

Yung-Hsiang Lu, Purdue Cam2

Anthony Cofer, Purdue University

Oral Presentation Abstract Number: 35 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Program Analysis as a Service

Author(s):

Zhaoyu Jin, College of Engineering

Abstract:

Program Analysis as a Service seeks to better prepare the next generation of programmers by easing the steep learning curve of many programming languages. This service will grade student code submissions, finding errors and mistakes along the way. After the students gain feedback, debugging and correcting inaccuracies will become simple to complete.

Programming can be very difficult to understand for both first time learners and veteran programmers. Many students believe coding is an abstract language they cannot understand, so many students struggle to develop basic skills to overcome those obstacles. Bill Gates once said, “Learning to write programs stretches your mind, helps you think better, and creates a way of thinking about things that I think is helpful in all domains.” The Program Analysis service allows students to find common errors and go through the steps to solve the issue on their own. They don’t need someone with years of programming experience to tell them what to do; they can solve problems and develop solutions with their own creative minds.

The main goal of Program Analysis as a Service is to teach students about error prevention, mitigation, and response. Software can be very frustrating to learn, so our team seeks to create an environment where failure develops future success. As programming becomes more complex, Program Analysis as a Service paves the way towards a brighter future.

Mentor(s):

Yung-Hsiang Lu, College of Engineering, Electrical & Computer Engineering

Oral Presentation Abstract Number: 36 :: Physical Sciences

College of Engineering

Synthetic Control of Al Arrangements in Chabazite Zeolites at the Unit Cell and Crystallite Length Scales

Author(s):

Elijah Kipp, College of Engineering, Honors College

Abstract:

Abstract redacted.

Mentor(s):

Rajamani Gounder, College of Engineering, Chemical Engineering

Siddarth Krishna, Purdue University (Davidson School of Chemical Engineering)

Oral Presentation Abstract Number: 37 :: Social Sciences/Humanities/Education

College of Engineering

Pandemic Altering Perceptions of College Experience

Author(s):

Bridget McCole, College of Engineering, Honors College

Abstract:

How does a crisis affect the normal way of student life? Having traditions and events at college help foster a collective campus culture and community. Since the COVID-19 pandemic has changed every aspect of life, there is concern as to how it will affect campus culture in the long term. This study hypothesizes that traditions could be lost to the pandemic and that participation in clubs and organizations will decline in the future. To support these claims, qualitative data from undergraduate students at Purdue University was collected through virtual interviews and an online survey. Students were asked to share how the pandemic has affected their life, from club involvement to participating in campus traditions. The results of the data collection showed that many students miss large campus activities, like sporting events and social gatherings with friends, and that virtual alternatives have not been as engaging. They also supported the theory that campus wide traditions could change permanently from upperclassmen graduating before passing down traditions and from the continuation of restrictions on events. Many participants also predicted that membership in clubs and organizations would rise after the pandemic, disproving the original hypothesis. Students have not been able to join clubs or see many people in person so they will likely be eager to participate in clubs and meet people. This data can help the university better understand what is going on in the minds of their students in addition to helping document an important point in history.

Mentor(s):

David Nelson, Vice Provost for Teaching & Learning, Center for Instructional Excellence

Oral Presentation Abstract Number: 38 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Modeling of Additive Manufacturing of 17-4 PH Stainless Steel

Author(s):

Michael Porro, College of Engineering, Honors College

Abstract:

The ability to additively manufacture metal parts presents an opportunity to spark major change in a variety of industries from automotive to energy production through rapid prototyping, reducing waste, and small volume production run optimization. Unfortunately, several hurdles impede the proliferation of additive manufacturing, including high research and development costs. The upfront cost of researching resulting physical properties of different metal powder or wire feedstocks results in a significant barrier to entry in the field of additively manufactured (AM) metal parts. The objective of this project is to demonstrate a procedure to reduce this cost by using neural networks to predict the tensile properties of AM 17-4 PH stainless steel. By analyzing the relationship between microstructure and mechanical properties, one can acquire comparatively low-cost microstructure images instead of conducting many expensive tensile tests and still generate a reasonable estimate (within a few percent) of properties such as yield strength and tensile strength. In this case, microstructure images such as EBSD and SEM images were collected from newly built AM samples, commercial data from industry leaders, and previously published images and properties of AM 17-4 PH stainless steel. These were processed to extract grain boundaries and used as inputs to the neural network. Outputs of the network included tensile data such as tensile and yield strengths. If successful this process could be applied to other materials and allow for reductions in testing costs and lead times in the metal AM industry.

Mentor(s):

Yung Shin, College of Engineering, Mechanical Engineering

Bin Zhang, Purdue University

Akanksha Parmar, Purdue University

Kyung-Min Hong, Purdue University

Oral Presentation Abstract Number: 39 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Development and Optimization of a Thermal Transfer System for Simulating Lunar Temperatures and Possible Scenarios

Author(s):

Nathan Stonitsch, College of Engineering

Abstract:

To prepare for future deep space explorations, it is essential to develop resilient habitats to house astronaut crews for extended periods of time. To this end, the Resilient Extra-Terrestrial Habitats Institute (RETHi) is constructing a cyber-physical testbed to simulate the harsh conditions of the moon and possible scenarios. Furthermore, it will be used to anticipate faults, and map out recovery efforts.

The cyber-physical testbed will be a combination of computational physics simulations and physical components interacting together to simulate the interaction between the lunar environment and habitat systems. The extreme temperatures on the lunar surface is one condition that will be simulated physically as the thermal properties are directly coupled to the structural aspects of the habitat. It will accomplish this through a cooling loop on the surface of the testbed. The initial testing will be conducted on a stand-alone cooling panel to determine how many pipe loops are required to maintain a uniform temperature profile, what material should be used for the panel, how low of an inlet temperature is required and the total cost while addressing any additional problems before moving on to a multi-panel cooling dome. To conduct this testing, a LABVIEW Real-Time system is being developed to collect data from the thermocouple wires and control the system deterministically. The successfully constructed testing system will be capable of maintaining the temperature of the panel within a tolerance of the setpoint, automatically transitioning to different setpoints, and will test communication networks to enable future experiments.

Mentor(s):

Davide Ziviani, College of Engineering, Mechanical Engineering

Jaewon Park, Purdue University

Kurtulus Orkan, Purdue University

Oral Presentation Abstract Number: 40 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

SCALE Radiation Hardened Technologies

Author(s):

Ricardo Xie, College of Engineering

Abstract:

Semiconductor devices and integrated circuits (ICs) used in spacecraft are exposed to large amounts of ionizing radiation. These environmental hazards can result in consequences for microelectronic devices ranging from temporary loss of data to permanent loss of spacecraft functionality. The purpose of this project is to study the Single Event Effects (SEE) of memories in the low-earth orbital radiation environment. SEEs are caused by a single ionizing radiation particle passing through a sensitive region of an electronic or photonic device. Prediction of SEE occurrence rate requires knowledge of both radiation environment and electronic devices. To address this problem using a systematic, peer-reviewed methodology, the 1996 revision of the Cosmic Ray Effects on Microelectronics (CREME96) suite developed by the Naval Research Laboratory (NRL) is used for this work. We find that shielding materials can reduce the rate at which microelectronics are damaged, but the environment plays an important role in determining the amount of shielding required for a given mission lifetime.

Mentor(s):

Peter Bermel, Discovery Park, I-GSDI

Allen Garner, Purdue University

Oral Presentation Abstract Number: 41 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Interface engineering to kinetically trap the photovoltaic crystal phase of formamidinium lead iodide perovskite

Author(s):

Yiyuan (Melody) Zhang, College of Engineering

Abstract:

Perovskite solar cells (PSCs) are emerging photovoltaic technologies with remarkable properties including large light absorption coefficients, tunable band structures, and low-temperature solution processability. Within only 12 years, the power conversion efficiency (PCE) of PSCs has been greatly improved from 3.8% to the most recent 25.5%, which rivals the 26.1% record efficiency of single crystal silicon solar cells. Formamidinium lead iodide (FAPbI3) is used in the highest performing perovskite solar cells for its near-ideal bandgap, but the photovoltaic crystal phase is thermodynamically unstable at room temperature. By modifying the interface and passivating crystal defects, the photovoltaic phase can be kinetically trapped. Typically, long chain alkylammonium ligands are used to bond to the perovskite surface and create a hydrophobic and strained interface. While this method is effective, it is limited by the insulating nature of alkyl chains, the rotations of carbon-carbon bonds, and poor thermal stability of organics. In this research, we extend the intentions of previous passivation studies by creating a strained interface with a more stable and semiconducting passivation layer. In-lab synthesized π-conjugated oligothiophene ligands with formamidinium (FA) anchoring groups are used to match the FA vacancies in the perovskite lattice. In addition, the bulky and rigid conjugated ligands can both tune the surface optoelectronic properties and stabilize the surface against moisture ingression and phase transformation. With these novel passivation agents, perovskite solar cells with PCEs over 20% and improved stability are achieved.

Mentor(s):

Blake Finkenauer, ,

Letian Dou, Purdue University

Oral Presentation Abstract Number: 42 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Adolescent Substance Use: Findings from a Pilot Indiana State-wide Parent Education Program

Author(s):

Sarah Arnold, College of Health & Human Sciences

Abstract:

Adolescent substance use (ASU) remains a top public health priority as it is linked to continued use, dependence, and other psychosocial adjustment concerns later in life (Marshall, 2014). In Indiana, high rates of youth alcohol use are coupled with increasing trends in opioid, synthetic marijuana, and over-the-counter drug use in recent years (Jun et al., 2020). Based on research indicating that parent-based prevention efforts may be a particularly effective way to target ASU (Kuntsche & Kuntsche, 2016), we conducted an applied research pilot study targeting ASU across the state. The study included: 1) a needs assessment of Indiana parents' and Extension educators' concerns regarding ASU, 2) creation and dissemination of an evidence-based parent education program on ASU through Purdue Extension, and 3) community-based participatory research through qualitative focus group discussions at the end of each program which assessed the challenges families face regarding ASU, the types of information and resources they wish they had, and the usefulness of our program. From pilot programs across 8 different Indiana counties, qualitative themes (analyzed using Saldaña's (2015) coding methods) indicate that participants were particularly concerned about: the rise in marijuana, vaping, and opioid use; adolescents' easy access to substances; and the appropriate way to communicate with teens about substance use. To tackle ASU, participants felt that Indiana communities would especially benefit from after-school recreational activities and increased funding for community-based prevention efforts. Participants perceived the information and resources they received during our program to be very useful, but also indicated the need for more treatment-focused information. Overall, participants felt that there was a strong need for this programming in their communities, but suggested collaborating with schools or similar local community stakeholders to increase attendance.

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Mentor(s):

Kristine Marceau, College of Health & Human Sciences, Human Development & Family Studiess

Nayantara Nair, College of Health & Human Sciences, Human Development & Family Studiess

Oral Presentation Abstract Number: 43 :: Life Sciences

College of Health and Human Sciences

Improved methods for astrocyte derivation

Author(s):

Adam Barmash Rubinchik, College of Health & Human Sciences

Frank M. Yanko, College of Health & Human Sciences

Abstract:

In the age of rapidly advancing scientific research, time is increasingly valued. Most groundbreaking discoveries in the field of neuroscience depend on obtaining quality data in a short span of time without sacrificing the integrity of scientific work. Unfortunately, such research is severely limited by the time-intensive and expensive methods that characterize in vitro brain modeling. As such, this project is dedicated to improving the quality and quantity of data collected from human stem cell-derived neuronal cell models, especially human astrocytes. Amongst other functions, astrocytes maintain the glutamate cycle, establish a protective effect against toxic insult, provide metabolic support and prevent over-excitation. Preliminary data from the Bowman lab suggests that some neurons especially show improved survival if passaged on top of a “bed” of astrocytes. However, such conditions are difficult to achieve due to the lengthy differentiation process of astrocytes (the process can take several months). In this study, two control cortical cell lines were designated a unique set of conditions to better understand the mechanisms involved in the process. The control cell lines were split into wells with alternating types and concentrations of media. During the growth process, samples were periodically collected for immunofluorescence staining, glutamate release assays, or qPCR assays. Current experimental data confirms the presence of developing astrocytes at around day 49. Extensive analysis of the collected data will be carried out after several rounds of passaging. In the long term, this project may propel similar research in the constantly advancing field of neuroscience.

Mentor(s):

Aaron Bowman, College of Health & Human Sciences, Health Sciences

Anke Tukker, Purdue University

Xueqi Tang, Purdue University

Oral Presentation Abstract Number: 44 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Can virtual reality generate closeness among unacquainted people? Examining moderation by agreeableness

Author(s):

Jonathan Carter, College of Health & Human Sciences

Abstract:

People who lack the ability or resources to meet previously unacquainted others face-to-face may benefit from using virtual reality (VR) technology to form meaningful connections. Past research has not studied how initial social interactions that occur in VR compare to other interaction modalities, nor has it examined key personality variables that may influence the generation of closeness. The present study fills this gap by examining how the induction of closeness through a validated social interaction task affects affiliative outcomes among unacquainted participants interacting via text, audio, audio/video, or VR. We focused on agreeableness as a possible moderator of affiliative outcomes given the social nature of this personality factor. We hypothesized that participants' reported closeness to the randomly assigned other following interaction would increase overall as sensory richness increased (e.g., from text to VR; Hypothesis 1). We further hypothesized that participants' level of agreeableness would moderate their closeness in the low sensory richness condition (i.e., the text condition, where social cues to "get along" are lacking), such that closeness would be particularly low in dyads featuring lower agreeable participants (Hypothesis 2). In this study, 206 previously unacquainted undergraduate students were randomly assigned to interact with a partner (forming 103 dyads) using the "fast friends" procedure (Aron et al., 1997) via text, audio, audio/video, or VR modality. Participants then completed an online survey containing multiple affiliative and personality measures. Initial results indicate that, consistent with Hypothesis 1, participants in the text condition reported significantly lower closeness than participants in the other three conditions, whose participants reported similar levels of closeness. Analyses testing Hypothesis 2 largely failed to provide support in the expected manner, though dyads in which both members were lower in agreeableness reported closeness levels that trended toward statistical significance. Future research should continue to investigate how well social psychological phenomena translate within different modalities, including virtual reality.

Mentor(s):

Christopher Agnew, College of Health & Human Sciences, Psychological Sciences

Ledina Imami, Purdue University

Oral Presentation Abstract Number: 45 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

STUDENT AWARENESS & USAGE OF BREAVEMENT LEAVE POLICIES

Author(s):

Hannah Darr, College of Health & Human Sciences, Honors College

Abstract:

Purdue University is one of the few colleges in the United States that offers a Grief Absence Policy for Students (GAPS) (Servaty, 2019). It is empirically well-established, but perhaps practically less known, that a significant population of students experience a death loss during their time in college. The goal of this study was to examine general student awareness of GAPS, the means through which students learned about GAPS, the primary methods students would like to find out about GAPS, and reasons students decided not to use GAPS. To investigate these research questions, a random sample of 10,000 students at Purdue were invited to participate in an online survey. Respondents (N = 1151, 11.51% response rate) answered a series of questions pertaining to the research goals. The results suggested that only 11% of students were aware of GAPS and knew how to use the policy, whereas 26% of students had never heard of GAPS. Students commonly found out about GAPS through faculty members and student orientation programs, and they suggested that the best methods to learn about GAPS was through academic advisors, faculty, orientation programs, and course syllabi. Students choose not to use GAPS mainly due to lack of awareness about the policy and academic concerns (e.g., the stress of taking time away from school and making up assignments).

Mentor(s):

Heather Servaty-Seib, Honors College

Oral Presentation Abstract Number: 46 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Is there an association between attentional disengagement and language abilities in children with autism spectrum disorder?

Author(s):

Debanjana Das, College of Health and Human Sciences

Abstract:

Autism spectrum disorder (ASD) is diagnosed on the basis of social and communication impairments as well as the presence of restricted and repetitive behaviors. However, differences in the adaptive allocation of attention are also present in infants later diagnosed with ASD and persist across the lifespan. Critically, primary deficits in attentional disengagement may contribute to the development to impairments in joint attention and language acquisition. Therefore, the objective of this study was to determine whether attentional disengagement is associated with language measures in children with and without ASD. Participants included a total of 15 children, 8 children with ASD and 7 typically developing (TD) children. Participants completed the Peabody Picture Vocabulary Test (PPVT) and Expressive Vocabulary Test (EVT) as well as an eye-tracking experiment, a gap-overlap paradigm, to measure attentional disengagement. In the gap-overlap task, participants were instructed to fixate on a central crosshair and then move their eyes to a peripheral target once it appeared. Each trial began with a crosshair presented alone for a random duration. Next, a target could appear with either the crosshair remaining on the screen (overlap condition) or 200ms after the crosshair disappeared (gap condition). Preliminary analyses using non-parametric correlations showed that measures of attentional disengagement were significantly associated with PPVT, but not the EVT scores for all children. Although these findings should be considered preliminary due to a small sample size, they suggest that for both children with ASD and TD children attentional disengagement abilities are associated with receptive language abilities.

Mentor(s):

Brandon Keehn, College of Health & Human Sciences, Speech, Language, & Hearing Sciences

Oral Presentation Abstract Number: 47 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

How Does the Syntax of Conditional Sentences Compare in ASL and English?

Author(s):

Katherine Edwards, College of Health & Human Sciences, Honors College

Abstract:

Examining the order of the conditional and main clauses of conditional sentences already poses a challenge in the English language. However in ASL, the syntactic rules for ASL conditionals are as yet unknown. A conditional sentence presents a main clause that is based on a contingency, or a truth that depends on a condition. For example, “if I get sick, I will not go to work” is a conditional sentence because going to work depends on the conditional state of not being sick. Conditional phrase types are categorized based on the relationship between the clause and conditional phrase (hypothetical, factual). In English, the syntax of the conditional phrase depends both on the category into which the conditional phrase falls, and the fluidity of the syntax of the overall sentence. The goal of this research project is to compare the syntax of conditional phrases in ASL and English. 60 conditional English sentences and their translation in ASL were compared using the ELAN software. The syntax of the order of the conditional and main clauses is more rigid in American Sign Language than in English, with the condition most often preceding the main clause. In English however, the syntax varies even within the same type of conditional phrase. This research is important and beneficial for ASL interpreters and teachers when they learn the rule for ASL conditional sentences is even simpler than its counterpart in English.

Mentor(s):

Ronnie Wilbur, College of Health & Human Sciences, SPEECH, LANGUAGE, & HEARING SCIENCES

Oral Presentation Abstract Number: 48 :: Life Sciences

College of Health and Human Sciences

A comparison of genital self-image and sexual functioning among women with vulvar and non-vulvar dermatologic disease

Author(s):

Anna Flood, College of Health & Human Sciences

Abstract:

Introduction: Inflammatory dermatologic vulvar diseases represent a significant burden for affected women. Genital itching and pain impact sexual function, and research suggests women with generalized non-vulvar dermatologic diseases also have impaired sexual function. The Female Genital Self-Image Scale (FGSIS) was developed with the intent to help further understand the burden of genital disease. However, both vulvar and non-vulvar inflammatory skin disease have yet to be characterized by impact on genital self-image (GSI).

Objective: The study describes GSI and sexual function and behaviors among women with vulvar and non-vulvar inflammatory dermatoses.

Methods: A Qualtrics survey was distributed through social media ads, support groups, and online research volunteer services. Survey items analyzed included FGSIS, Female Sexual Function Index (FSFI), and sexual behavior histories.

Results: The sample consisted of 348 women, with one-third reporting inflammatory dermatologic disease isolated to the vulva, half with strictly non-vulvar disease, and 21% experiencing both. The average FGSIS score among women with vulvar disease was significantly lower than those with non-vulvar (16.9 vs 21.2, $p<.01$). Higher scores indicate a more positive FGSIS. Similarly, the FSFI of the vulvar group was significantly lower compared to the non-vulvar group (15.4 vs 21.2, $p<.01$). Higher scores indicate better functioning.

Conclusions: This study demonstrates severe sexual health morbidity associated with inflammatory vulvar dermatoses, characterized by low FGSIS and FSFI scores. Additionally, women with non-vulvar disease reported low FSFI scores, with FGSIS scores similar to previously-described healthy controls. A better understanding of the role of GSI will provide improved patient-centered disease management in the realm of sexual health.

Mentor(s):

Andrea DeMaria, College of Health & Human Sciences, Public Health

Sydney Rivera, IU School of Medicine, Medical Student

Oral Presentation Abstract Number: 49 :: Life Sciences

College of Health and Human Sciences

Cognitive Consequences of Smartphone Presence and Separation

Author(s):

Trishla Gandhi, College of Health & Human Sciences

Abstract:

As smartphone usage and ownership has increased in recent years, there is an abundance of literature on the potential negative cognitive effects of these devices. However, most of the literature is contradictory, with some studies claiming that smartphone presence leads to poor cognitive scores while others saying that smartphone absence leads to poor cognitive scores. The current research aims to resolve the discrepancy between the mere presence effect and the separation anxiety account. For Experiment 1, N = 200 introductory psychology students were given four computerized working memory, attention, and fluid intelligence tasks in the presence and absence of their smartphones. One-factor ANOVA revealed no significant differences between the smartphone presence and absence conditions, providing no support for the mere presence or separation anxiety accounts. Currently, Experiment 2 replication data collection is underway. The goal for Experiment 2 is to resolve some of the discrepancies we have between our study and the existing literature on smartphone effects on cognition. Our results have implications for daily activities, such as students studying for a later exam as we are trying to determine whether having their smartphones near or away from them will result in better cognitive performance.

Mentor(s):

Thomas Redick, College of Health & Human Sciences, Psychological Sciences

Oral Presentation Abstract Number: 50 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Associations between Sympathetic Nervous System Activation and symptom presentation in children with Autism and Typical Development

Author(s):

Rachel Gitter, College of Health & Human Sciences

Abstract:

Children with Autism Spectrum Disorder (autism) present with a wide range of clinical symptoms. Physiological regulation and reactivity may influence the observed variability in presentation. Electrodermal activity (EDA) is a peripheral measure of the activation of the sympathetic nervous system. EDA is measured using both tonic and phasic measurements. Associations between measures of EDA and clinical symptoms could inform our understanding of symptoms and identify potential biomarkers of autism likelihood. The goal of present study was to examine the association between EDA and psychiatric symptoms in young children with and without autism. We hypothesized that within the autism group there would be a positive association between phasic EDA and measures of hyperactivity, irritability, and compulsive behavior. Participants included 49 children, 27 with autism and 22 typically developing between two to seven years of age. EDA was collected using BIOPAC from electrodes placed on the child's foot during two baseline conditions: watching a video and eating a snack. Files were edited using MindWare to identify segments with artifacts (signals below 0.01µ, above 100µ, or more than 5 SCR's in one 10 second segment). Parents also completed the Aberrant Behavior Checklist. Based on additional analysis Associations between tonic and phasic measures of EDA and subscales of the ABC will be assessed with bivariate correlations. Differences between groups will be assessed within a series of regression models. Significant associations between psychiatric symptoms and EDA would indicate the role of physiological arousal in clinical presentation within children with autism.

Mentor(s):

Carolyn McCormick, College of Health & Human Sciences, Human Development & Family Studies

Oral Presentation Abstract Number: 51 :: Life Sciences

College of Health and Human Sciences

Tumor Necrosis Factor Alpha as an Autocrine Regulator of Trex1 During Radiation Cancer Treatment

Author(s):

Phillip Harter, College of Liberal Arts, Honors College

Abstract:

Three prime repair exonuclease 1 (Trex 1) is an enzyme that degrades double stranded DNA breaks. While in many instances this mechanism is beneficial to the cell when it comes to treating cancers with radiation immunotherapy this decreases the effectiveness of the treatment. Double stranded DNA breaks caused by radiation therapies accumulate in the cell resulting in the production of Interferon- β which communicates with surrounding immune cells to dispose of the cancerous cell. Prior studies have displayed an increase in Trex 1 production a higher specific doses of radiation and in hypoxic conditions but the mechanism driving this response remains unclear. In response to increased double stranded DNA breaks, tumor cells have been shown to increase their secretion of Tumor necrosis factor alpha (TNF-α) which can promote an autocrine pathway in the cell known as the JNK pathway. This pathway is responsible for cellular proliferation, embryonic development, and apoptosis. Activation of the pathway has been documented to result in the increased production of the proteins c-jun and c- fos which form the heterodimer transcription factor AP-1. Consequentially, AP-1 has been identified as the primary transcription factor for Trex 1. My work examines the potential linkage between TNF-α and Trex 1 in high dose radiation to determine the extent at which the autocrine pathway regulates the levels of Trex 1 resulting in decreased effective of high dose radiation immunotherapy.

Mentor(s):

Keith Stantz, College of Health & Human Sciences, Health Sciences,

Oral Presentation Abstract Number: 52 :: Life Sciences

College of Health and Human Sciences

“I was working out daily prior to COVID”: Impact of the COVID-19 Pandemic on the Physical Health of Purdue Graduate Students

Author(s):

Lauren Heniff, College of Health & Human Sciences

Abstract:

The COVID-19 pandemic has disrupted physical activity patterns, potentially impacting health. This study aimed (1) to quantify physical activity and self-perception of health; (2) to identify social disparities in physical health; and (3) to identify barriers to physical activity among Purdue graduate students. Students completed two online surveys: the Graduate Student Experience in the Research University Survey (gradSERU, Apr-Jun 2019, n=2516) and the Fostering Food Security, Health, and Resilience in Graduate Education Survey (FORGE, Nov-Dec 2020, n=2266). Students rated their physical health and indicated time spent on physical activity. Logistic regression analyses were performed in StataSE16. In 2020, only 27% of graduate students met physical activity guidelines (150 minutes/week). Prevalence of students rating their physical health as poor increased from 27% in 2019 to 51% in 2020. Odds of reporting poor physical health were higher among women (OR: 1.29, 95%CI 1.07-1.57), LGBTQ+ students (1.68 [1.25-2.26]), and racial and ethnic minorities (1.27 [1.05-1.53]). Students who had 7+hrs of sleep per night (1.74 [1.43-2.11]) or reported good mental health (6.17 [4.89-7.77]) had greater odds of good physical health. Students identified lack of time (72%), lack of facility access (38%), discomfort at facilities (31%), and disinterest (19%) as barriers to being physically active. Qualitative data identified heavy workload and expectations, lack of parking access, fear of infection, and restricted hours and reservation systems at health facilities as specific barriers. After the pandemic, several barriers to physical activity will remain and should be addressed to improve graduate student health.

Mentor(s):

Nilupa Gunaratna, College of Health & Human Sciences, Public Health

Yumary Ruiz, Purdue University

Ramya Ambikapathi, Purdue University

Oral Presentation Abstract Number: 53 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Evaluating the Impact of 24-Hour Access Pharmacy Vending Machines at Purdue University

Author(s):

Alexandra Hughes, College of Science

Claudia Pobanz, College of Health & Human Sciences

Abstract:

Background: Purdue University implemented two Pharmacy Vending Machines (PhVMs) in January 2021. More campaigning is needed to inform students, staff, and faculty of machine locations, products, and safety to increase awareness and use. Messaging should feature content related to privacy, reliability, affordability, and convenience. More information is needed to determine how the PhVM initiative can be scaled up through additional machines, items, or other means.

Objective: The purpose of this project is to expand the PhVM initiative by increasing awareness through a campus-wide campaign and then evaluating awareness, attitudes, and use.

Methods: A web-based survey was emailed to 1,500 undergraduate and graduate students for baseline information (n=292). Additional distribution occurred informally through social media to further reach students, alumni, and Purdue affiliates. Guided by public health theories, a campus-wide campaign was implemented. Evaluation efforts, via a follow-up web-based survey, are ongoing and will be completed in April 2021.

Results: Outcomes of this work will be used to make decisions, in collaboration with the Purdue University Pharmacy, on implementing two additional PhVMs. The anticipated outcome of this project is to increase access to affordable and reliable family planning, personal hygiene, and other health-related items at Purdue University.

Conclusions: Findings offer practical recommendations to guide PhVM messaging to increase awareness, use, and program expansion. Reflecting consumer needs via diversified product offerings, ensuring safety and privacy, and guaranteeing product quality should be considered a priority for increased PhVM use. Promoting PhVMs requires clear messaging that attends to outlets preferred by the target audience.

Mentor(s):

Andrea DeMaria, College of Health & Human Sciences, Public Health

Shawn O'Brien, Purdue University

Jake Tuell, Purdue University

Nicole Noel, Purdue University

Oral Presentation Abstract Number: 54 :: Life Sciences

College of Health and Human Sciences

Sleep duration and gross motor development within the context of elevated autism risk

Author(s):

Amy Janis, College of Health & Human Sciences

Abstract:

The purpose of this study is to expand our understanding of gross motor development in early childhood by examining its relationship with sleep duration in a longitudinal infant siblings design. The data used in this project was collected at 12, 15, 18, 24, and 30 months of age. The Mullen Scales of Early Learning (MSEL) and actigraphy data is used to assess gross motor skills and sleep, respectively.

A linear regression model was run for gross motor T-scores and sleep duration from onset to offset, with maternal education as a covariate. Sleep duration was not significantly correlated at any age with gross motor development. Correlates of gross motor skills included previous gross motor skills at 12, 15, and 18 months of age (r = .625, .726, .505, all $p<.05$). Correlates of sleep included previous sleep durations at 12, 15, 18, and 30 months (r = .987, .988, .353, .990, all $p<.05$).

The results of this study indicate that there is not a robust relationship between sleep duration and gross motor development in infants at high and low risk for ASD, which is in line with past research. With this new understanding, it could be useful to examine fine motor skills in relation to sleep, and to examine sleep and motor development in relation to emerging ASD diagnoses.

Mentor(s):

Amy Schwichtenberg, College of Health & Human Sciences, Human Development & Family Studies

Oral Presentation Abstract Number: 55 :: Life Sciences

College of Health and Human Sciences

"They're very passionate about making sure that women stay healthy": Women's experiences participating in a community paramedicine home visiting program

Author(s):

Hannah King, College of Health & Human Sciences

Abstract:

BACKGROUND: Community paramedicine programs (i.e., non-emergency preventive care by emergency medical services personnel under the direction of a physician) offer a novel approach to home-health programming. By addressing (directly or through warm referrals) the physical, mental, social, and economic needs of mothers and their infants, community paramedics improve the health and wellbeing of families.

OBEJCTIVE: To describe women's experiences in Project Swaddle, a community paramedicine home visiting program for pregnant women and postpartum mothers. By understanding their experiences, our work begins to build the foundation for similar programs and future examinations of the efficacy and effectiveness of these approaches.

METHODS: We completed interviews with women living in Indiana who were currently participating in or have graduate from Project Swaddle. Interviews were audio-recorded, transcribed, and analyzed using a six-phase approach to thematic analysis.

RESULTS: Four emerging themes resulted: 1) Program enrollment was influenced by the community paramedic's experience and connections; 2) Participating women trusted the community paramedic as an individual provider; 3) The community paramedic enhanced patient care through communication with other providers; 4) The program connected participants to resources improving their overall health and wellbeing.

CONCLUSIONS: Although the results of our process evaluation suggest Project Swaddle is a promising approach to improving the health and wellbeing of women and infants, rigorous outcome and impact evaluation is critical. Project Swaddle, and other community paramedicine programs, need to be rigorously evaluated to ensure that there are not unanticipated negative consequences of the program and that it is an effective use of resources.

Mentor(s):

Andrea DeMaria, College of Health & Human Sciences, Public Health

Laura Schwab Reese, Purdue University

Oral Presentation Abstract Number: 56 :: Life Sciences

College of Health and Human Sciences

Reproductive health decision-making among women at risk for having a child with Autism

Author(s):

Hannah King, College of Health & Human Sciences

Abstract:

Background: Many factors contribute to the rising prevalence of Autism Spectrum Disorder (ASD) over the past few decades, increasing parental concern and affecting future family planning. Despite an increase in ASD literature, limited research investigates reproductive health decision-making and genetic testing experiences among women at risk for having a child with ASD.

Objective: The purpose of this study is to understand reproductive healthcare access and decision-making among women who are at elevated risk (clinical, genetic, environmental) for having a child with ASD.

Methods: As part of a larger ASD-related sociocultural reproductive health and telehealth project, researchers conducted 18 in-depth interviews (February–November 2020) with women aged 23-59 years (37.07±7.88) living in the United States. Interviews were audio-recorded, transcribed, and analyzed using an expanded grounded theory framework. Constant comparative analysis identified emergent themes. HyperRESEARCH aided data organization and analysis.

Results: Three emerging themes resulted: 1) Healthcare access related to convenient team-based care; 2) Communicating healthcare decisions with partners, family, and healthcare providers; and 3) Genetic testing awareness, barriers, and facilitators.

Conclusions: Women's reproductive healthcare determinants focus on ease of access while displaying a tendency to pursue team-based care with a gynecologist as their primary care physician. Clear patient-provider communication and increased provider accessibility are associated with positive reproductive healthcare communication experiences. Insufficient consistent prenatal genetic testing communication led to decreased opportunity and widespread patient misconceptions. Understanding reproductive healthcare access and decision-making among this population allows researchers to recommend practical interventions for improving patient-provider communication and overall health outcomes.

Mentor(s):

Andrea DeMaria, College of Health & Human Sciences, Public Health

Carolyn McCormick, Purdue University

Oral Presentation Abstract Number: 57 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Investigating the effect of negative life events during pregnancy on infant temperament

Author(s):

Julia Kramper, College of Science

Abstract:

Prenatal risks like psychological distress can have formative effects on child outcomes, such as child temperament (Buitelaar et al. 2012). Wurmser et al (2006) found that infants of mothers with more negative life events in the preceding 12 months of early-mid gestation experienced more crying and fussing than infants of mothers who experienced fewer events. However, Bush et al (2017) did not find stressful life events during pregnancy to be related to any of the 3 temperament subscales (surgency, regulation and negative affectivity) of the Infant Behavior Questionnaire (IBQ). Given these inconsistent findings, the current study tested the association between negative life events experienced during pregnancy and child temperament at 6 months using the IBQ and additionally controlled for perceived stress, depression symptoms, hair cortisol concentrations and demographic variables. Data came from the Maternal Context of Pregnancy Project (n=34, Mage=29.14, 83% White), which followed pregnant women longitudinally at 12, 26, and 38 weeks, and 6 months post-partum (Marceau et al., 2021). Multiple regression models were used to test the association between negative life events and each IBQ subscale separately with covariates. Results showed no associations between negative life events and IBQ subscales. Lower hair cortisol concentration predicted higher negative affect (p=.0189) as did older maternal age at delivery (p=.0318). No significant predictors emerged for the surgency or regulation subscales. The current study did not find evidence of an association of negative life events with infant temperament. Nonetheless, results suggest that prenatal stress, particularly physiological stress, is related to infant temperament.

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Mentor(s):

Kristine Marceau, College of Health & Human Sciences, Human Development & Family Studies

Olivia Robertson, Purdue University

Oral Presentation Abstract Number: 58 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Purdue Canines for Autism Research Study

Presentation can be found under Poster Abstract #276.

Oral Presentation Abstract Number: 59 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Why is climate policy, not climate change itself, perceived to be a threat to the socioeconomic status quo?

Author(s):

Katherine Mason, College of Health & Human Sciences

Abstract:

Rhetoric surrounding climate change often focuses on the economic and social costs of climate action, stimulating motivations to downplay environmental problems - particularly among those predisposed to defend existing socioecological arrangements. Although climate policies may incur economic costs, scientists and economists warn that climate change itself presents an even greater economic threat in the long run. We examined perceptions of climate policy versus climate change itself as a threat to the socioeconomic status quo. As expected, conservatives and those high in system justification [SJ] perceived climate policy to be more threatening than did liberals/those low in SJ. The reverse was true for the perceived threat of climate change itself. Moreover, liberals/those low in SJ perceived climate policy to be less threatening than climate change; conservatives/those high in SJ did not differentiate between them. Study 2 will manipulate messages about climate policy and climate change itself as a threat to the status quo. We expect that those exposed to a message framing climate change itself (vs. climate policy) as a threat will show improved pro-environmental attitudes.

Mentor(s):

Erin Hennes, College of Health & Human Sciences, Psychological Sciences

Oral Presentation Abstract Number: 60 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Physical Affection and Marital Satisfaction in Newlyweds: the Mediating Role of Attachment Style

Author(s):

Abigail McDonald, College of Health & Human Sciences

Beatrice Smith, College of Health & Human Sciences

Abstract:

Both giving and receiving physical affection have been linked with greater overall health, commitment, communication, and relationship satisfaction. Reduced exchanges of physical affection have correlated with more pervasive marital problems and less constructive tactics for resolving conflict. Adult attachment styles are also an important element of maintaining successful relationships and individual growth. Previous research indicates that how an individual interprets and provides support is influenced by their attachment style. The goal of the current project is to determine if physical affection by a spouse in the presence of a (nonmarital) stressor leads to greater marital satisfaction, and if this association is moderated by attachment style. We present quantitative data on number and kind of stressors, the variety of types of support provided by partners, and receptiveness between spouses. Our sample comprises 99 newlywed couples (N = 198) from a Midwest community. Each person was assessed for anxious, secure, or avoidant attachment using a baseline questionnaire. Participants then completed a 12-day diary protocol that recorded daily events and partner interactions, including stressors within and outside of the marriage, the type of support each member of the couple gives and receives, and their individual daily marital satisfaction. Multilevel modeling is used to examine the association of physical support with daily marital satisfaction moderated by attachment style. We hypothesize that physical affection in the presence of a stressor will correlate with greater daily marital satisfaction, particularly for those with secure attachment; those with high anxious attachment will not display a satisfaction increase.

Mentor(s):

Susan South, College of Health & Human Sciences, Psychological Sciences

Oral Presentation Abstract Number: 61 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Human factor simulation study on the feasibility of bystander-administered naloxone delivered by medical drone to opioid overdose

Author(s):

Caitlin McGaffick, College of Health & Human Sciences

Noor Gulrajani, College of Engineering

Abstract:

Bystanders play a significant role in medical emergencies that do not occur in a hospital setting. The efficacy of bystanders who take action in an emergency situation must be assessed in order to develop future technology for bystander-administered medication to victims of opioid overdose, similar to the use of an automated external defibrillator (AED). This study focuses on the environmental factors that play a role in an individual's ability to accurately perform a task in response to verbal and/or visual instructions. The effect of a stressful environment, when compared to a controlled environment, was hypothesized to decrease the accuracy of performing a task guided by instructions and increase the time spent. College students will be recruited in busy outdoor areas on campus at Purdue University and asked to complete a six-question task-based survey. Participants of the control group will be asked to wait until they are in a controlled environment (i.e., home or library) to complete the survey. The experimental group will complete the same survey immediately in a publicly simulated stressful environment, filled with a variety of intentional distractions. The target number of participants is 225, with 150 in the control group and 75 in the experimental group to account for potentially poor adherence from the control group. We hypothesize that out of the six questions on the survey, the experimental group will answer one fewer question correctly than the control group. Data collection will take place in the last two weeks of March with analysis to follow.

Mentor(s):

Nan Kong, College of Engineering, Biomedical Engineering

Oral Presentation Abstract Number: 62 :: Life Sciences

College of Health and Human Sciences

Inequalities in Urban Exploration

Author(s):

Jacquelyn Meade, College of Health & Human Sciences

Abstract:

Commonly referred to as a socio-economic phenomenon, social inequality occurs when resources are distributed unevenly and is deeply intertwined with urban spaces Conceptualized as an activity to seek out, visit, and document derelict manmade structures including rooftops, runnels, and industrial complexes, urban exploration focuses on a unique and often hidden segment of urban spaces. The unguided and risk-taking nature of urban exploration has led to potential inequality issues in the urban exploration community including gender imbalance, uneven accessibility, and safety concerns. Through examination of secondary academic sources and online urban exploration forums, this study is designed to profile the inequality issues in urban exploration community and how these shape urban exploration as a tourism practice.

Mentor(s):

Jianan Zhang, College of Health & Human Sciences, Hospitality & Touris

Liping Cai, Purdue University

Oral Presentation Abstract Number: 63 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Productivity Tool Use, Performance, and Productivity

Author(s):

Megan Mitchell, College of Health & Human Sciences

Dante Bruno, College of Engineering

Abstract:

The purpose of this study was to understand the correlation between performance and use of productivity tools within U.S. undergraduate university students (N=253; 58.7% female ; Mage 19.64 ; 57.7% white). There is high pressure for students to perform well often with busy schedules at the university level. This online survey measured their performance, use of 13 productivity tools, and productivity goal setting (e.g., setting short-term goals as means to long-term goals). Correlational results showed that the use of a checklist (r=.143, p=.039) and a wall calendar (r=-.169, p=.015) was related to overall gpa. Moreover, the use of a brainstorming list (r=.166, p=.016) correlated to self-reported quality of academic performance. Average use across all tools correlated with productivity goal setting, specifically with setting short-term goals to achieve long-term goals (r=.136 p=.048), setting goals to improve while struggling (r=.139, p=.042), and making small goals to track progress (r=.315, p<.001). Overall, the findings have revealed potential benefits of certain productivity tool use and strategies for students. In particular, using a calendar, checklist, or brainstorming list may help improve academic performance. We draw caution to this conclusion as the current research relies on the use of a correlational design. Implications for workplace and future research directions (e.g., adopting an experimental approach) will be discussed.

Mentor(s):

Franki Y.H. Kung, College of Health & Human Sciences, Psychological Sciences

Oral Presentation Abstract Number: 64 :: Life Sciences

College of Health and Human Sciences

The effects of a single bout of aerobic exercise on hippocampal-dependent memory in children

Author(s):

Brandon Muczynski, College of Health & Human Sciences

Abstract:

Due to a growing trend of childhood inactivity, young children are becoming overweight and unfit, resulting in poorer physical health but also suboptimal development of the brain and cognition. In response, research has focused on designing exercise-based interventions to increase physical activity while improving cognitive function. Specifically, aerobic exercise has been shown to have acute benefits to the functional integrity of the hippocampus, a brain region essential for memory function, with exercise resulting in greater hippocampal functional connectivity and hippocampal dependent memory performance in young adults (Suwabe et al, 2018). It remains to be determined whether similar exercise-induced facilitation of hippocampal dependent memory can be observed in children. The purpose of this study was to explore acute effects of aerobic exercise on children's hippocampal memory. 8-10 year olds were recruited to complete a 20-min moderate aerobic exercise or a seated rest intervention on separate and counterbalanced days. Following intervention, a relational and item-specific encoding task and a memory recognition task were completed to evaluate hippocampal-dependent memory. Preliminary results (N = 6) did not show a significant difference in children's recognition performance following exercise compared to rest. This suggests that acute bout of moderate intensity exercise may not be enough to elicit changes in behavioral outcomes of hippocampal memory. Future research measuring hippocampal activation as a neural expression of memory performance in a larger sample size is needed to provide statistically powered and neural evidence to test the effect of a single bout of aerobic exercise on hippocampal memory in children.

Mentor(s):

Shih-Chun Kao, College of Health & Human Sciences, Health & Kinesiology

Nicholas Baumgartner, Purdue University

Oral Presentation Abstract Number: 65 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Role Implications for Social Support Network Structure in Depression among Adjudicated Adolescents

Author(s):

Sanjana Murthy, College of Health & Human Sciences

Abstract:

The current study examines how the relationship between the structure of social support networks and depressive symptoms changes over time in a population of adjudicated adolescents (N=1262) using data from the Pathways to Desistance study. Depressive symptoms were measured using the Brief Symptom Inventory, in which participants rated the extent they were distressed by various symptoms (0 = “not at all” to 4 = “extremely”). Supportive relationships were assessed using the Contact with Caring Adults inventory, in which participants identified the total number of domains in which at least one relationship was present and the number of domains in which at least three relationships were present (given that the total number of caring adults was not significant in the previous study, this dimension of social support will not be moving forward in data analyses). If our hypotheses are supported, we will find that a higher number of domains in which relationships are present will significantly be associated with a lower level of depressive symptomatology within adjudicated adolescents.

Mentor(s):

David Rollock, College of Health & Human Sciences, Psychological SciencesAdilene Osnaya, Purdue University

Oral Presentation Abstract Number: 66 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Evaluating the Impact of a University-Wide Free Menstruation Management Product Policy and Program

Author(s):

Allison Novorita, College of Health & Human Sciences

Jaclyn Frank, College of Health & Human Sciences

Stevie Burgett, College of Engineering

Abstract:

Background: Lack of access to menstruation products can negatively affect school attendance, academic performance, and individual health. To combat burdens menstruators face, the implementation of “period policies”, or programs offering free menstruation products, have become popular in schools, businesses, and communities. Purdue University announced in February 2020 that free tampons and pads will be stocked in all women’s and gender-neutral restrooms in campus buildings.

Objective: The goal of this study is to understand: 1) knowledge and stigma Purdue members hold surrounding menstruation; 2) experiences students and staff have had with the free menstruation product program and its influence on campus culture; 3) how the program and policy can be improved.

Methods: Our ongoing research plan includes three phases: 1) product testing via daily diary surveys (n=43); 2) focus group discussions (n=32 across 6 focus groups); and 3) a campus-wide survey (pending), all of which will be conducted from November 2020 through May 2021. Eligible participants are Purdue University students, staff, and faculty. All protocols and measurement tools will be approved by the Purdue University Institutional Review Board prior to data collection.

Results: Pending

Conclusions: Outcomes from this project will significantly contribute to menstruation management and period poverty solutions for faculty, staff, and students at Purdue University. The availability of free menstruation products may alleviate harsh social stigma surrounding menstruation and positively affect menstrual experiences.

Mentor(s):

Andrea DeMaria, College of Health & Human Sciences, Public Health

Audrey Ruple, Purdue University

Risa Cromer, Purdue University

Meghana Rawat, Purdue University

Oral Presentation Abstract Number: 67 :: Life Sciences

College of Health and Human Sciences

Role of Fatty Acid Metabolism in Human Breast Cancer Cell Migration

Author(s):

Parikshit Pawar, College of Health & Human Sciences

Abstract:

Breast cancer is the leading type of cancer in US women. Cancer cells may utilize fatty acids (FAs) for fatty acid oxidation (FAO) to produce adequate energy needed for cancer progression. FAs are primarily supplied by FA uptake, FA synthesis, or FA lipolysis from cellular stores of triacylglycerol. We previously showed that inhibiting FAO significantly reduces metastatic cancer cell migration, an important step in metastasis, whereas non-metastatic cell migration was unaffected. The goal of the current study is to determine the source of FAs that support FAO-dependent migration. We hypothesized that lipolysis of triacylglycerol drives breast cancer cell migration by providing FAs for FAO. To test this hypothesis, we analyzed metastatic MCF10CA1a human breast cancer cell migration treated with inhibitors of key enzymes involved in FA synthesis (FA synthase; TVB-3166), triacylglycerol lipolysis (adipose triacylglycerol lipase; ATGListatin), or either inhibitor in combination with the FAO inhibitor, etomoxir. Inhibition of FA synthesis significantly increased cancer cell migration compared to vehicle (~20% increase); however, dual inhibition of FA synthesis and FAO significantly reduced cell migration compared to FA synthesis inhibition alone (~25% decrease). Inhibition of FAO or triacylglycerol lipolysis alone significantly decreased cell migration compared to vehicle (~20% and ~10%, respectively) and cells treated with both inhibitors (for FAO and lipolysis) had similar percent cell migration compared to inhibition of lipolysis alone. Our results suggest that lipolysis provides FAs required for FAO-dependent migration in metastatic cells; therefore, inhibiting lipolysis may be a potential target to reduce the progression and mortality of cancer.

Mentor(s):

Chaylen Andolino, College of Health & Human Sciences, Nutrition Science

Dorothy Teegarden, Purdue University

Oral Presentation Abstract Number: 68 :: Life Sciences

College of Health and Human Sciences

USDA Nutrition Composition Databases, FNDDS and NNDSR, Yield Significantly Different Nutrient Totals of Food Items from 8 Midwestern Food Pantry Inventories

Author(s):

Catharine Pickford, College of Health & Human Sciences

Abstract:

Food pantries are part of the food environment that serve as a resource to food insecure groups. Determining nutrients within food pantries will inform interventions aimed to improve this food environment. This project's objective is to quantify and compare amounts of key nutrients from eight Midwestern food pantry inventories and the accuracy of food identification through novel application of two nutrition composition databases, the Food and Nutrient Database for Dietary Studies (FNDDS) and the National Nutrient Database for Standard Reference (SR 28). This cross-sectional secondary analysis of food pantry inventory data from the Voices for Food (VFF) Clinical Trial Registry: NCT0356609 included quantifying the mean amount of nutrients per food group and for total inventory by each nutrition composition database. The accuracy of food identification by each database was graded by assigning an accuracy score judging how closely the recorded food description matched the nutrient database food description. Ranked nutrient means and accuracy scores for each database were compared using the Wilcoxon 2-Sample Test, Fisher's Exact, and Multiple One-way ANCOVA. SR 28 was significantly more accurate in classifying food items when compared with FNDDS (P<.0001). For the *total* all food pantry inventories and when split by food groups, ranked LS mean values for Vitamin D differed significantly between databases (P<0.05). The total ranked LS nutrient means were also significantly different between databases for vitamins A, B12, C and D, calcium, choline, fiber, potassium, and sodium (P<0.0001). SR 28 may be a better choice to quantify nutrients in the food pantry environment.

Mentor(s):

Heather Eicher-Miller, College of Health & Human Sciences, Nutrition Science

Oral Presentation Abstract Number: 69 :: Life Sciences

College of Health and Human Sciences

Fast in vivo 23Na imaging and T2* mapping using accelerated 2D-FID magnetic resonance imaging at 3T

Author(s):

Evan Pogue, College of Health & Human Sciences

Abstract:

Purpose

To implement an accelerated MR- acquisition method allowing to map sodium T2* relaxation and absolute concentration within skeletal muscles at 3T

Methods

A novel fast-2D density-weighted concentric-ring-trajectory 23Na-MRSI technique was used to acquire 64 time-points of FID with a spectral bandwidth of 312.5 Hz from a 2.5 x 2.5 mm2 in-plane resolution within about 15 minutes. The fast-relaxing 23Na signal was localized with a single-shot, inversion-recovery based, non-echo (SIRENE) OVS method. The sequence was verified using simulation and phantom studies before implementing it in human calf muscles. Within two same-day sessions, 2D-SIRENE-MRSI (UTE = 0.55 ms) and 3D-MRI (UTE = 0.3 ms) data were acquired. The T2* values were fitted voxel-by-voxel using a bi-exponential model for the 2D-MRSI data. Within-subject coefficients of variation were estimated for both acquisition methods.

Results

The MRSI-FID data allowed for fast and slow T2* mapping of the calf muscles in vivo with minimal sensitivity reduction. The spatial-distributions of 23Na concentration for both in vivo MRSI and 3D-MRI acquisitions were significantly correlated (r = 0.7, P<0.001). The test-retest results rendered high reliability for both MRSI (CV = 5%) and 3D MRI (CV = 6%). The mean T2*Fast in calf muscles was 0.7 ± 0.1 (contribution fraction = 37%), while T2*Slow was 13.2 ± 0.2 ms (63%). The mean absolute muscle 23Na concentration calculated from the T2*-corrected data was 28.6 ± 3.3 mM.

Conclusion

Our proposed MRSI technique is indeed a reliable technique to map sodium's concentration and T2* within a clinically acceptable scan time at 3T.

Mentor(s):

Uzay Emir, College of Health & Human Sciences, Health Sciences

Oral Presentation Abstract Number: 70 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Variability of COVID-19 housing mitigation strategies at universities in Indiana: A content analysis

Author(s):

Madeline Powers, College of Health & Human Sciences, Honors College

Abstract:

Background: U.S. colleges and universities returned to classes in the fall of 2020 during the COVID-19 pandemic with little evidence-based information on which programs are effective for mitigating the spread of COVID-19. College students live in close quarters and are more likely to engage in high-risk behaviors, resulting in an increased risk of infection.

Methods: We conducted a systematic evaluation of COVID-19 campus initiatives regarding COVID-19 precautions in communal living environments for colleges and universities in Indiana with on-campus housing (N=40). After developing and refining a codebook, resolving discrepancies, and establishing strong intercoder reliability (Cohen's kappas = 0.74-0.95), the schools were coded using content analysis. We then quantitatively compared public and private institutions using chi-square analyses and independent samples t-tests.

Results: The majority of the schools included in the study were private institutions (70.0%; n=28). Average undergraduate enrollment was 5,331 students (SD=7,855), and mean female enrollment was 54.66% (SD=15.3). Results from the statistical analyses demonstrated public institutions had significantly higher prevalence of quarantine ($p=0.006$) and isolation ($p<0.001$) housing for Greek/Congregate living, as well as the presence of decreased housing density ($p=0.038$), compared to private institutions.

Implications: With the COVID-19 pandemic likely to extend into 2021, these results are critical to understanding how institutions of higher education can stay open until it is safe to resume normal activities. More work is needed to develop evidence-based strategies for housing during a pandemic to ensure that universities are using the best strategies to mitigate the spread of the virus.

Mentor(s):

Monica Kasting, College of Health & Human Sciences, Public Health

Oral Presentation Abstract Number: 71 :: Life Sciences

College of Health and Human Sciences

Evaluating the Particle Collection Efficiency of Dried and Reused Breathing System Filters

Author(s):

Kaushal Arvind Prasad, College of Health & Human Sciences, Honors College

Abstract:

Respiratory ventilators supply air with extra oxygen to patients who are unable to breathe adequately on their own. The surge of the COVID-19 pandemic demanded the need for mechanical ventilators because the onset of the illness can severely impair respiratory functions. Moreover, the demand for the air filters or breathing filters utilized in the ventilators increased, since the filters are recommended to be disposed upon single use. Therefore, methods to save or reuse filters have been urgently required. In this study, we collected dried used (wetted) filters from a city hospital and evaluated their particle collection efficacies for re-useability. Three clean filters and twelve dried filters were tested using the ISO standard. The total number concentration (TNC) and size of the test salt particles were measured. A photometer combined with a mass flow controller (MFC) and vacuum pump was used to measure the mass concentrations of test particles upstream and downstream of the test filters. The average collection efficiency of the filters was collected. For the results, the TNC and geometric mean diameter of particles ranged from 1.24 × 10^6 ± 3.86 × 10^4 particles/cm^3 and 70.9 ± 0.8 nm, respectively. The average mass concentration of the test particles ranged from 14.11 ± 1.53 mg/m^3. The average collection efficiency was found to be greater than 99.99%. Overall, this study demonstrated that drying the breathing system filters has not compromised their integrity and performance, thus allowing infection preventionists to consider drying and re-using these filters in mechanical ventilators.

Mentor(s):

Jae Hong Park, College of Health & Human Sciencesences

Tammy L. Poole, Indiana University Health

Jeffery Attwood, Indiana University Health

Rajat Kapoor, Indiana University School of Medicine

Vicky Strock, Indiana University Health

Leslie A. White, Indiana University Health

Melissa Kult, Indiana University Health

William A. Snyderman, Indiana University Health

Oral Presentation Abstract Number: 72 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

"We have to improve our culture about this": Family planning decision-making among women and men living in Italy

Author(s):

Taylor Raff, College of Science

Alyssa Amidei, College of Health & Human Sciences

Abstract:

Background: The male condom is currently seen as the most widely used family planning method in Italy and across Southern Europe. The majority of research on family planning methods is focused on women, so could be missing significant gender differences in behavior, as male partners play a critical role in family planning decision-making and pregnancy prevention.

Objective: A plethora of factors impact family planning decision-making. The purpose of this study was to explore attitudes toward contraceptive methods, including decision-making and desired improvements related to family planning in Italy.

Methods: Semi-structured interviews with 42 men and women aged 18–50 years (29.1±7.9) and living in or near Florence, Italy, were conducted between May and June 2019. Techniques from expanded grounded theory-guided data analysis allowed for a constant comparative approach to contextualize data and identify emergent themes.

Results: Four themes developed from the data:(1) Family planning methods; (2) Decision-making regarding family planning; (3) outside sources that influence decision-making about family planning; and (4) Desired improvements to family planning. Participants invited most forms of family planning methods; however, participants also revealed knowledge gaps and misinformation about hormonal contraceptive methods efficacy and long-term health effects. Participants illuminated family, general doctor, and significant other as the primary resource for information about family planning methods

Conclusion: Findings offer practical recommendations to guide social marketing and behaviour change interventions to increase family planning access among women and men in Italy. Improved messaging strategies could address concerns and knowledge gaps, which may improve family planning decision-making among couples.

Mentor(s):

Andrea L. DeMaria, College of Health & Human Sciences, Public Health

Oral Presentation Abstract Number: 73 :: Life Sciences

College of Health and Human Sciences

Influence of race and sex on student perceptions of COVID-19 prevention

Author(s):

Meredith Robbins, College of Health & Human Sciences

Belle Hinshaw, College of Health & Human Sciences

Perry Curtis, College of Health & Human Sciences

Abstract:

While mask wearing and social distancing practices have been proven to be effective in preventing infection of COVID-19, opinions regarding these precautions have been understudied. During fall 2020, 646 Purdue undergraduate and graduate students completed an online survey investigating opinions about general COVID-19 prevention efforts at Purdue, including effectiveness of masks, social distancing, compliance, and approval of disciplinary action. The goal for this analysis was to determine whether race, sex, and/or college are correlated with opinions regarding prevention. Statistical analysis included student's t-tests and ANOVA single factor analysis using Excel and Stata. Demographic characteristics included 386 (59.8%) female and 257 (39.8%) male participants. White participants were the most represented at 466 (72.14%) of the survey responses. The largest percentage of students who responded to the survey were a part of the College of Engineering and College of Health and Human Sciences at 146 (22.6%) and 111 (17.2%) respectively. Those more likely to strongly agree with statements consistent with stronger preventative actions were non-white participants excluding multiracial individuals (3 out of 10 questions were statically significant) and females (5 out of 10 questions were statically significant). Females and non-white participants indicated that they were more likely to reporting a friend for violating guidelines and agree that disciplinary action regarding violations were appropriate; these differences were statistically significant. No significant differences in opinions regarding prevention were observed based on College. Overall, student opinions were in favor of COVID-19 protective measures and gave a unique insight in an understudied population.

Mentor(s):

Ellen Wells, College of Health & Human Sciences, Health Sciences

Oral Presentation Abstract Number: 74 :: Life Sciences

College of Health and Human Sciences

Sleep in Veterans with Post-traumatic Stress Disorder and their Spouses

Author(s):

Carly Schofield, College of Health & Human Sciences

Abstract:

Background: Partners of individuals with PTSD present with higher levels of psychological distress when compared to partners of an individual without PTSD (Manguno-Mire, 2007). However, it is unknown if sleep disruption/deficiency plays a role in partner distress.

Objective: The present study will expand our understanding of the effect of sleep patterns in PTSD veterans on the sleep patterns of their spouses by examining simultaneously recorded actigraphy data. Based on previous research, we expect to find a positive correlation between veteran sleep and their spouse's sleep; wherein, veterans with more disrupted sleep will have spouses with more disrupted sleep.

Methods: The data for this study was collected by The Organization for Human-Animal Interaction Research and Education, in a prospective clinical trial to assess if service dog support could improve overall biopsychosocial functioning for veterans with PTSD. Prior to service animal placement in the home, each veteran and their spouse spent a 2-week period wearing an actigraph to record their wake and sleep states (O'Haire, 2018). Participants also self-rated their sleep disturbances with the Pittsburgh Sleep Quality Index (PSQI) - higher score suggests worse sleep quality (Buysse, 1989).

Results: Average nocturnal awakenings between veterans and their spouses followed a negative correlation pattern ($r = -.22$, $p < .05$); wherein, veterans with more awakenings had spouses that were less likely to wake at night. The same Pearson correlation test was done for average sleep efficiency between veterans and their spouses which followed a similar negative correlation pattern ($r = -.24$, $p < .05$). PSQI scores of the veteran and the sleep efficiency of their spouse were not correlated ($r = -0.081$, $p >.05$). Contrary to our hypotheses, veteran sleep disruption did not 'overflow' to disrupt spouse sleep in this sample.

Conclusion: Careful inspection of the data revealed that the negative associations were a reflection of high sleep variability for veterans and relatively low variably in their spouses. Future research can build on this study by assessing circadian elements of sleep (i.e., bedtime, morning rise time). Previous research demonstrates circadian sleep elements have a 'household' influence that may better capture how veteran sleep could influence spouse sleep (e.g., Strawbridge, 2004).

Mentor(s):

Amy Schwichtenberg, College of Health & Human Sciences, Human Development & Family Studies

Maggie O'Haire, Purdue University

Oral Presentation Abstract Number: 75 :: Life Sciences

College of Health and Human Sciences

High-Resolution Metabolic Mapping of the Cerebellum Using 2D Zoom Magnetic Resonance Spectroscopic Imaging

Author(s):

Jaiyta Sood, College of Health & Human Sciences

Abstract:

The purpose of the study was to propose a high-resolution Magnetic Resonance Spectroscopic Imaging acquisition strategy for the cerebellum. Due to its location in the posterior cranial fossa with complex anatomical structure, the cerebellum poses many challenges to medical imaging field and MRS. Cerebellum plays an indispensable role in supporting the functional activity of cerebrum, motor, and cognitive functions. This study included 5 volunteers who were scanned under a reduced field of view (rFOV) metabolite cycled MRSI acquisition with a grid of 48 x 48 to achieve a nominal 62.5 µL resolution in 9.6 minutes. The spectra was computed with the LCModel package. The generation of high-resolution metabolic mapping of metabolites such as the N-acetylaspartate, total creatine, total choline, glutamate and glutamine, and myo-inositol, in the cerebellum was possible because of the high quality of metabolic spectra obtained. Concentration distribution of different metabolites that were studied aligned with findings of previous MRSI studies. Thus, this study provided high-resolution metabolic maps of the cerebellum using the rFOV 2D MRSI technique.

Mentor(s):

Uzay Emir, College of Health & Human Sciences, Health Sciences

Oral Presentation Abstract Number: 76 :: Life Sciences

College of Health and Human Sciences

Changes in Neuropsychological Function in Welders over a Three-Year Period

Author(s):

Lauren Stucky, College of Science

Abstract:

Symptoms of manganese (Mn) toxicity often include subtle cognitive/motor effects. In a previous study on 45 welders, we reported significant correlations between manganese exposure and fine motor function. This follow-up study was done to assess changes in neuropsychological (NP) test performance over 3 years in a subset of 19 welders.

At teach time point, welders completed 7 NP assessments (examples: Finger Tapping Test (FTT), WAIS-III Digit Span (WDS), Trail Making Test (TMT), and Verbal Learning Test (VLT)). Exposure assessment involved personal air sampling at work and measurement of toenail Mn with ICP-MS. Repeated-measure ANOVA was used to test for significant change in both exposure and NP scores between the two time points. Spearman Rank correlation tests between NP scores and Mn exposure were completed at each time point (TPA and TPB).

Toenail Mn levels were significantly reduced ($p<0.05$) between the timepoints. ANOVA found a significant decrease in the FTT score ($p=0.023$) but increases in VLT-mean/total scores ($p=.014$/$p=.003$, respectively). Correlations of WDS and TMT with toenail Mn levels looked similar at TPA ($p<0.01$, $rho=-0.58$ and $p=0.02$, $rho=0.53$) and TPB ($p=0.11$, $rho=-0.43$ and $p=0.08$, $rho=0.46$), but were no longer significant at TPB.

These results may indicate that motor function (FTT) is not improving with decreasing exposure, while memory deficits (VLT) may be reversible. At TPA and TPB, subjects with higher Mn levels performed worse in attention/memory (WDS) and visual scanning/cognitive flexibility (TMT). A longitudinal study with a larger sample size is necessary to confirm these conclusions. (Supported by NIH R01 ES020529)

Mentor(s):

Ulrike Dydak, College of Health & Human Sciences, Health Sciences

Humberto Monsivais, Purdue University

Sandy Snyder, Purdue University

Oral Presentation Abstract Number: 77 :: Life Sciences

College of Health and Human Sciences

Evaluate the level of biological contaminants in the classrooms

Author(s):

Wendi Yuan, College of Health & Human Sciences

Abstract:

The Coronavirus disease 2019 (COVID-19) pandemic has been spreading in the U.S. According to the official data from Purdue COVID-19 Dashboard, 167,555 Purdue students and employees have been tested and 5,434 positive cases have been reported from August 1st, 2020 to March 12th, 2021. Both the Fall 2020 and the Spring 2021 semesters have offered hybrid in-person and virtual classes for more than 45,000 students. Although all classrooms and instructional equipment in the classrooms were cleaned with disinfection chemicals periodically during the semesters, the level of biological contaminants has never been evaluated. In this study, levels of biological contaminants in the classrooms were measured to ensure that classrooms were cleaned properly. A total of six classrooms were randomly selected in the HAMP and PHYS buildings on the Purdue West Lafayette Campus. In each classroom, biological contaminants on the surface of five spots including desks, the sneeze guards for the instructor, and the instructor’s desk were collected using sampling swabs. Biological contaminants collected on each swab were analyzed using adenosine triphosphate (ATP) bioluminescence assay. Three restrooms in the HAMP building were also randomly selected and the level of biological contaminants of one toilet seat in each restroom was also measured for the comparison. From the result, biological contamination levels of student desks are slightly lower than those of toilet seats. The surface of the sneeze guard was least contaminated. The results can be referred to improve Purdue’s plan for cleaning classrooms.

Mentor(s):

Jae Hong Park, College of Health & Human Sciences, Health Sciences

Oral Presentation Abstract Number: 78 :: Social Sciences/Humanities/Education

College of Liberal Arts

White Saviorism Through Religion

Author(s):

Gabriel Ako, School of Management

Abstract:

This essay aims to analyze religious imperialism and conversion and the manners in which it perpetuates both explicit and “colorblind” racism. Through an investigation of the history of white saviorism and colonial tourism under the guise of religious charity, I propose new perspectives on how this practice continues to destroy diverse cultures in the modern world. White saviorism is a complex in which a traditionally white person attempts to manipulate and transform the beliefs and practices of people of color in order to assimilate them into the construct of Western whiteness. I argue that this self-serving process, often masked in positive connotations, diminishes and demeans the rich and important cultures of those whom it effects. In order to analyze the contemporary effects of these power structures, I present a historical overview of white saviorism in Judeo-Christian religions, predominantly in the early colonization of the Americas and in Africa. These histories make clear that American imperialism is a major factor in contemporary white saviorism, and I will argue that imperialist ideologies in the U.S. are not only still as active today as they were in early American colonization, but also that these ideologies work through religious white saviorism to destroy cultural diversity through conversion while maintaining an illusion of charity. Ultimately, this work asks how we might learn from our history of religion-motivated racism in order to improve race relations in the unsettlingly divided present.

Mentor(s):

Monica Wolfe, College of Liberal Arts, English

Oral Presentation Abstract Number: 79 :: Social Sciences/Humanities/Education

College of Liberal Arts

Children's Museum Education Through the Interface of Virtual Exhibition

Author(s):

Abigail Craig, College of Liberal Arts

Abstract:

The purpose of this project is to partner with the Children’s Museum of Indianapolis to research and begin to develop a museum exhibition in a completely digital format that engages the primary audience of the Children’s Museum; namely, children and their families. The research behind the project comes from academic journals about digital exhibitions, journals concerning children's museum education, and surveys of elementary classes to determine what children wish to see in an online exhibit. The capstone of the project will be the framework of an exhibit meant to be completely rendered online, with artifacts rendered in a 3D medium using references from actual artifacts in the Children's Museum of Indianapolis. The final project will be presented as a combination of a PowerPoint presentation detailing the project and research as well as the beginnings of the design itself in a 3D rendering software. This project will serve as a prototype for museum exhibitions that are meant to be viewed entirely in an online format while remaining engaging with young audiences and their families.

Mentor(s):

Jennifer Noffze, The Children’s Museum of Indianapolis

Oral Presentation Abstract Number: 80 :: Social Sciences/Humanities/Education

College of Liberal Arts

The Saga of the People of Laxardal and Bolli Bollason’s Tale: Women within Viking Sagas

Author(s):

Alicia Geoffray, College of Liberal Arts

Abstract:

An essential prerequisite of the intensely patriarchal Viking society was a rigid binary denoting masculinity as superior to femininity, also intrinsically conflating and linking physical dominance to men. However, a number of women represented in Viking saga managed to operate skillfully under the guise of submission to such hegemony. While some, such as Unn from The Saga of the People of Laxardal and Bolli Bollason’s Tale, managed to decisively act and secure financial security of their own right, others, such as Gudrun, another female character within this saga, managed to connive and contrive a place for themselves in the midst of the brutal reality of Viking culture, which cared little for autonomous female desire.

Mentor(s):

Dino Felluga, College of Liberal Arts, English

Oral Presentation Abstract Number: 81 :: Social Sciences/Humanities/Education

College of Liberal Arts

Beauty Products: Chemicals Disproportionately Endanger Women of Color

Author(s):

Samantha Lu, College of Engineering

Abstract:

The purpose of this research is to spread awareness of the issue that women of color are facing more exposure to toxic chemicals than white women due to usage of personal care products designed to achieve European or white features. Conclusions were drawn from a scientific review of the literature on the motivations for buying these products as well as the effects of their ingredients on this population. Although the majority of the reviewed studies were performed in the United States, studies from around the world show that the pressure to conform to Western beauty standards is a transnational concern. Colorism, hair texture preference, and odor discrimination paired with ethnic marketing idealizing white or European features influence women of color to buy skin-lighteners, hair straighteners/relaxers, and odor-masking products. Usage of these products leave women of color with higher beauty-product chemical levels in their bodies than white women. This disparity cannot be explained by socioeconomic status. Studies have found that the ingredients in these products (mercury, phthalates, parabens, talc powder) pose a threat to a woman's reproductive system and can lead to life-threatening or life-altering outcomes. Additionally, studies have noted that personal care and beauty products lack complete ingredient labels. These findings highlight a need to continue to raise awareness among women of color about the health risks of these products, and medical professionals to counsel their patients who use them. Furthermore, in order for government regulators to enact legislation to protect consumer health, additional research is required.

Mentor(s):

Maria Mears, College of Liberal Arts, School of IDIS

Oral Presentation Abstract Number: 82 :: Social Sciences/Humanities/Education

College of Liberal Arts

Online Radicalization on Facebook

Project can be found under Poster Abstract # 275

Oral Presentation Abstract Number: 83 :: Social Sciences/Humanities/Education

College of Liberal Arts

White Feminist Icons: An Intersectional Case Study on Amelia Earhart

Author(s):

Rachel Small,

Abstract:

In recent years, a decentering of whiteness within the feminist movement has emerged due to the influx of postmodernist thought and an attention to the variety of lived experiences amongst women of color. This research will argue that this decentering initiated by the work of Black feminist activists like Alice Walker and Kimberlé Crenshaw has not been fully or properly meditated on by white feminists today. White feminists like Jessie Daniels have challenged the racist ways of the first and second waves calling them the ‘white women’s movement.’ However, this analysis on our past has not been realized within the current state of the feminist movement resulting in racial disparities amongst women in America. This research will position that the ‘white women’s movement’ still persists today, one example being the justification of historical white feminists as representative of all women. This ideology will be exemplified in a case study over the life and career of feminist icon Amelia Earhart. This research works to redefine Earhart through an intersectional lens that will reconcile the racist history of the feminist movement through a clarification of how she opened doors for women, and what women were allowed through those doors. Therein, this research will posit that an intersectional analysis of icons, like Earhart, as white feminists will aid in the fight to make the feminist movement an equal coalition for the lived experiences of all women.

Mentor(s):

Nancy Gabin, College of Liberal Arts, History

Oral Presentation Abstract Number: 84 :: Social Sciences/Humanities/Education

College of Liberal Arts

Making Humans New: Early 20th Century Transhumanism

Author(s):

Daniel Williams, College of Liberal Arts

Elizabeth Carrillo, College of Health & Human Sciences, Honors College

Abstract:

The purpose of this project is to investigate the sociological, political, and bioethical roles of human reproduction, the human body, and racial hierarchies through the lens of early 20th century transhumanism and eugenics . Transhumanism is the belief that people are capable of transforming and modifying their bodies through means of (but not limited to): spiritual exploration, physical enhancement, and genetic engineering . (Cambridge Dictionary) Eugenics is the belief that the human race can be improved through the promotion and breeding of "superior" genetic makeup within selected groups of humans. (Cambridge Dictionary)

Using peer-reviewed journals, and nonfiction and fictional works from the early 20th century, we investigate: 1) What is the role of human reproduction in making humans new? 2) What are the roles of the human body and its sense organs in making humans new? 3) How will we overcome racial hierarchy in making humans new? 4) How far should we go in making humans new? All findings from our research are gathered to develop an understanding of the authors' rational, public reactions at their date of publication. Then compared contemporary reactions and how they contribute to today's understanding of transhumanism and eugenics. Results of our investigation are used to compare the similarities and differences in how transhumanism and eugenics aim to "improve" the human body and track their separation from each other over time. Over the duration of this project, research has provided interesting perspectives on women's role within transhumanism.

Mentor(s):

Maren Linett, College of Liberal Arts, English

Oral Presentation Abstract Number: 85 :: Life Sciences

College of Pharmacy

Designing a Protein Drug with the Computer Program FoldIt

Author(s):

Ma. Emmanuelle Domingo, College of Pharmacy, Honors College

Abstract:

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) caused a global outbreak and encouraged study of the virus to develop treatments and vaccines to gain a deeper understanding into slowing the spread. The COVID-19 spike protein is important for viral entry into cells and has been identified as a potential therapeutic target. Computer algorithms have predicted novel proteins that can potentially bind to the receptor-binding domain of the spike protein and prevent COVID-19 infection; however, accurately predicting the natural folding of proteins into 3D structures inside cells using computer algorithms remains a challenge in computational biology. In this study, the inquiry of what protein structure is optimal for binding to the spike protein was addressed. First, a literature review was conducted of the structure-function relationship of the 2019-nCoV spike protein. Next, the online game FoldIt was used to manually manipulate proteins until the least energetically costly configuration was identified. Two proteins were designed to have optimal 3D structures that could bind to the spike protein. These two proteins were discovered to be strong candidates due to optimization of their hydrophobicity and intact hydrophobic core for stability, hydrogen bonding to increase affinity between the protein and virus, and amino acid sequence specificity against the ACE2 spike protein.

Mentor(s):

Zahra Tehrani, Honors College

Oral Presentation Abstract Number: 86 :: Life Sciences

College of Pharmacy

Clinically-viable DMSO-free cryopreservation of human natural killer cells

Author(s):

Zachary Leung (equal contributions), College of Pharmacy, Honors College

Emmett Niemeyer (equal contributions), College of Pharmacy

Abstract:

Cryopreservation is a critical part of the preparation of natural killer (NK) cells for adoptive transfer immunotherapy into patients. Clinical infusions of NK cell-based products, including their genetically engineered variants, typically contain DMSO. Clinically, the use of DMSO is undesirable because its use has resulted in severe reported toxicities in patients. Development of safer, infusible alternatives which eliminate DMSO and have favorable safety profiles, including the ability to eliminate laborious washing steps at the point-of-care facility, are needed. However, efforts to develop clinically-viable DMSO-free alternatives for human primary NK cells have been met with little success. We have shown that DMSO-free solutions based on combinations of sugars, osmolytes, and amino acid derivatives can successfully cryopreserve NK cells without DMSO with high viability post-thaw. Based on these observations, we have postulated that combinations of non-penetrating and penetrating cryoprotectants—including sugars, osmolytes, proteins, and polymers—that are infusible and eliminate the need for post-thaw washing can achieve superior cryopreservation of NK cells. We have evaluated these combinations on human NK cells and tested their post-thaw viability and cytotoxicity. This is the first time that such DMSO-free cryopreservation studies have been carried out on human primary NK cells. Our studies pave the way toward safe, effective, and infusible cellular therapy products devoid of DMSO-associated toxicities.

Mentor(s):

Sandro Matosevic, College of Pharmacy, Indus & Phys

Oral Presentation Abstract Number: 87 :: Physical Sciences

College of Pharmacy

Analyzing Excipient Variability

Author(s):

Jack Moen, College of Pharmacy

Abstract:

This project aims to identify how identically labeled products of magnesium stearate (MgSt) vary in physio-chemical properties on a molecular scale. Specifically, this project focuses on the particle sizes and surface areas of MgSt products that has been sourced from different manufacturers. Each sample has been assessed on its surface area, range of particle sizes, and rate of dissolution against each measured particle size. This has been done to understand how physio-chemical properties can play an integral role in a multitude of facets; all the way from tablet processing to the distribution of medication in-vivo. As it stands, the data is indicative of the assumption that lower particle sizes have greater surfaces; thus, enabling greater rates of dissolution. That said, the range of these particle sizes within each manufacturer's product varies heavily. Supposing that a certain range of particle sizes produce more desirable results leaves room to discuss how one manufacturer's MgSt is superior to another's in the world of pharmaceuticals.

Mentor(s):

Eric Munson, College of Pharmacy, Indus & Phys

Daniel DeNeve, Purdue University

Oral Presentation Abstract Number: 88 :: Life Sciences

College of Science

Key Genetic Contributors to Myasthenia Gravis and Other Autoimmune Disorders

Author(s):

Alyssa Flint, College of Science

Abstract:

Myasthenia Gravis (MG) is an autoimmune disease of the neuromuscular junction. The purpose of this study is to further analyze the effect that Human Leukocyte Antigen (HLA) alleles have on genetic risk for MG as well as to determine if there are any shared genetic contributors to other autoimmune disorders as to MG. For the HLA analysis, we performed association tests and conditional analyses on EOMG, LOMG, and a merged EOMG and LOMG dataset. With the LOMG dataset we discovered that AA_DRB1_-16_3_2665457_V (P value = $2.2x10^{-6}$), AA_DRB1_71_32_659935_K (P value = 0.001), and AA_DRB_-25_3_2665484_R (P value = $2.2x10^{-6}$) were the top variants. To explore the shared genetic background with other autoimmune disorders, we tested the genetic correlation of MG with 15 autoimmune traits; and we found significant genetic correlations with Juvenile Idiopathic Arthritis (rg = 0.721 , P value = 0.003), Vitiligo Late Onset (rg = 0.327, P value = 0.032), Type 1 Diabetes (rg = 0.669, P value = $4.8x10^{-7}$), and Rheumatoid Arthritis (rg = 0.499, P value = $3.8x10^{-5}$). Furthermore, we performed a meta-analysis on these four diseases along with MG in order to determine which SNPs may be contributing to all of the diseases. These results will allow for a better understanding of the genetic and immunologic basis of MG which may lead to improved therapeutics based on novel target loci.

Mentor(s):

Peristera Paschou, College of Science, Biological Sciences

Apostolia Topaloudi, Purdue University

Oral Presentation Abstract Number: 89 :: Physical Sciences

College of Science

Examining the Geologic History of Mercury's Caloris Basin using Mapped Faulting Patterns within Superposed Volcanic Flows

Author(s):

Evan King, College of Science

Aubrey Bennett, College of Science, Honors College

Abstract:

The 1500-km-diameter Caloris basin is Mercury's largest, oldest, and best-preserved impact basin. It is filled with volcanic flows that display a variety of faulting features, including extensional graben and compressive ridges, with varying orientations from radial to concentric relative to the basin center, suggestive of a complex loading history. In order to unravel this history, we conducted a comprehensive mapping campaign by uploading high-resolution imagery from the MESSENGER spacecraft's Mercury Dual Imaging System into ArcGIS Pro. Faults were categorized by style and orientation to reveal their spatial variability throughout the basin, and their relative timing was inferred through cross-cutting relationships.

Our results reveal three distinct regions of graben distinguished by a change in orientation: a progression of radial orientation near the center of the basin, known collectively as Pantheon Fossae, to a concentric nature at medial regions, to more polygonal towards the basin's edge. In contrast, ridges are found to be almost exclusively concentrically oriented throughout the basin. Cross-cutting relationships established between graben and ridges suggest that the ridges may generally be older, suggesting a transition from a compressive regime, perhaps due to subsidence induced by the emplacement of the fresh lava flows, to extension, perhaps resultant from uplift due to loading outside the basin. Collectively, the spatial and temporal relationships derived from our mapped features aide in reconstructing Caloris basin's complex geologic history and changing stress field from the time of its formation to the present day.

Mentor(s):

Gregory Gosselin, College of Science, EARTH, ATMOSPHERIC, & PLANETARY SCIENCES

Andy Freed, Purdue University

Oral Presentation Abstract Number: 90 :: Life Sciences

College of Science

Development of Continuous Flow Sonogashira Coupling of lead Anti-Cancer Small Molecule Inhibitors for Potential Treatment of Acute Myeloid Leukemia

Author(s):

Yuta Moriuchi, College of Science, Honors College

Abstract:

HSN-608, an anticancer lead compound for Acute Myeloid Leukemia (AML) has a specific potent activity to FTL3 Kinase as it inhibits FLT-3 as wells as all mutated forms of FLT-3. Inhibition of FLT3 Kinase leads to inhibition of downstream pathways such as MPK and P13K pathways. The batch synthesis of HSN-608 poses challenges in process chemistry and scale up due to high catalyst loadings, poor yields, and handling of an explosive reagent. We have developed a robust process for the two-step synthesis of HSN-608 involving Sonogashira coupling and Amide Coupling using flow chemistry. Continuous flow synthesis is more efficient, safer, faster, and readily scalable. For the amidation reaction, variation in residence time and temperature revealed that higher residence time and lower temperatures are more favorable for the reaction. For the Sonogashira coupling reactions, different types of palladium catalyst and copper co-catalyst were screened. The best catalyst found was PdCl2(MeCN)2 with the ligand [(t-Bu)3PH]BF4 giving us a yield of 88%. Further optimizations led to reduction in the catalyst loadings to 1%. In conclusion, we were able to develop an optimal, safe, and scalable continuous flow synthesis of a lead medicinal chemistry anti-cancer agent. This approach can be applied to other anticancer and medicinal chemistry targets.

Mentor(s):

David Thompson, College of Science, Chemistry

Shruti Biyani, Purdue University

Oral Presentation Abstract Number: 91 :: Mathematical/Computation Sciences

College of Science

Child Speech-to-Text Model

Author(s):

Vishaak Narayan, College of Science, Honors College

Moya Zhu, College of Science

Shaan Luthra, College of Science

Skyler Tucker, College of Engineering

Abstract:

In the last decade, the field of Automatic Speech Recognition (ASR) has rapidly transformed. However, current ASR systems do not have enough children's speech data to build a recognition model that accurately transcribes a 3-5 year old child’s speech patterns. The goal of this project is to develop a working speech recognition model that is compatible with both young children and adult voices.

We began by comparing the adult transcription accuracy and child transcription accuracy of popular ASR systems, finding that accuracy decreased by 20-25% when a child was speaking. The team then began planning our algorithm and developmental workflow.

In Fall 2020, our work focused on the pre-processing pipeline that cleans the audio signal, performs pre-emphasis to balance high and low-frequency components, and reduces the dimensionality of the audio signal making it easier to train on. Furthermore, we created processes to extract features from the audio signal like Mel-Frequency Cepstral Coefficients.

This semester, the team has focused mostly on preparing for model training, specifically aligning our audio features with their given transcripts. Upon completion of this task, the next step is to begin training the model. This involves building the Hidden Markov Model, Probabilistic Model, and Deep Learning model that will input the audio signal and transcribe it. Upon completion of training, the model will accurately transcribe children’s speech. This technology is a valuable stepping stone to improve Artificial Intelligence systems and further implement technology into social and educational environments.

Mentor(s):

David Purpura, College of Health & Human Sciences, Human Development & Family Studies

Oral Presentation Abstract Number: 92 :: Social Sciences/Humanities/Education

Honors College

Geographical Analysis of Indicators of Resident Retention

Author(s):

Eli Coltin, School of Management, Honors College

Abstract:

In the northern neighborhoods of the City of Lafayette, Indiana, over 70% of households have an estimated income lower than $20,000. These northern neighborhoods are plagued by residents that see their living situation as transient, but the city strives to build a community where residents will want to live for an extended period. The purpose of this study was to identify geographical and numerical trends associated with these low-income residents. In partnership with the City of Lafayette, geographical and numerical data about local households was analyzed to understand these trends and aid in the city's effort to increase resident retention in the northern neighborhoods by identifying areas to focus retention efforts on. So, the study focused on analyzing household data to identify locations with patterns of low-income home renters. The method to identify these locations was plotting each household on a map of the studied neighborhoods and filtering households by different factors to derive geographical trends. Analyzing these trends concluded that household income and retention had minimal relation to the value of the home. Also, renters were more likely to live in their home for shorter amounts of time. Geographical visualizations were produced focusing on the low-income home renters, the northern neighborhood's likely transient residents, and geographical areas of low-income home renters were identified. With these specific areas identified, it was recommended to the community partner, the City of Lafayette, to focus resources on efforts of retention on these specific areas of the northern neighborhoods of Lafayette.

Mentor(s):

Jason Ware, Honors College

Oral Presentation Abstract Number: 93 :: Life Sciences

Honors College

Designing SARS-CoV-2 antiviral proteins using FoldIt

Author(s):

Taryn Coyle, College of Science, Honors College

Abstract:

In 2019, a novel coronavirus called SARS-CoV-2 was discovered and found to cause the respiratory disease COVID-19. Since then, this infectious disease has spread across the globe, creating a healthcare and economic crisis. A primary target for pharmaceuticals has been the spike glycoprotein of SARS-CoV-2, a highly-antigenic region that is integral in viral entry and infection. This project proposes two novel antiviral protein designs, constructed to competitively inhibit binding of the SARS-CoV-2 spike glycoprotein to the human ACE2 (hACE2) receptor. Thousands of potential antiviral protein candidates have been generated algorithmically, however algorithms are not able to reliably predict the 3D structure of these protein candidates, and these proteins will only function in their most energetically-favorable configuration. Utilizing the FoldIt software, a game-like protein-design program designed at the University of Washington, the potential 3D configurations of two different proteins have been proposed. These proposed protein designs have potential applications in the ongoing development of therapies for those suffering from COVID-19, due to the competitive inhibition of the SARS-CoV-2 spike glycoprotein.

Mentor(s):

Zahra Tehrani, Honors College

Oral Presentation Abstract Number: 94 :: Social Sciences/Humanities/Education

Honors College

Investigating the Effects of Community-Based Educational Robotics Programs on Underrepresented Youth

Author(s):

Eric Flaningam, College of Engineering, Honors College

Hanna Keyerleber, College of Engineering, Honors College

Chris Embry, School of Management, Honors College

Abstract:

Low-income and minority students are widely underrepresented within STEM programs. This disparity is evident throughout all grade levels and the trend carries through to the workforce, where low-income and minority students enter STEM occupations at a lower rate than their peers from other demographics. Several STEM programs have been developed within schools to address the gap, but previous research has demonstrated that low-income students have a lower participation rate in academic STEM programming. The Ware Research Group has prior experience in studying low-income communities. This study is investigating how FIRST LEGO League, an established STEM program, can affect low-income and minority student engagement when conducted in a community-based setting. The research team has established two FIRST LEGO League teams in local community centers serving low-income neighborhoods within Lafayette, IN. Participating students range in age from 9-14 and come from primarily minority demographics within the community. Acting as instructors, the research team is engaging students in action-based projects which rely on the use and development of technical, teamwork, and critical thinking skills. The study, thus far, has collected qualitative data on the students' skills. Observations are based on student growth and educational outcomes focused on technical skills and abilities, critical thinking, communication, and teamwork. Community-based STEM programs may improve low-income and minority student representation in STEM programs and fields. Furthermore, the study could provide a resource for developing similar community-based STEM programming.

Mentor(s):

Jason Ware, Honors College

Oral Presentation Abstract Number: 95 :: Physical Sciences

Honors College

Dual Bed Recycle Catalyst Deactivation

Author(s):

Akash Garg, College of Engineering

Abstract:

The company, Scientific Design Co. Inc (SD), has created a model for a dual bed recycle reactor in Excel VBA. The company is involved in ethylene glycol (EG) production and produces designs for chemical facilities as well as catalysts. One of the goals is to increase selectivity towards MEG, as opposed to byproducts (DEG, TEG, etc.) This model utilizes several optimization algorithms to determine what the selectivity and production is at a given input, temperature, and catalyst. This model uses resin catalysts that hydrate ethylene oxide in the EG reaction. Resin catalysts deactivate over time. The model assumed no deactivation, which prevents SD from suppling an accurate lifetime. My project was to incorporate, using proprietary information and the following paper, “The Cause and Quantitative Description of Catalyst Deactivation in the Ethylene Oxide Hydration Process,” (Shvets et al.) a model for catalyst deactivation into the dual bed recycle reactor model. When a client wants to buy a catalyst, SD would generally guarantee a particular lifetime. The resin catalyst increases selectivity towards MEG from 91% (thermal PFR) to >99% with resin catalytic EO hydration. Through modeling deactivation, SD would be able to evaluate this new scheme with catalytic EO hydration. Most information regarding this project is proprietary. Therefore, this presentation will consist of a methodological discussion of what was done, and the approach taken to resolve the questions. Furthermore, there will be a discussion as Shvets et al. and how modeling can be done with respect to it.

Mentor(s):

Alan Rempel

Oral Presentation Abstract Number: 96 :: Social Sciences/Humanities/Education

Honors College

Purdue Student Body's Eating Habits and Motivations for Selection of Food in Relation to Getting Takeout

Author(s):

Ethan Guardado, College of Science

Kiet Nguyen, College of Engineering

Sonny Ghosh, College of Engineering

Carmen Benes, College of Health & Human Sciences

Sharavanan Sivakumar, College of Engineering

Setul Parekh, College of Engineering

Abstract:

Students make up the highest college population, so dining courts and restaurants are advisory to follow students' wants and needs closely. Managers can better tailor eating places, in particular, the takeout aspect, by examining the eating habits of students. Even though it may be counterintuitive to order takeout due to various expenses, a large portion of students engage in the activity. However, research on the topic is scarce in spite of the importance. Related literature is limited concerning the relationships between college students' eating habits and getting takeout and motivations for choosing takeout instead of other food options. Therefore, this research hopes to contribute information to the subject by determining usual and unusual characteristics in the correlation between eating habits and getting takeout. It does this by examining the Purdue student population by utilizing a questionnaire addressing different features, such as academic year, schedule availability, and dietary restrictions. The study will also discover how often students order takeout, confirming how much the activity's popularity is for the population. Eventually, our research revealed that it is not often that students choose takeout as a food option. Moreover, as students become older in college, they seem to commit to the activity less. However, students still rely on getting takeout under certain conditions, such as personal diet or lack of food options from dining courts and their opening hours. The research has furthered knowledge in getting takeout concerning a large college community and addressing the causes behind a commitment to the activity.

Mentor(s):

Jason Parry, Honors College

Oral Presentation Abstract Number: 97 :: Social Sciences/Humanities/Education

Honors College

The Role of Social Media in Celebrity Endorsements

Author(s):

Georgia Miller, College of Health & Human Sciences, Honors College

Abstract:

Celebrity endorsements utilize the visibility, accessibility and familiarity of celebrities to advertise a product or brand. Celebrities who are attractive and possess likeable qualities tend to have endorsements that are more effective, in that consumer purchase intention and behavior increase from viewing the advertisement. Social media has created new opportunities for visibility and accessibility of celebrity endorsements. Consequently, this has changed the methods in which companies engage celebrities for advertising purposes. Social media also affects a celebrity's image and reputation that, in turn, affects the effectiveness of an endorsement. This paper will explore the important factors that contribute to effectiveness of celebrity endorsements and the role of social media in advertising.

Mentor(s):

Deborah Nichols, College of Health & Human Sciences, Human Development & Family Studies

Oral Presentation Abstract Number: 98 :: Social Sciences/Humanities/Education

Honors College

Automated Data Processing: Making Community Indicators Possible for Lafayette, Indiana

Presentation can be found under Poster Abstract # 274.

Oral Presentation Abstract Number: 99 :: Social Sciences/Humanities/Education

Honors College

Genres of Music Impacting Performance in Academia

Author(s):

Riya Raj, College of Engineering

Claire King, College of Agriculture

Shruti Goyal, College of Science

Shannon Sturt, College of Science

Nathan Hunt, College of Engineering

Abstract:

The use of study music can positively, negatively, or not affect an individuals performance on their assignment or project. Comparing different genres, based on their influence on students' productivity, has been intensively researched in academia. However, there is a lack of testing on the preferences and performance of college students across different disciplines. We have collected data from 100 Purdue University students on what type of music, if any at all, they prefer to listen to while performing different academic tasks, thus revealing their study preferences for maximizing focus and productivity. The academic tasks we considered included memorizing material, problem solving, reading, creative writing, and hands-on learning. Our results revealed that a majority of students prefer to do most of these activities without music, indicating that they feel music hinders their ability to perform at their peak.

Mentor(s):

Jason Parry, Honors College

Emily Myers

Rina Jiang

Oral Presentation Abstract Number: 100 :: Social Sciences/Humanities/Education

Krannert School of Management

Projected Student Enrollment during the Covid-19 Pandemic for Fall 2020 at Purdue University

Author(s):

Maxim Bebekoski, School of Management, Honors College

Abstract:

Predicting and projecting student enrollment has been of continued interest for higher educational institutions. At Purdue University in West Lafayette, the Purdue Office of Enrollment Management provides services detailing yield rates and selectivity for enrollment, including the number of incoming students to specific college programs and students taking distance learning remotely. The Fall 2020 academic school year at Purdue University was analyzed with regard to incoming freshman students in the College of Engineering. Using institutional data on the Purdue University IDATA website, the incoming freshman class size total for Fall 2020 was 8,869 students at Purdue West Lafayette, the freshman class size in the College of Engineering for Fall 2020 was 2,455, with 373 being online and 2,082 being residential. Online refers to anyone who is part of the official online cohort, meaning that they are actually paying a reduced tuition and are only able to take a subset of the total Purdue Catalog of offered courses. The Office of Enrollment Management noted this was a special item that was created just for the pandemic. It was hypothesized that with COVID-19 and students choosing to stay at home rather than attend in-person, this could have had a significant impact on the student population size. It was concluded that with the Office of Enrollment Management planning ahead of time during summer 2020, student population size was not drastically affected. Big Ten universities are compared regarding enrollment projections, yield rates, and population numbers using Bridgett Milner’s Big Ten Common Data Set and IPEDs Comparisons on Tableau.

Mentor(s):

David Nelson, Vice Provost for Teaching & Learning, Center for Instructional Excellence

Oral Presentation Abstract Number: 101 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

Prolonged Standing in the Operating Room

Author(s):

Mengzhou Chen, School of Management

Abstract:

Prolonged standing is strongly associated with fatigue and affects many occupations, such as surgeons. Prior research has revealed that a lack of dynamic movement for 30 minutes can lead to discomfort. Hence surgeons, who often perform operations that last 2-3 hours, may be affected by static positions in the operating rooms that put them at ergonomic risk for musculoskeletal injuries. This study aimed to investigate how surgeons use weight shifts and other foot movements to mitigate the effects of prolonged standing during surgery. Data was collected in the operating rooms using a pressure sensing platform. Pre- and post discomfort surveys were collected from each surgeon. A total of 16 exposures (Mean=136.4 mins, SD=41.0 mins), consisting of 9 attending and 7 assisting surgeons, were analyzed. The data was processed by the MATLAB algorithm, and the outputs were analyzed to increase the accuracy for each exposure. Preliminary results have revealed that there were differences in the standing patterns between attending and assisting surgeons. Average shifts increased over time for the fatigued surgeons and slightly decreased for the non-fatigued surgeons. Further, fatigued surgeons had higher entropy than non-fatigued surgeons, and the entropy of both surgeons decreased over time. Fatigued surgeons had higher entropy in mediolateral direction and non-fatigued surgeons had higher entropy in anterior-posterior direction. On average, fatigued surgeons had higher entropy than non-fatigued surgeons. As a result, the standing related metrics in unconstrained prolonged standing will be determined, and the impact of job-specific roles in surgeons' standing patterns will be identified.

Mentor(s):

Denny Yu, School of Industrial Engineering, Purdue University

Hamed Asadi, School of Industrial Engineering, Purdue University

Dimitrios Stefanidis, School of Medicine, Indiana University

Oral Presentation Abstract Number: 102 :: Social Sciences/Humanities/Education

Krannert School of Management

A Study on Business Strategies Implemented to Deal with the Impacts of the COVID-19 Pandemic

Author(s):

Natalie Gurnik, School of Management

Abstract:

This research investigates the impact of the COVID-19 pandemic on a variety of businesses. It examines the strategies that businesses deployed as a reaction to COVID-19 to see if these strategies assisted or hindered the businesses success. This study analyzes both short-term and long-term impacts of the strategies implemented as a reaction to the pandemic and proposes a reapplication plan for the best strategies that other companies can implement to improve resiliency in the face of other future challenges. This study includes data from three different companies from varying industries and locations. The findings show that the companies who were flexible in varying degrees, changed their prioritization, and adapted their supply chain were the most successful at counteracting COVID-19s biggest impacts on their business. Moreover, the companies who built new or strengthened weak supplier relationships were able to respond effectively to COVID-19s challenges. While this research does look at an array of businesses, it does not consider small companies and local businesses. Therefore, the impacts and strategies identified may not apply.

Mentor(s):

Olga Senicheva, School of Management, Operations Management

Oral Presentation Abstract Number: 103 :: Social Sciences/Humanities/Education

Krannert School of Management

Contact Tracing and Civil Liberties During the Covid-19 Pandemic

Author(s):

Rachel Hauser, School of Management, Honors College

Abstract:

The Covid-19 pandemic presents unique challenges to universities seeking to maintain student and staff safety while still holding in-person classes during the fall semester of 2020. Universities across the country have implemented various technological initiatives to limit the spread of Covid-19, including location tracking, physical distance monitoring, and contact tracing of both students and faculty. These technological responses yield serious concerns regarding invasions of privacy and could create a dangerous precedent leading to increased location surveillance in the future. While the fourth amendment and subsequent case law protects individuals from unwarranted violations of privacy by the government and public universities, it does not hold private universities to the same strict standard.

The Protect Purdue Plan, which outlines Purdue University's response to the Covid-19 pandemic, avoids sweeping location tracking of students. Rather, the Protect Purdue Plan provides for contact tracing consisting of in-person interviews and mandates that all students must participate. Though the method of data collection itself is not particularly invasive, the data that is collected and stored can potentially be misused and given to the state without student permission. Purdue University and other universities across the country must consider the tradeoff between maintaining the spread of Covid-19 and protecting the individual liberties of both students and staff.

Mentor(s):

Cara Putman, School of Management, Business Law

Oral Presentation Abstract Number: 104 :: Social Sciences/Humanities/Education

Krannert School of Management

Education's Approach to Upholding Academic Integrity After Transition to Remote Learning

Author(s):

Kenneth Kanwischer, School of Management, Honors College

Abstract:

Abstract redacted.

Mentor(s):

Cara Putman, School of Management, Business Law

Oral Presentation Abstract Number: 105 :: Innovative Technology/Entrepreneurship/Design

Krannert School of Management

Analysis of US Initial Public Offering (IPO) in 2015-2020

Author(s):

Xiyu Liu, School of Management, Honors College

Abstract:

Private companies often find it difficult to keep raising funds from external investors once they have received many rounds of financing. In these cases, going public through an initial public offering (IPO) becomes an attractive source of funding for their growth while allowing current investors to harvest their returns. In this study, I collect data from S&P Capital IQ to analyze the newest cohort of IPOs in the U.S. between 2015 and 2020. It shows that small companies have a better long-term performance compared to large ones. One year after the IPO, the first had an average return of 43.30%, while the latter was 29.95%.

Mentor(s):

Fabrício d'Almeida, School of Management, Dept. of Management

Oral Presentation Abstract Number: 106 :: Mathematical/Computation Sciences

Krannert School of Management

Data-driven Workload Prediction and Resource Planning for COVID-19 Preparedness

Author(s):

Hang Wang, College of Science

Shuwen Kan, College of Science

Abstract:

Since the first outbreak of the highly contagious virus called COVID-19, the United States has tragically turned into the most impacted country. Our research team has been collaborating with IU Health with the goal of helping hospitals in Indiana make quick adjustments and design strategies to meet the anticipated demand for space, staff and other resources during the disruptive pandemic. With the data provided by IU Health, we have made sophisticated analyses of daily patient census, arrivals, and discharges in different hospitals across multiple regions in Indiana using various methods of data analytics. Meanwhile, we designed and fine-tuned a brute-force search algorithm that learns from aforementioned descriptive statistics and makes daily census prediction. Later, we moved beyond this naïve algorithm and developed multiple advanced machine learning models including linear and logistic regression, gradient boosting tree, random forest, and neural network to generate more accurate discharge predictions from both the individual and hospital level. So far, we have found that our brute-force algorithm can produce relatively good census prediction and that while our neural network model can make more accurate hospital-wise discharge prediction, errors may accumulate when used to produce census prediction due to the model’s high sensitivity to input. As for individual level prediction, our machine learning models for predicting probability of discharge have achieved an AUC greater than 0.7. Next, our team plans to predict probability distributions of patient discharge using neural network with modified layers and loss functions, hoping to obtain better census prediction for major hospitals.

Mentor(s):

Pengyi Shi, School of Management, Supply Chain and Operations Management

Oral Presentation Abstract Number: 107 :: Mathematical/Computation Sciences

Krannert School of Management

The Future has Spoken: The Opportunity of Passive Investment

Author(s):

Michael Welleck, School of Management, Honors College

Abstract:

Abstract - Purpose. This paper explores the effort, risk and reward associated with two unique investment strategies, known as passive investing and active investing. Methodology. Empirical data for a large set of equities spanning a decade is divided into those within unique exchange-traded fund portfolios and those that are not part of these portfolios. The raw data itself is harvested from the Wharton Research Database as well as public sources. Historical returns viewed as stochastic processes are then analyzed using regression analysis. Subjective and objective data sources are used to estimate effort and risk. Novelty. Unique and contemporary insights are established that are vital to deciding on an appropriate investment strategy. Conclusions. Active investment strategies are built on the notion of informed and highly skilled investors utilizing deep insights and costly information to frequently trade equities based on the advantage of early price discovery. Since the effort involved is high, overhead cost is implicitly high. Despite deep predictive analyses, individual equities benefit and suffer from more volatility than indexed portfolios due to the inherent variability in an individual company's challenges and performance. Passive investment strategies by definition require less effort and less expertise because they rely on pooled equities reflecting a lower cost of management and returns based on the overall performance of entire market segments or indexes. The strategy that produces the highest returns with the least amount of effort and lowest risk all depends on the profile of the investor.

Mentor(s):

Kevin Koharki, School of Management, Accounting

Oral Presentation Abstract Number: 108 :: Social Sciences/Humanities/Education

Krannert School of Management

Managing Supply Chain Disruption Risk for Coronavirus Outbreak

Author(s):

Hui Zeng, School of Management

Quan Wang, School of Management

Shuoyao Li, School of Management

Abstract:

The ongoing COVID-19 pandemic continues to threaten public health and the global economy. The shortage of the medical supply chain, such as personal protective equipment (PPE) and ventilators, may have amplified the damage of the pandemic. Our research aims to address the following research questions: What happened to the medical supply chain and how resilient is the medical supply chain? How to enhance the strategic sourcing and procurement for the medical supply chain? How should the distribution system respond to the pandemic and supply chain disruption caused by the pandemic?

We collect the trade data and characterize the change of medical supply before and after the pandemic using difference-in-difference analysis. We then use Python programming to construct a PPE global supply chain map and integrate it with the distribution of suppliers and the regional economic indicators, which could ensure supply chain transparency. In terms of the sourcing strategy, we analyze the product category for PPE products and ventilators based on the Kraljic Matrix and Dutch Windmill Matrix and propose new sourcing and procurement recommendations. In terms of the response strategy, by investigating the resource allocation guidelines, there are potential impacts of different response strategies on the infection rate and death rate relative to the pandemic. Through the comparison, we are able to identify strategies that are more effective in controlling the spread of COVID-19 disease. By looking at both supply and demand sides, we aim to rebuild a supply chain that is resilient to disruptions such as the COVID-19 pandemic.

Mentor(s):

Zhan Pang, School of Management, Dept. of Management

Oral Presentation Abstract Number: 109 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

Early Childhood Education, Animation, and YouTube

Author(s):

Kayla Cole, Polytechnic Institute, Honors College

Lauren Krieger, Polytechnic Institute, Honors College

Em Miller, Polytechnic Institute

Abstract:

The purpose of this project is to take a children’s book, created by the Department of Human Development and Family Studies, focused on teaching pattern recognition, and make it easily accessible for children on YouTube by restyling it into a 3D animated short. This study documents the process researchers went through to create the animation from the book, and seeks to examine how childhood education television programs can be adapted to fit the rapidly changing media environment in which online viewing platforms, such as YouTube, are surpassing television as children's primary choice for screen viewing. First, this study describes the process of creating an animated short and introduces steps such as modeling, rigging, and texturing the characters and environment used in the book. Then, using an illustrated voiceover reading of the children’s book created by the Department of Human Development and Family Studies as a control video, researchers will also compare YouTube Analytics to examine audience attention span and reach between the animated video and control video to see if the project is a successful recreation that shares the same educational material, and captures the audience’s attention.

Mentor(s):

David Purpura, College of Health & Human Sciences, Human Development & Family Studies

Alexa Ellis, Postdoctoral Fellow

Yemimah King, Doctoral Student

Oral Presentation Abstract Number: 110 :: Social Sciences/Humanities/Education

Purdue Polytechnic Institute

A Woman's Path to the Aviation Industry

Author(s):

Katelyn Graver, Polytechnic Institute, Honors College

Abstract:

The purpose of this study is to understand what motivates and attracts women to become pilots and to outline how they got involved in the aviation industry and the path they took to get there, especially those without a family legacy of pilots. Only six percent of pilots are women, and as one of few female pilots in Purdue University's flight program, I wanted to research how other women decided that aviation was the career for them. This study involved interviewing several female pilots, all at different stages in their careers: college students who work as flight instructors, recently graduated alumni working as airline pilots, and women with decades of experience working at legacy airline companies. Each participant in the study was asked a set list of questions including how the subject got into flying, what made them want to be a career pilot, and what obstacles or gender norms/stereotypes they faced along the way. The majority of female pilots enter the aviation line of work because they know someone who is already a part of the industry or because they have had previous exposure to it. The goal of this study is to not only learn how each of these pilots chose their path, but also discover how more women can get exposure to this male-dominated industry. Through this study, I will analyze the career path of various female pilots, and determine what could be done to attract and increase the number of female pilots for the future.

Mentor(s):

Alyssa Harvey, Polytechnic Institute, AVIATION & TRANSPORTATION TECHNOLOGY

Oral Presentation Abstract Number: 111 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

Development of an Open-source Mobile Robot Platform for Multi-robot Systems

Author(s):

Jaeeun Kim, Polytechnic Institute

Abstract:

Multi-robot systems have become more popular over the years with the advancement of mass production and communication technology. One of their advantages is breaking a cumbersome task into smaller, manageable tasks with a swarm of cooperating robots. However, such systems may require high costs and skill levels to manage the environment. Therefore, we propose an open-source, low-cost mobile robot platform that can facilitate the research and education involving multi-robot systems.

The developed robots run on Robot Operating System (ROS) 2, using Raspberry Pi 4 as the mainboard computer. The hardware is composed of 3 layers of PCB, including various input and output devices. The robots as a swarm can form different types of formations, change their light either individually or as a whole, and measure the distance of nearby obstacles. In the future, we will utilize this platform to investigate the effects of a swarm/multi-robot on human perception and cognition. In addition, we will enable K-12 teachers and students to access this robot platform to promote their education and interests in STEM.

Mentor(s):

Wonse Jo, Polytechnic Institute, Computer Information Technology

Byung-Cheol Min, Polytechnic Institute, Computer Information Technology

POSTER PRESENTATIONS

Presentations arranged by the academic unit judging the presentation and by the first author's last name.

Poster Presentation Abstract Number: 1 :: Life Sciences

College of Agriculture

Comparative Analysis of the Bacteriophage SilverDipper

Author(s):

Allison Ayers, College of Engineering

Jordan Keuneke, College of Pharmacy

Michael McGovern, College of Engineering

Lucas Johnson, College of Engineering

Maansi Asthana, College of Engineering

Abstract:

Bacteriophages are the world's largest source of untapped genetic information. Researchers have recognized their various applications ranging from medical to agricultural uses and further research is being done to unlock their full potential. The purpose of our final project is to fully annotate and evaluate the start site and function of all genes within our bacteriophage, SilverDipper. Our methods involve consulting different online resources such as PECAAN, DNA Master, Phamerator, PhagesDB, and the SEA-PHAGES guide to effectively evaluate the probability that a gene exists, the start site of this gene, as well as product sequence analysis to evaluate the function and the protein produced by these genes. Additionally, our team has consulted PyMOL, Phyre2, SplitsTree, Phylogeny.fr, and Python in order to better annotate our genome and understand the inner workings of our phage and how it interacts with the environment. Since the process of annotating an entire genome has been split between multiple groups, our results will be finalized by the time of the poster due date. Our project focuses on a comparative study of computational, structural, and evolutionary methods to evaluate how physical characteristics affect function. Specifically, the genes that we are analyzing code for specific functions such as: minor tail proteins, DNA helicases, endonucleases, and glycotransferases.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Emily Kerstiens, Purdue University

Gillian Smith, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 2 :: Physical Sciences

College of Agriculture

Lawrence Pedestrian Realm: Integrating the needs of people into street design

Author(s):

Nathan Barsanti, College of Agriculture

Abstract:

The purpose of the Lawrence Pedestrian Realm is to redevelop transportation zones within the city of Lawrence so that they can safely accommodate pedestrians, bicyclists, public transportation users, and personal vehicles. Currently, Lawrence, Indiana is a personal vehicle dominated city in Marion County which is in the Indianapolis metropolitan area. The city is predominately suburban in nature and is home to many people who commute to Indianapolis. The Lawrence Pedestrian Realm is serving the community by creating methods of transportation networks that are safe, accessible, and sustainable. The city lacks appropriate networks for pedestrians and public transportation. The compiled evaluation models serve to address the zones within the city that currently lack pedestrian infrastructure and have space for redevelopment. The data gathered came from interviews with stakeholders in the community from Purdue Extension and the Indianapolis Public Transportation Corporation, as well as public GIS spatial data. The appropriate layers have been overlaid to provide a complete understanding and breakdown of the opportunities within the project zone. These layers of data serve to pinpoint specific locations in Lawrence that are in critical, moderate, and low need for redevelopment. The locations addressed in the evaluation model have provided enough information to bring together a model that encapsulates potential change in the community. The change model meets the goals that I have set forth for this site in the locations addressed in the evaluation model.

Mentor(s):

Aaron Thompson, College of Agriculture, Horticulture & Landscape Architecture

Poster Presentation Abstract Number: 3 :: Life Sciences

College of Agriculture

Assessing bias in odor communication studies

Author(s):

Stephanie Dijak, College of Agriculture, Honors College

Abstract:

Many species use olfaction as a main form of communication. Because of this, odor signals could be a useful tool to improve captive animal welfare by reducing aggression and promoting positive social interactions. However, to fully gauge the potential benefits of odor manipulation, the quality of existing literature must be evaluated first. Therefore, a systematic review was conducted to assess bias in existing olfactory literature, focusing on how intraspecific odors from mammalian species can impact non-reproductive social behaviors.

A library database search produced 3609 articles. Articles were screened for pre-determined inclusion criteria: they must be peer reviewed studies and evaluate how an odor signal directly effects social behavior, among other key points. After screening, 66 articles remained and were assessed using SYRCLE's risk of bias tool, which examines ten sources of research bias. These results will focus on randomization, blinding, and housing.

Of the 66 articles, 61.76% did not describe a randomization method for assigning treatment/treatment order. In 83.82% of articles, it was unclear (either reported vaguely or not mentioned) if the researchers were blinded to the treatment when recording outcomes. Similarly, in 89.71% of articles, it was unclear if animals were assigned to housing randomly.

Overall, these data indicate that the majority of the articles in this study contain major experimental biases. A lack of reporting makes it difficult to determine each experiment's quality and how much weight it should be given when interpreting outcomes pertaining to our overall understanding of olfactory communication.

Mentor(s):

Brianna Gaskill, College of Agriculture, Animal Sciences

Amanda Barabas, Purdue University

Marisa Erasmus, Purdue University

Poster Presentation Abstract Number: 4 :: Life Sciences

College of Agriculture

Determining the role of antifungal drug resistant mechanisms of Candida glabrata

Author(s):

Livia Georgescu, College of Agriculture

Abstract:

Antifungal drug resistance is a growing problem that affects millions of people. Fungal infections can be superficial, such as ringworm and athlete’s foot, or systemic, such as those that affect immunosuppressed patients. Systemic infections affect patients suffering from autoimmune diseases, HIV/AIDS, undergoing chemotherapy, or who had undergone an organ transplant. Human pathogens such as Candida glabrata opportunistically infect hosts with weakened immune systems and are naturally resistant to azole drug treatment. Azoles are a class of antifungal drugs that inhibit the biosynthesis of ergosterol, which is an integral part of fungal membrane fluidity and is equivalent to cholesterol in humans. Antifungal drug resistance can originate through various mechanisms, among them being altered gene expression or mutations in the genes that govern the ergosterol biosynthesis pathway or are involved in exporting xenobiotic drugs, and biofilm formation. Our approach is to identify genes that alter azole drug efficacy to find new pathways that could be targeted for antifungal drug development.

Mentor(s):

Scott Briggs, College of Agriculture, Biochemistry

Kortany Baker, Purdue University

Poster Presentation Abstract Number: 5 :: Life Sciences

College of Agriculture

A bioinformatic analysis of the relationship between α-KG-dependent histone demethylases and cancer formation

Author(s):

Clayton Hicks, College of Agriculture, Honors College

Abstract:

Abstract redacted.

Mentor(s):

Ann Kirchmaier, College of Agriculture, Biochemistry

Poster Presentation Abstract Number: 6 :: Life Sciences

College of Agriculture

Phenotypic Analysis of ino80 pkl Plants

Author(s):

Emily Johnson, College of Agriculture, Honors College

Abstract:

Abstract redacted.

Mentor(s):

Joseph Ogas, College of Agriculture, Biochemistry

Jiaxin Long, Purdue University

Poster Presentation Abstract Number: 7 :: Physical Sciences

College of Agriculture

Greening the Food Desert - A Design Approach to Flanner House Urban Farm

Author(s):

Ellen Joseph, College of Agriculture

Abstract:

The purpose of my project is to design a sustainable community farm that seeks to recycle resources and enhance biodiversity. The area of study is located in the northwest neighborhood of Indianapolis where there is a mixture of low-income households and other commercial uses such as churches and gas stations. This section of Indianapolis is defined as a food desert. By partnering with Flanner House, a local organization that runs a farm and grocery store, I am researching the world of low food access and addressing the community's need for healthy, sustainable food sources and educational opportunities. The research methods to identify these opportunities included layering GIS data as well as an extensive search of appropriate case studies that related to the site. By evaluating components such as environmental, physical, and social structures, I identified the areas requiring greatest improvement. Through this process, I learned there is a need for stronger pedestrian connections, the collection of stormwater runoff, and habitat to increase wildlife biodiversity. Since this is a low household income area, it is important to include pedestrian access points as well as additional signage to alert and educate the community about the farm while also incorporating sustainable processes such as water harvesting and composting. Therefore, my framework plan is formulated around connecting people and nature, promoting sustainability, and inviting in more wildlife.

Mentor(s):

Aaron Thompson, College of Agriculture, Horticulture & Landscape Architecture

Poster Presentation Abstract Number: 8 :: Social Sciences/Humanities/Education

College of Agriculture

Accessing Indiana Communities: Regional Trail Networks as a Guide for Community Development

Author(s):

Sydney King, College of Agriculture

Abstract:

The ecologically rich landscape of northwestern Indiana, specifically Lake, LaPorte, Porter, and St. Joseph counties, requires a complete trail framework plan to connect its communities to key natural and built amenities. The Northwestern Indiana Regional Planning Commission and the National Parks Service have documented the region’s existing trails and proposed important corridors, but they have also expressed that the area is in need of a comprehensive assessment of these trail locations. There are pieces of natural cores scattered throughout this region that the current trail network does not reach, and a connection would improve the quality of life for the surrounding communities. The purpose of this project is to evaluate where in the study area is best for trail development through analysis of the existing natural, social, and built amenities. The region’s existing habitat cores and recreational parks or facilities, populated areas and places, and abandoned rail corridors with the trail proposals from NIRPC and NPS led to the final proposal for a trail framework plan. Layering maps of this data from GIS outlined the places within the region that are well or poorly served with trail networks, as well as built trail systems that would benefit from improvement. With these layers of information, the following landscape framework plan will serve as a resource to improve the connectivity between these communities and define northwest Indiana with one of the best trail networks in the nation.

Mentor(s):

Aaron Thompson, College of Agriculture, Horticulture & Landscape Architecture

Poster Presentation Abstract Number: 9 :: Life Sciences

College of Agriculture

FAP-targeted NIR imaging of cancer for florescence guided surgery (FGS)

Author(s):

Kate Kragness, College of Agriculture

Abstract:

According to the American Cancer Society in 2019, there will be an estimated 1,762,450 new cancer cases diagnosed. A typical post-diagnosis cancer treatment plan is surgery followed by radiation and/or chemotherapy. However, there are challenges when patients follow this standard treatment plan. First, it can be difficult to determine which tissues are cancerous; depending on the type of cancer and the size of the tumors. Second, if most of the cancer cannot be surgically removed, the odds of radiation or chemotherapy being successful are significantly lower. Some patients may have to go through multiple rounds of radiation and/or chemotherapy. Multiple treatments could compromise the health of patients and they may not be strong enough to continue their treatment plan depending on their stage of cancer. Fluorescence guided surgery (FGS) can solve the identification and localization of cancer tissues. Cancer cells express a protein called fibroblast activation protein (FAP) that can be targeted by a synthesized ligand with a florescence dye tag. The ligand will only bind to FAP and cause the cancer cells to glow under direct florescent light in surgery. FGS allows the surgeons to remove cancerous tissues from patients more thoroughly, which greatly improves their odds for a successful outcome.

Mentor(s):

Philip Low, College of Science, Chemistry

Ramesh Mukkamala, Purdue University

Poster Presentation Abstract Number: 10 :: Life Sciences

College of Agriculture

Using a Split-Root System to Identify Genes Involved in Shoot-to-Root Signaling of Arabidopsis

Author(s):

Emily Kuhn, College of Agriculture

Abstract:

Increasing nitrogen use efficiency of plants, through approaches such as increasing the capacity of roots to forage for nitrogen, can reduce the need for artificial fertilizers and lead to a cleaner environment. It is known that root-to-shoot long-distance signaling plays an important role in root foraging in Arabidopsis, but the identity of these signals is still unclear. A unique “split-root” system was developed to study root foraging. For the procedure, Arabidopsis seedlings had their primary roots cut until two lateral roots remained. These two lateral roots were separated using a split plate and exposed to different nitrogen conditions (nitrogen-supplied or nitrogen-deprived). After four days, the roots were scanned and the images were analyzed to compare root growth between the nitrogen-supplied side and the nitrogen-deprived side, as a measurement of the root foraging capacity of the plant. Our preliminary studies have identified 2 candidate genes whose expression levels are regulated by the split-root conditions. We hypothesized that these candidate genes are required for adequate root foraging. To test this, multiple mutant lines in these genes were compared to wild type plants in the split-root system. We expected that mutations in genes that are important in shoot-to-root signaling will lead to altered root foraging in Arabidopsis. We are still in the process of screening mutants and interpreting the results, but we hope to find mutants in specific genes to cause altered root foraging, indicating that biological processes dictated by these genes could be involved in the signaling pathway important for root foraging. The obtained knowledge can then be applied to suggest new targets for conventional breeding or genetic engineering to help increase nitrogen uptake efficiency and reduce synthetic nitrogen fertilizer use.

Mentor(s):

Ying Li, College of Agriculture, Horticulture and Landscape Architecture

Ryan Patrick, Purdue University

Poster Presentation Abstract Number: 11 :: Physical Sciences

College of Agriculture

Effects of Soil Thaw on Nitrous Oxide Emission Rate

Author(s):

Erika Maneke, College of Agriculture

Abstract:

Nitrous oxide is a greenhouse gas that is non-uniformly emitted from soil throughout the year. Frozen soil has been found to have an increase in nitrous oxide emissions during the thawing process. This study aims to compare the nitrous oxide emission rates between thawing soil that has been frozen for more and thawing soil that has been frozen for less than forty-eight hours. For this study, nitrous oxide emissions, air temperatures, soil temperatures and other meteorological and soil data were collected for two consecutive winters from a corn field the experienced periods of freezing and thawing. The data was inputted to Windtrax, a program that uses the atmospheric and emissions data collected to calculate the emission rate based on a Lagrangian stochastic model. A minimum detection limit of nitrous oxide emissions was calculated for the entirety of the two winter time periods to establish a baseline emission rate. Results showed that the nitrous oxide emission rates from thawed soil that was frozen for less than forty-eight hours were not statistically different from the emission rates of thawed soil that was frozen for more than forty-eight hours. The nitrous oxide emission rates of thawed soil frozen for less than forty-eight hours exceeded the minimum detection limit during more than one thawing event. Furthermore, nitrous oxide and carbon monoxide emissions during the spring thaw suggest that the output source is of natural, nonanthropogenic origin.

Mentor(s):

Richard Grant, College of Agriculture, Agronomy

Poster Presentation Abstract Number: 12 :: Life Sciences

College of Agriculture

High-carotenoid popcorn, an opportunity to deliver beneficial nutrients to consumers.

Author(s):

Rachel McDowell,

Abstract:

Consumption of higher levels of lutein and zeaxanthin (L&Z) is associated with visual health function and a reduced risk of age-related macular degeneration. Unfortunately, American adults consume on average 1.7 mg/day of L&Z combined, which is likely insufficient to attain these health benefits. Popcorn has traces of L&Z, and modern breeding can increase these concentrations to improve nutrient potential. We examined popping expansion (PE) capacity and carotenoid levels of commercially available popcorn (n=13) and on a subset (n=93) of our experimental orange popcorn breeding lines. PE among commercial popcorn seeds had an average value of 30.8 mL/g (24.7–37.8 mL/g). Various experimental orange breeding lines made of five different orange donors were backcrossed with four different commercial elite popcorn inbreds. As expected at this stage of the breeding process, PE in orange popcorn lines showed an average of 26.9 mL/g (5.6–38.8 mL/g). Determination of total carotenoids revealed a commercial average of 13.1 μg/g dried weight (9.2–17.2 μg/g DW), whereas our orange popcorn breeding lines showed a mean of 28.6 μg/g (18.2 μg/g DW–42.9 μg/g DW). Despite only partially phenotyping just a subset of our orange popcorn breeding lines, we identified specific lines with high PE (>30 mL/g) and total carotenoids (>32 μg/g DW) that have become candidates to serve as parents of our first Orange Popcorn F1 hybrid.

Mentor(s):

Torbert Rocheford, College of Agriculture, Agronomy

Darwin Ortiz, Purdue University

Tyler Lawson, Independent researcher

Poster Presentation Abstract Number: 13 :: Life Sciences

College of Agriculture

The effect of day and level of colostrum intake on uterine development in neonatal pigs

Author(s):

Sara Scinto, College of Agriculture

Lisa Senn, College of Agriculture

Abstract:

Colostrum is the first milk, and provides nutrients and bioactive factors critical to survival, development and fertility of pigs. Endometrial glands of the uterus support fetal growth during pregnancy. The first week postnatal is a critical period of uterine development. At birth the uterus is composed of the myometrium, stromal tissue and a single layer of epithelial cells that line the lumen. Endometrial glands develop from the single layer of epithelial cells by invading into the stroma. We hypothesized that amount of colostrum piglets intake effects the growth and development of the uterus. Study objectives were to: 1) Compare uterine development at birth and 7 days postnatal, and 2) Determine the effect of two different doses of colostrum on uterine development. Gilts (n=20) were assigned at birth to Day 0 (D0;n=6) or Day 7 colostrum 10% (D7COL10;n=7) or colostrum 20% (D7COL20; n=7). D0 were immediately euthanized. Remaining pigs were bottle fed colostrum at a dose of 10% (D7COL10) or 20% (D7COL20) of body weight the first 24 h after birth, and then returned to litters to nurse. On postnatal day 7, COL10 and COL 20 were euthanized. After euthanasia uteri were removed. Tissue was fixed in formalin, sectioned, mounted on glass slides and stained with hematoxylin and eosin. Images were captured at 5X and 10X magnification using light microscopy. ImageJ was used to measure area and perimeter of the myometrium, stromal and endometrial tissues. Analysis of variance will be used to determine effect of day and treatment on uterine development.

Mentor(s):

Theresa Casey, College of Agriculture, Animal Sciences

Kelsey Teeple, Purdue University

Poster Presentation Abstract Number: 14 :: Life Sciences

College of Agriculture

Can heterosis increase the success of restorations using seed from small remnant sources?

Author(s):

Isabelle Turner, College of Agriculture

Abstract:

Only 10% of native tallgrass prairie remain. Prairie species are therefore at greater risk of extinction due to habitat loss, reduced genetic variation needed to adapt to environmental change, and stochastic fixation of deleterious alleles. One strategy to alleviate these risks is active site restoration by seeding with prairie species, thus preserving biodiversity and providing habitat for pollinators and other animal species. However, restoration efficacy critically depends on initial seed sourcing method. Highly local seed sourcing preserves adaptation to local conditions while more distant seed sourcing should maximize genetic variation and relieve the consequences of fixed deleterious alleles. Both aspects are necessary for the establishment and continuation of restorations. Regional admixture sourcing—collecting seed from multiple regional populations—has been proposed as a compromise between increasing genetic variation and retaining adaptation to local conditions. Here, I experimentally test the efficacy of regional admixture seed sourcing for restorations by performing more than 600 crosses within and between three populations of the threatened Indiana prairie perennial, Silene regia, from remnant sites in Tippecanoe, Fountain, and Vermillion counties. Crosses between populations mimic the result of regional admixture and may have increased fitness compared to crosses within populations because of heterosis or hybrid vigor. Estimates of fitness are still underway, but so far, I have quantified germination success of 3600 total seeds, juvenile survival for nearly 2000 seedlings, and will continue to monitor survival and reproduction in controlled environment and field experiments.

Mentor(s):

Christopher Oakley, College of Agriculture, Botany & Plant Path

Poster Presentation Abstract Number: 15 :: Physical Sciences

College of Agriculture

A Grand Welcome into the Life of Abraham Lincoln

Author(s):

Kelli Varney, College of Agriculture

Abstract:

The purpose of this project is to maximize the visitor experience at the Lincoln Home in Springfield, Illinois to create a strong level of confidence, comfort, and ease for guests, allowing for interactions to be as impactful as possible. This landscape is currently maintained to uphold historical integrity, but lacks a clear sense of arrival. The visitor experience lacks strong direction and doesn't allow for guests to have an impactful interaction upon arrival. By reimagining the welcome sequence and interaction level throughout the site, visitors will be immediately welcomed in a way that seamlessly immerses them into the culture of the 1850s to learn more about the life of our sixteenth president.

Mapping the opportunities and constraints within the current site conditions determined areas where improvements can be made to maximize guest experience. Visitor's studies conducted by the National Park Service and personal testimony from the current Chief of Interpretation for the site were utilized for this process.

Producing these models outlined specific locations where the visitor's experience can be improved to allow for a smooth transition into the site and promote recognition of the historic location. Understanding these locations allows for the creation and implementation of a strong sense of arrival.

Utilizing these areas of opportunity, conceptual plans will address the arrival sequence to create a strong site identity that welcomes visitors in with ease. Conceptual plans will include landscape revisions and wayfinding elements designed to accentuate the historic elements of the site while maintaining its integrity.

Mentor(s):

Aaron Thompson, College of Agriculture, Horticulture & Landscape Architecture

Poster Presentation Abstract Number: 16 :: Life Sciences

College of Agriculture

Phylogenetic and Structural Analysis of a Cluster B1 Mycobacteriophage Adenylate Kinase

Author(s):

Brendan Williams, College of Agriculture

Emily Lintott, College of Engineering

Marisa Aloe, College of Engineering

Abstract:

Bacteriophages are viruses that infect bacterial cells to reproduce. Bacteriophages have strong industrial functionality; broadening knowledge of gene evolution can expand applications. This project is focused on Gene 01 of bacteriophage Giraffe (adenylate kinase) and aims to develop a relationship between individual genes and phage clusters based on conservation of functional domains. Phylogenetic-tree-generating software, such as PhyML and SplitsTree, was used to develop visual representations of the adenylate kinase's evolution based on the genomic sequence and indicated confidence levels of evolutionary relationships between comparable genes within other phage genomes. A protein modeling website, Phyre2, was used to create theoretical structures based on existing structures present in databases, such as the Protein Data Bank. Theoretical structures were analyzed using Pymol to visualize any conserved domains or motifs. Comparative analysis of genetic sequences indicated by phylogenetic trees and structures indicated by protein modeling software can reveal evolutionary relationships regarding the evolution of a gene's structure and genomic sequence. With a focus on Gene 01 of mycobacteriophage Giraffe, phylogenetic trees were developed to relate genes within the B cluster as well as genes across other clusters. The phylogenetic tree showed high confidence that Gene 01 of Giraffe was evolutionarily similar to the corresponding gene in other phage within the subcluster. Phyre2 showed Giraffe's adenylate kinase has high structural alignment to other members in its subcluster.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Lauren Novak, Purdue University

Alyssa Easton, Purdue University

Julia Mollenhauer, Purdue University

Poster Presentation Abstract Number: 17 :: Innovative Technology/Entrepreneurship/Design

College of Agriculture

Small Miracles: the PATH School Learning Garden Redevelopment Plan

Author(s):

Zheyi Xi, College of Agriculture

Abstract:

The purpose of this project is to create a learning garden with therapeutic functions inside the PATH school, Indianapolis, Indiana. This project is coordinated with the PATH school board, Indiana University Health and Purdue Extension Marion County. Current project site is a 5,500 square feet outdoor area with lack of design and functional elements. The goal of this project is to develop a therapeutic learning garden, as well as a sharable community space that integrates local resources like artists and a diverse space that promotes cultural inclusion. The research is devoted to analyze the strength and opportunity of the project site hence fulfilling the expectation of multi-functionality that this project aims to achieve. The research methods used to identify the opportunities include layering GIS (Geographic Information System) datas and research on similar cases to provide a deeper, complete understanding of the project. The most prominent problem of the site right now is how underutilized it is and there is almost no sign of planning inside. Therefore, it is imperative for this study to understand and analyze the impact that the project site can have at the environmental and community levels, thereby sublimating the theme of the 'therapeutic garden'.

Mentor(s):

Aaron Thompson, College of Agriculture, Horticulture & Landscape Architecture

Poster Presentation Abstract Number: 18 :: Social Sciences/Humanities/Education

College of Education

Behavioral Management Strategies for New Teachers

Author(s):

Margaret Foster, College of Liberal Arts

Abstract:

As a new teacher, one of the most daunting tasks is figuring out a classroom management style that works for you and your students. This project explores a variety of classroom management strategies, their impact on student behavior, and how they affect the classroom environment as a whole.

Mentor(s):

Benjamin Lathrop, College of Education, Curriculum and Instruction

Poster Presentation Abstract Number: 19 :: Social Sciences/Humanities/Education

College of Education

Spatial Analysis: Priming of Shapes in Tangram Puzzles

Author(s):

Alexandra Foster,

Abstract:

“Spatial understandings are necessary for interpreting, understanding, and appreciating our inherently geometric world” (National Council of Teachers of Mathematics, 1989, p. 48). Puzzles have been traditionally used in and outside of classrooms to reinforce students’ shape composition. Mastery of puzzles is achieved when students are able to flip and turn pieces intentionally to place shapes adhering to solving the puzzle. Tangram puzzles reside in the most difficult category of puzzles due to their silhouette-like feature. However, there is little indication to distinguish what makes one tangram puzzle harder than another. Over 100 tangrams and their solutions were coded based on the orientations of the seven shapes each were made up of, number of sides, and sections. Puzzles that primed for nonstandard square orientation, standard square orientation, and parallelograms were chosen for the assessment. Undergraduate and graduate students were required to identify placement of the primed shape of a silhouette puzzle within 3-4 seconds per puzzle. In total, subjects identified 90 shapes in intervals. Though students faced challenges, the structure of the tangram was a determinant in difficulty. Puzzles with prominent right angles or more sides tend to prime squares and parallelograms more often. Absence of indicative structure shows that in the future students need to rely on other spatial thinking strategies.

Mentor(s):

Denny Yu, College of Engineering, Industrial Engineering

Poster Presentation Abstract Number: 20 :: Social Sciences/Humanities/Education

College of Education

Breaking Bread, Breaking Bread: Developing Positive Relationships with Elementary-Aged Students with Disabilities

Author(s):

Zoe Johnson, College of Health & Human Sciences

Nadia Crace, College of Liberal Arts

Abstract:

Developing positive teacher-student relationships leads to better behavioral and emotional wellbeing of students (Murray, 2007). In addition, a well-developed sense of teacher self-efficacy helps to build up those relationships as well as family relationships (Garcia, 2004).

This qualitative study explored the development of positive relationships between pre-service teachers and their students with disabilities in elementary classrooms. Participants completed a series of activities during their classroom field experiences outside of instructional time, including an activity called Breaking Bread, Breaking Bread, where they ate lunch with students. The current study explored this activity by analyzing the views of pre-service teachers' perceptions of participating in Breaking Bread, Breaking Bread. Twenty-one pre-service teachers, majoring in special education, completed and wrote a reflection of their experience eating lunch with their student(s). The content of each participant reflection was coded by a research team and analyzed for themes. Data analysis is ongoing, and we are presenting preliminary results. Themes identified thus far, including insight into students' family relationships, signify a need for practices that encourage preservice teachers to develop teacher-student relationships outside of instructional time with students with disabilities in order to improve teacher self-efficacy and students' emotional well-being.

Mentor(s):

Jennifer Smith, College of Education, Educational Studies

Jasmine Begeske, Purdue University

Poster Presentation Abstract Number: 21 :: Social Sciences/Humanities/Education

College of Education

Classroom Management in a Rural Middle School

Author(s):

Katherine Reed, College of Liberal Arts

Abstract:

Classroom management is one of the most daunting aspects of teaching for any pre-service teacher entering the field for the first time. It is doubtless that these pre-service teachers have had a variety of methods of instruction, classroom environments, and management systems in their time as a student. These management systems each have different effects upon the perception of classroom learning and, by extension, behavior in the classroom.

In order to determine classroom management strategies in a Middle School English classroom preferred both by teachers and students, I have compiled a collection of surveys and interviews from each group. Three English teachers were interviewed regarding their classroom management strategies, detailing strictness, discipline, class-wide instruction, and changes in management over time. Likewise, 166 rural Middle School English students were given a survey rating their enjoyment, quality of learning, and perceived strictness of the class. 15 students were randomly selected from this dataset for an interview to clarify their answers. Finally, observations of each class were conducted in order to compare student and teacher perspective.

Using the collected data, I intend to analyze patterns of responses between students and teachers in order to identify successful or less successful management strategies.

Mentor(s):

Benjamin Lathrop, College of Education, Curriculum & Instruction

Poster Presentation Abstract Number: 22 :: Social Sciences/Humanities/Education

College of Education

Comprehending Shakespeare in a Learning Environment Focused on Utilizing Soft-Skills to Better Student Engagement

Author(s):

Sara Siener,

Abstract:

While a range of instructional models are used to teach William Shakespeare's various plays and poetics, limited research has been conducted on the effectiveness of instructing Shakespeare through the focus of building soft-skills. The premise of this study is soft skills development, through focused Shakespearean instruction, will enhance student career-readiness and lead to engagement. More precisely, the soft-skills that align in the context of teaching Shakespeare are collaborative teamwork, creativity, organization, communication, presentational voice and composure. This study measures and analyzes the effectiveness of using an approach that enhances students' career-readiness by teaching Shakespeare using focused lessons that encourage soft-skills development, while striving for improved student engagement.

Mentor(s):

Benjamin Lathrop, College of Education, Curriculum & Instruction

Poster Presentation Abstract Number: 23 :: Social Sciences/Humanities/Education

College of Education

Differentiation in an Inclusion Classroom

Author(s):

Helen Zoss, College of Liberal Arts, Honors College

Abstract:

The purpose of this study is to find ways to meet the needs of students through differentiated instruction in an inclusion classroom. This study takes place in a 7th grade English Language Arts classroom at a Jr./Sr. High School in Indiana. Of the twenty students in the class, seven students have IEPs and two of these seven are also classified as English Language Learners (ELL). The remaining students range from achieving at grade-level to exceeding grade-level instruction. The researcher’s goal through this project is to discover how to meet the needs of this vast array of students, all of whom are at varying levels.

The researcher collected data through a pre-assessment and a post-assessment. The goal was to use this data to direct a differentiated approach to teaching. During the data collection stage, due to the dynamics of the classroom, the researcher had to shift her focus to include strategies for encouraging students to complete their work. The resulting data is informed by a mixed-methods approach, including the quantitative data from the original research design plan, as well as the qualitative data that came out of the shift in the original plan. The results of this data lead to new questions surround why students do or do not turn in work; however, the data suggests that methods such as grouping and conferencing are beneficial to meeting the needs of all students.

Mentor(s):

Benjamin Lathrop, College of Education, Curriculum & Instruction

Poster Presentation Abstract Number: 24 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Development of a Smartphone App to Automate the Supine Pressor Test

Author(s):

Aditi Acharya, College of Engineering

Abstract:

Preeclampsia is a pregnancy complication characterized by proteinuria, hypertension, and multi-organ failure, causing approximately 76,000 maternal deaths [1] and over 250,000 neonatal premature deaths worldwide [2].

The supine pressor test (SPT) is a non-invasive diagnostic tool for predicting preeclampsia [3]. Here, we automate the SPT to aid pregnant women in assessing their risk for preeclamptic development. The automated device consists of a blood pressure cuff, an inertial measurement unit (IMU), and a smartphone app. The app was written for iOS in Swift, using the Swift for TensorFlow library to receive and process IMU data. The patient was guided through the SPT with the iOS app through an interactive user interface incorporating images, written instructions, graphs, and alerts. The app interface was designed to be both visually appealing to the user and technically robust to handle the large amount of user data. Sketch IO and Expo were used for rapid prototyping during the development process.

Accelerometer, gyroscope, and magnetometer data from the IMU were processed through an extended Kalman filter-based algorithm to track user angular body position in real time. This data was then communicated to the patient through the app using visual and quantitative feedback, instructing the patient to stay within 15 degrees of the desired body position for the SPT. These results were then relayed to a secure database and stored with the patient's encrypted User ID.

Through automation of the supine pressor test, we hope to standardize the diagnostic process, providing improved prediction of preeclamptic risk during pregnancy, and saving and improving both maternal and infant lives.

Mentor(s):

Craig Goergen, College of Engineering, Biomedical Engineering

Poster Presentation Abstract Number: 25 :: Life Sciences

College of Engineering

Mystery, Inc: Investigating the ScoobyDoobyDoo Mycobacteriophage Genome

Author(s):

Emily Aicher, College of Engineering

Megan Walker, College of Engineering

Hannah Mitchell, College of Engineering

Sarah Heffner, College of Engineering

Abstract:

The purpose of this study was annotating the genome of a C2 cluster bacteriophage, ScoobyDoobyDoo, and to examine phage evolution, sequence mutations, and protein structure. ScoobyDoobyDoo is a bacterial virus that infects mycobacteria. For annotation, programs such as DNA Master and PECAAN were employed. DNA Master was utilized for detecting mutations and aiding in gene annotation. PECAAN was utilized for gene and tRNA annotations because it accessed multiple other programs integral to the annotation process, like the NCBI database and others. More specified programs, such as Splitstree, Pymol, and Python, were used to further analyze the genome for exploration of evolutionary relationships, protein structure, and sequence mutations respectively. Results from this project will include an annotation of base pairs 613 through 17928, along with results from individual gene/protein analysis. The C2 cluster is small, so the addition of ScoobyDoobyDoo's annotation will expand the knowledge of this cluster. Minimal cluster information meant the annotation relied heavily on examining RBS scores and coding potential when other programs were non-informative. Annotating new C2 phage, like ScoobyDoobyDoo, adds to the knowledge of this cluster which will help future annotations of C2 phage.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Gillian Smith, Purdue University

Emily Kerstiens, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 26 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Establishing Conductivity Patterns of PTEO Using Protected TEMPO and Unprotected TEMPO Blends

Author(s):

Leyla Akmanligil, College of Engineering, Honors College

Abstract:

Organic electronic materials, which include open-shell stable radicals, are being used in emerging technologies like flexible screens for cell phones and televisions. Unfortunately, not much detailed research has been done on these organic materials and their properties. The purpose of this study was to bridge this gap by doing more research on the conductive properties of the organic electronic polymer: poly(4-glycidyloxy-2,2,6,6-tetramethylpiperidine-1-oxyl) or PTEO. There is a large gap in the research on the conductivity of PTEO between 70% and 90% radical density, so this study focuses on this region while confirming previous results at other densities. In order to synthesize polymers of different concentrations of unpaired electrons, copolymers of protected and unprotected 4-hydroxy-2,2,6,6- tetramethylpiperidine-1-oxyl, or TEMPO, were created. Unprotected TEMPO has a radical that gives the polymer its conductive properties, while protected TEMPO has a carbon group instead of the radical. Polymers of radical density zero to 100 percent were synthesized and tested with Gel Permeation Chromatography (GPC) and Electron Paramagnetic Resonance (EPR). The GPC results showed that the molecular weight distributions overlapped for the various blends meaning that they all polymerized correctly and therefore have similar characteristics. The EPR results showed a shoulder starting to emerge at about 70% radical density which indicates a splitting pattern. At about 20% radical density, the polymers began to start looking like the isolated radical in the unprotected TEMPO monomer. These results can be used to help reveal the limits of radical density that can be used to create conductive organic polymers.

Mentor(s):

Bryan Boudouris, College of Engineering, Chemical Engineering

Poster Presentation Abstract Number: 27 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

AEGIS

Author(s):

Kareem AlDohaim, College of Engineering

John Chan, College of Engineering

Justin Lee, College of Engineering

Connor Davin, College of Engineering

Kirk Weibel, College of Engineering

Marc Zabit, College of Engineering

Abstract:

Dynamic Wireless Power Transfer (DWPT) involves wirelessly charging electric vehicles (EVs) while in motion through electromagnetic induction. Implementing this technology would increase the range of EVs without the need for extended stops for recharging, thus significantly reducing required onboard battery storage and alleviating range anxiety, especially for longer-range travel. Studying the impact of DWPT on the power grid is important for deploying this new technology effectively. In this project, we focus on the integration of advanced simulation tools that model both power and transportation infrastructures into a single co-simulation using the Hierarchical Engine for Large-scale Infrastructure Co-Simulations (HELICS). For simulating the transportation side, the Behavior, Energy, Autonomy, and Mobility (BEAM) software package was chosen to simulate dynamic traffic flow over time in a given area through an agent-based modeling framework. The power distribution system is modeled using GridLab-D, which is suitable for simulating realistic electric distribution networks. The main outcome of this work is the overall system architecture for communicating and maintaining synchronization throughout the co-simulation.

Mentor(s):

Dionysios Aliprantis, College of Engineering, Electrical & Computer Engineering

Diala Haddad, Purdue University

Poster Presentation Abstract Number: 28 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

CAM2 Autonomous Drone

Author(s):

Razan Alkawai, College of Science

Justin Chan, College of Engineering

Alex Ishac, College of Engineering

Riya Mehta, College of Engineering, Honors College

Abstract:

The purpose of this project is to create research infrastructure for computer vision and real-time decision making using autonomous mobile robots. The components of this project include a UAV laboratory decorated with a miniature city and programmable ground mobile vehicles with identifiers on their top surface, a simulator that visualizes the laboratory and can be used to implement drone control/active tracking algorithms in a virtual environment, programmable aerial robots with the same interface as the simulator, and sample solutions for computer vision based control as a baseline for the competing teams to improve upon. Currently the team is in the process of building both the infrastructure and the baseline solution. From a flight hardware standpoint, the team has been working towards the overall goal of utilizing the Robotic Operating System (ROS) to interface with the PX4 Vision drone. Specifically, intentions include developing a flight algorithm to operate a drone based on visual and environmental queues from onboard sensors and cameras.

The infrastructure needed for the project includes creating ground vehicles for drones to track as means for teams to score points for the competition. The team has been working on implementing the ground vehicles and This includes looking for ways to have the ground vehicles travel in paths accurately through the use of various sensor inputs as well as PID functionalities. Additionally, the team has been experimenting with variable indicators for the drones to track including QR codes and color blocks for drones to actively track the ground vehicles.

Mentor(s):

Yung-Hsiang Lu, College of Engineering, Electrical & Computer Engineering

James Goppert, Purdue University

Xiao Hu, Purdue University

Poster Presentation Abstract Number: 29 :: Mathematical/Computation Sciences

College of Engineering

Deep Learning Based Plant Disease Identification using SLIC Segmentation

Author(s):

Nikhita Anantha Madhavan, College of Engineering

Ava Riaziat, College of Engineering

Abstract:

About 20-40% of crop yield worldwide is lost to pests and diseases. In Indiana, this number is 2-15% for corn crops and around 8% for soybean crops in 2010-2014. In a country as populous as the US, feeding the population has become a concern for many. With the population of the US increasing at a great pace, it is important to ensure food sustainability. We hoped to find a way to predict crop loss due to disease before a disease becomes detrimental to crop production. Our project involves accessing remote sensing data from publicly available resources and assisting with development of exercises that promotes utility of the data in general. Most of the analysis will involve machine learning methods. We will gather aerial images of crops using unmanned aerial aircrafts and collect disease data from public databases. We will then use machine learning to predict what crops will have diseases in the future based on these two sources of data.

Mentor(s):

Dharmendra Saraswat, College of Agriculture, Agricultural & Biological Engineering

Aanis Ahmad

Benjamin Hancock

Poster Presentation Abstract Number: 30 :: Life Sciences

College of Engineering

Computational Model of CD8 T Cell Proliferation and Death During SARS-CoV-2 Infection in the Lung

Author(s):

Maansi Asthana, College of Engineering, Honors College

Abstract:

Dynamics of the novel SARS-CoV-2 infection in lung remains widely unknown, especially its contribution to disease progression and lung damage It is important to understand the infection’s spatial effects but can be difficult to measure due to limitations in animal models and in vivo and in vitro model. Computational models such as agent-based models provide an alternative research tool. These methods allow precise control over cell dynamics, simulations of hypothetical test cases, and measurement of infection at certain time t and location x.

T cells, a type of immune cells, proliferate in response to viral infection. Specifically, CD8+ T Cells proliferate in response to viral invasion of cells. Although the number of T cells increase in general, they do not multiply and continue to exist in the body, even during active infection. Therefore, in order for the computational model to reflect the biological system, integration of cell proliferation models must be countered with a suppression model.

Within this project, generational-based CD8 T cell proliferation will be integrated into an existing COVID-19 computational simulation to accurately model T cell growth during active viral infection of lung tissue. This new model will limit the number of CD8+ T cell proliferation cycles. Once the limit has been reached, the death rate of the cell will be increased, thus accelerating cell death. Integration of this function prevents exponential cell growth, leading to biologically accurate results.

Mentor(s):

Elsje Pienaar, College of Engineering, Biomedical Engineering

Poster Presentation Abstract Number: 31 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Trade study for Camera Selection for the Solar Sail Deployment Verification Option for the NASA Solar Cruiser Mission

Author(s):

Jinit Gandhi, College of Engineering

Justin Bagdan, College of Engineering

Ansh Patel, College of Engineering

Thomas Placzkowski, College of Engineering

Yashoheet Sethi, College of Engineering

Maria Soare, College of Engineering

Stephanie Yates, College of Engineering

Abstract:

Purdue University is collaborating with NASA Marshall Space Flight Center for the NASA Solar Cruiser mission scheduled for October 2025. The student collaboration portion aims to demonstrate the imaging capabilities of an off-the-shelf camera under predetermined NASA constraints. Our mission is to find a camera appropriate for the verification of sail deployment.

The objective is to capture live data of the sail during the deployment stage to verify the deployment of the sail. To achieve this, the camera will need to have high resolution, a large Field of View (FOV), and on-site storage. The deployment verification will be visual inspection, which makes high resolution an important criterion. A large FOV is crucial to map the sail without an additional motor. To tackle transmission delays and capture data over the full duration of deployment, storing data on the camera before transmission is important.

Our aim this semester is to conduct a trade-study between different cameras and choose a final camera to prototype. To perform the trade-study we have devised a weighted-decision matrix specific to our task of verifying the sail’s deployment. The matrix includes generic and specific NASA mission constraints like mass, power, volume, durability, and space heritage. Our next step is to score each of these metrics corresponding to their assigned importance and devise normalizing and comparable standards. Once we establish consistent standards, we can then compare various camera options via the weighted decision matrix, to determine a camera that best fits the overall mission.

Mentor(s):

Katherine Fowee, College of Engineering, Aeronautics & Astronautics

Alina Alexeenko, Purdue University

Yung-Hsiang Lu, Purdue University

Anthony Cofer, Purdue University

Poster Presentation Abstract Number: 32 :: Life Sciences

College of Engineering

A Comprehensive Analysis of Mycobacteriophage Delylah

Author(s):

Jason Barahona Rosales, College of Engineering

Amanda Blankenberger, College of Engineering

Kyra Keenan, College of Engineering

Brady Stinson-Smith, College of Engineering

Rebecca Slaughter, College of Engineering

Abstract:

The goal of this research project was to investigate a portion of the genome for a novel bacteriophage Delylah, specifically genes 4 through 67. This project, conducted through the SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Sciences) program, was done as a part of an ongoing effort to gain comprehensive knowledge on bacteriophage genomics via bioinformatic analysis. The data gathered may advance bacteriophage applications in areas such as food processing, water treatment, and therapeutic technology. Genome annotation was conducted by using programs illustrating Delylah's genetic sequence to determine existence of protein coding and tRNA genes, viable gene start sites, and likely protein function. The evidence supporting conclusions originated from various database information and comparison to genetically similar bacteriophage. To expand upon the annotation information assembled, investigations were conducted in areas of phylogenetic and evolutionary analysis, computational biology in application to mutation identification, and protein bioinformatics. The results include identification of characteristics corresponding to annotated genes and their respective proteins and mutations, or lack thereof. The information corroborated from the three investigations solidified conclusions made on protein structure and function identification, specifically proteins that possess the function NKF (no known function). Comparing the sequences revealed possible mutation sites along with their nature. Finally, the genes were analyzed from an ancestral perspective to provide broader insight on the mutations and possible functions.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Emily Kerstiens, Purdue University

Gillian Smith, Purdue Univeristy

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 33 :: Mathematical/Computation Sciences

College of Engineering

Software Development on FPGA

Author(s):

Viranch Bateriwala, College of Engineering

Abstract:

An FPGA is an integrated circuit that can be programmed and reprogrammed according to a particular design's needs and capabilities. The overall objective is to design software to verify hardware directly on the FPGA. My project pursues methods of gathering run-time statistical information and alter the memory contents of the FPGA without requiring a full resynthesis. Additional goals include implementing a C-like printf() function and enabling communication with the FPGA via a serial interface. A python script was developed to collect post-synthesis statistics from the FPGA. Run-time data collection is done via the CPU tracker. The CPU tracker is a hardware monitor that collects and displays traces such as RISC-V instruction executions. The tracker's respective System Verilog components are compiled on the FPGA and is used in conjunction with a data collection script to stream or store information for inspection by the end user. Tools such as Intel's Quartus II software is used to compile and implement hardware designs. The NIOS II soft-core processor serves as a testing ground for enabling C compilation and interfacing with the FPGA due to its versatility such as enabling access to FPGA memory contents. The AFTx06 chip will be used in place of the NIOS II processor once functionality has been verified. The expectation is to provide a framework for writing software for in-progress versions of the chip which helps to streamline the verification process and reduce time commitments.

Mentor(s):

Mark Johnson, College of Engineering, Electrical & Computer Engineering

John Martinuk, Purdue University

Cole Nelson, Purdue University

Poster Presentation Abstract Number: 34 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Trade Study for Camera Selection for the Single Quadrant Solar Sail Analysis Option for the NASA Solar Cruiser Mission

Author(s):

Michael Bi, College of Engineering

Tasveen Chopra, College of Engineering

Katie Kneeland, College of Engineering

Connor Proudman, College of Engineering

Shashwat Punjani, College of Engineering

Sharon Xu, College of Engineering

Abstract:

Solar sails use the energy from photons to propel themselves and are the future of space propulsion for long distance missions. Our research problem was to find an off-the-shelf camera to image one sail quadrant of the 2025 Solar Cruiser solar sail mission conducted by NASA. The goal is to capture high quality photos and develop a topographical analysis of the quadrant to identify where the photons are hitting the sail and to be able to adjust the sail accordingly. Therefore, the chosen camera must have a high resolution and be within dimensional, mass, and power constraints previously set by NASA. We created a weighted decision matrix to compare cameras and lenses found during the research phase using these constraints and other criteria. Later, we will conduct further thermal and radiation research as we narrow down our cameras and lenses of interest. Through the making of the weighted decision matrix, we decided that the most important criteria to consider during our research process is more imaging specific criteria. Our requirement is to image a single quadrant of the sail, so our team determined that the camera needs to be of high resolution coupled with a 90 degree field of view. With no extra mass added on the device other than the camera itself, it will be possible to use a heavier duty camera to image the sail. We plan to further explore heavy duty cameras with higher specs and more advanced image quality in the future.

Mentor(s):

Katherine Fowee, College of Engineering, Aeronautics & Astronautics

Alina Alexeenko, Purdue University

Yung-Hsiang Lu, Purdue University

Anthony Cofer, Purdue University

Poster Presentation Abstract Number: 35 :: Mathematical/Computation Sciences

College of Engineering

Lab Localization with Deep Learning and AI Tracking

Author(s):

Ryan Boyd, College of Engineering

Benjamin Loshe, College of Engineering

Joseph Attardo, College of Engineering

Kaiwen Shen, College of Engineering

Tim Zhou, College of Engineering

Shiqi Wang, College of Engineering

Abstract:

The purpose of this project is to enable the members of a lab to quickly get information about the usage of lab tools in a lab. This process will expedite the process of troubleshooting because users will have an easily accessible, detailed record of who used what equipment. Inputs for the project will be lab video recordings of the lab room as well as a floor plan of the lab. The outputs of the project will be a dashboard providing real time, relevant statistics on lab equipment usage. To produce the outputs, two strategies will be implemented, and the effectiveness of these two strategies will be compared. The first is using a pure deep learning algorithm that takes the videos but will need to be trained for each lab and is computationally expensive. The second is a more traditional model that will map the camera input to the floor plan of the building and use AI to track users as they move through the grid. This comparison will demonstrate whether deep learning is suitable for this type of task or not. The results of this project could be a great use case showing how to use artificial intelligence to create a useful database from video input.

Mentor(s):

Mithuna Thottethodi, College of Engineering, Electrical & Computer Engineering

Poster Presentation Abstract Number: 36 :: Mathematical/Computation Sciences

College of Engineering

AFRL UAS Team - Purdue VIP Program

Author(s):

Derek Carpenter, College of Engineering

Colton Griffin, College of Science

Angel Daniel Avila Gonzalez, College of Engineering

Sam Hynds, College of Engineering

Nicholas Hansen, Polytechnic Institute

Ellen Nguyen, College of Science

Duncan Mulgrew, Polytechnic Institute

Arpit Amin, College of Engineering

Jeremy Frederick, College of Science

Mohmmad Alwakeel, College of Engineering

Andrew Chen, College of Engineering

Grady Arnold, College of Engineering

Christopher Ji, College of Engineering

Leonard Jung, College of Engineering

Bojan Ruttens, College of Engineering

Ranjan Behl, College of Engineering

Graciela Hernandez, College of Engineering

Carson Doering, College of Engineering

Brandon Dimitri, College of Engineering

Sam Doll, Purdue Polytechnic Institute

Mason Burgess, College of Engineering

Sen Wang, College of Engineering

Abstract:

The Purdue Unmanned Aerial Systems (UAS) Team, in collaboration with the Air Force Research Laboratories, is investigating how the unique capabilities of a UAS can affect the tracking of a moving ground target. Past studies have focused on autonomous flying and tracking of vehicles as independent goals, which conventionally requires iterative testing to verify completeness. Integrating autonomous flying and object tracking systems provides the ability to formally verify software. Initial research on past methods, techniques, and applications was conducted prior to designing an Unmanned Aerial System (UAS). The team prioritized existing hardware with real-time onboard object detection and multiple cameras. System integration and testing began after receiving CrazyFlie UAV kits capable of implementing trajectory planning algorithms. These initial models provided hands-on technical experience with trajectory planning and rapidly exploring random trees (RRT) algorithms.

Building upon the success of RRT path planning algorithms, the Spring 2021 semester is dedicated to upgrading to RRT star algorithms and integrating the system to track a ground target. The project sub-teams are studying various programming languages and implementing software skills core to AFRL’s mission directorates. Testing is completed at the Purdue Airport, where the team works in a converted hangar reserved for indoor testing. The UAS test facility is world-class, offering more motion capture and tracking capabilities than any other collegiate test facilities. Testing also involves a robust motion-capture camera system capable of constantly mapping the location of UAV drones and obstacles.

Mentor(s):

James Goppert, College of Engineering, Aeronautics & Astronautics

Shreyansh Shethia, Purdue University

Poster Presentation Abstract Number: 37 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Analysis of Radiation Hardening Techniques and Implementation

Author(s):

Landon Carre, College of Engineering, Honors College

Ishmam Iqbal, College of Engineering

Abstract:

The purpose of the conducted research was to develop a better understanding of radiation hardening techniques when designing digital, analog, mixed signal IC systems. Radiation hardening is a growing field with a large significance for any device passing through or operating in extreme environments in outer space be it a spacecraft or satellite technology. The intent of this research was to gather a greater understanding of what defines a system as radiation hardened. A large topic of exploration is what design techniques make a IC design relatively impervious versus susceptible to highly ionized particles. Research was done into what factors affect a system design on an architectural, circuital, and layout level when investigating radiation hardening-by-design approaches to mitigate effects from total ionizing dose (TID) and multitudes of single event effects(SEE). This research was carried out by studying and accumulating information and statistics from various research publications, datasheets of rad-hard product offerings, and presentations published by government agencies. Furthermore, the attention is now being focused toward developing an analysis of the SoCET team's design and the level of radiation hardness it already possesses or the lack of. We expect to analyze the current designs to produce a thorough analysis diagnosing the level of radiation hardness present, any additional measures that could be taken, and the potential drawbacks such measures could have on the current design. Additional areas of expansion include potentially working on an autocorrecting FPGA design and simulating the effects of radiation pertaining to Single Event Effects.

Mentor(s):

Mark Johnson, College of Engineering, Electrical & Computer Engineering

John Martinuk, Purdue University

Poster Presentation Abstract Number: 38 :: Physical Sciences

College of Engineering

Two Dimensional Halide Perovskite Solar Cells

Author(s):

Wyat-no-kwe Cervantes, College of Engineering

Abstract:

Abstract redacted.

Mentor(s):

Yao Gao, College of Engineering, Chemical Engineering

Letian Dou, Purdue University

Poster Presentation Abstract Number: 39 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Unmanned Core Sampling System for Surface Water Sediment Collection

Author(s):

Pou Hei Chan, College of Engineering

Abstract:

Sediment sampling is an essential activity for water quality and sediment monitoring. This is generally performed manually which can be costly and hazardous for contaminated or turbulent water conditions. Due to such concerns, there is need for remotely operated or autonomous vehicles to collect sediment samples while maintaining the integrity of the sample comparable to a manually extracted one.

We propose an unmanned core sediment sampling system that consists of the USV and sediment sampler to collect sediment in surface water environments such as rivers, streams, lakes, ponds, and reservoirs under both calm and turbulent conditions. The closed-loop coring system, monitored by sensors measuring its positions and forces exerted, allows for sample to be extracted with minimal disruption to the integrity of the sample core. We present the physical specification and the control system architecture of the USV and sediment sampler.

Mentor(s):

Byung-Cheol Min, Polytechnic Institute, Computer Information

Jun han Bae, Purdue University

Poster Presentation Abstract Number: 40 :: Mathematical/Computation Sciences

College of Engineering

Using computer vision to assess ureteroscopy motion techniques

Author(s):

Nan Chen, Polytechnic Institute

Abstract:

Flexible ureteroscopy is a kind of procedure performed by urologic surgeons which removes kidney stones from patients. When performing this surgery, a 3mm-diameter flexible camera will be used to pass through the patient's urinary tract to fragment, manipulate and remove kidney stones. While there are existing methods to teach and assess surgeon skills, those methods remain to be inconsistent. In this study, we tried to use computer vision techniques to analysis and characterized surgeon's ureteroscope movement in a simulated clinical scenario. A total of twelve subjects with different medical backgrounds have participated in this experiment. From those collected data, we were able to use computer vision techniques to calculate variables, overall ureteroscope tip travel distance (DIST), task time (TIME), spectral arc length (SPARC, a measure of path smoothness), and number of times the device tip collided with the wall of the simulation box (COLL), to determine if the ureteroscope movement were sufficient.

Mentor(s):

Denny Yu, College of Engineering, Industrial Engineering

Daniel Wollin, Division of Urology, Harvard Medical School, Brigham and Women's Hospital

Poster Presentation Abstract Number: 41 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

VIP47921 SoCET Senior Design - LDO Design

Author(s):

Boyuan Chen, College of Engineering

Youngjoo Moon, College of Engineering

Abstract:

The purpose of this study is to design a fully functional Low Drop Out (LDO) voltage regulator for a central process unit (CPU). The LDO generally consists of two major components, an attenuator and a differential amplifier. These two parts will work together to regulate lower input voltage such that the output voltage will remain in a constant range. The creation of LDO is the first step toward implementing power management on a SoC. The benefits include the ability to put the CPU to sleep mode, additionally power islands can be used to turn off the peripherals not in use. The LDO will protect the System-on-Chip (SoC) by guaranteeing the output voltage will be steady enough to prevent the gates, on-chip, from being damaged. The LDO can also supply power to any circuit that requires the input voltage to be decreased to function appropriately. The operating input voltage of the regulator will be 1.8 V-3.3 V regulated to a 1.2 V output. The regulator can also adjust output voltage, on a linear scale, to handle several power requirements. The schematic for the LDO has already been created; next, the layout will be designed using common-centroid methodology. After reviewing simulations which include parasitics, extracted from the layout, it is expected that some level of schematic/layout redesign will be required to mitigate non-ideal phenomena which influence the output voltage. Our targeted technology node is a 90nm process, fabricated by MIT Lincoln Labs, expected to be completed in one academic year.

Mentor(s):

Mark Johnson, College of Engineering, Electrical & Computer Engineering

Sutton Hathorn, Purdue University

Poster Presentation Abstract Number: 42 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Creating a Potentiostat Circuit for Chemical Sensor Applications

Author(s):

Jaideep Damle, College of Engineering, Honors College

Vick Hung, Polytechnic Institute

Abstract:

Chemical sensors are a useful tool in tracking gases in cows that can be harmful to the environment. With these sensors, experiments can be conducted into how changing diets and other various factors can cause changes in the gas concentration. The process of cyclic voltammetry (CV) can be used to measure the analyte concentration for the sensors. This process works by manually changing the voltage at a counter electrode (as part of a three electrode system) in order to produce a graph of voltage vs current. The peaks on the graph indicated where the electrochemical reactions were taking place and those voltages can be used to determine the concentration of analyte participating in the reaction. However, the CV process requires the use of large benchtop electronic equipment, namely the potentiostat. This device manually changes the voltage at the working electrode of a chemical sensor. In order to develop miniature chemical sensors to fit inside a cow's stomach, a scaled down potentiostat is desired.

In this project, the main circuitry behind the potentiostat was researched. Using analytical circuit techniques, the values of each component were calculated in order to meet the desired voltage specifications. After the design and simulation processes were conducted, the circuit was built on a breadboard. Voltage and current measurements used in a typical cyclic voltammetry experiment were taken using this circuit and compared to that of an actual potentiostat.

Mentor(s):

Robert Nawrocki, Polytechnic Institute, Engineering Technology

Huiwen Bai, Purdue University

Kateryna Vyshniakova, Purdue University

Poster Presentation Abstract Number: 43 :: Mathematical/Computation Sciences

College of Engineering

AI For Happiness - Clustering Based Anomaly Detection based on GPS Trajectory Data

Author(s):

Ansh Desai, College of Engineering, Honors College

Keith Patejdl, College of Engineering

Christina Lo, College of Engineering

Abstract:

The purpose of this project is to develop a clustering based unsupervised learning tool to identify abnormal locations based on frequently sampled GPS trajectory data. It is well evident that GPS trajectory data has been used to assess behavioral abnormality, which may suggest status changes in an at-risk population. This at-risk population includes college students suffering from stress and depression, the elderly population suffering from neurodegenerative diseases, and clients of a community-correction center who may commit crimes or misdemeanors again. AI-based early anomaly detection can help these at-risk populations to take preventive and interventional actions more proactively and precisely. To the best of our knowledge, there are many techniques that can be used to detect abnormal behaviors based on GPS trajectory data.

In this research, we investigate the performance of three clustering-based techniques, namely DBSCAN, Gaussian mixture model, and the third one being decided on. We identify proper open-source algorithm implementations and adapt them to our GPS trajectory data. We then compare these techniques and further improve the anomaly detection performance through unsupervised ensemble learning.

The tool developed from this research project can be widely used for monitoring a high-risk population. For example, it can suggest the frequency of psychological service by professional caregivers. The tool can also increase the awareness of the risk by the end-users and their “circle of trust.”

Mentor(s):

Nan Kong, College of Engineering, Biomedical Engineering

Poster Presentation Abstract Number: 44 :: Physical Sciences

College of Engineering

The Effect of PnPMA Thin Film Thickness on its Glass Transition Temperature

Author(s):

Piyush Deshpande, College of Engineering, Honors College

Abstract:

Poly(n-propyl methacrylate), or PnPMA, is a polymer surfactant; it thus has the ability to lower the surface tension of an air-water interface by exerting a surface pressure on this boundary. PnPMA is able to exert a large surface pressure due to its transition state into glass. The glass transition temperatures of Langmuir films formed from this polymer solely depend on thickness. The purpose of this study is to quantitatively determine how the glass transition temperature of a thin PnPMA monolayer film is affected by varying its thickness at multiple molecular weights. The temperature values are then compared to that of the bulk state PnPMA. The experiment is done by spreading PnPMA on a trough filled with water, and then collecting surface pressure values as the system is cooled to 9°C and then heated to 45°C. This cycle is done three times for each molecular weight of the polymer. The temperature where a relative extremum occurs with its relationship with surface pressure is where the glass transition occurs. The glass transition temperatures at a film thickness of 42.37 nm have been determined at two different molecular weights (4k and 6.9k) to be 24.5°C and 25.2°C respectively, which are approximately half of that of PnPMA in the bulk state. The effect of PnPMA thickness on its glass transition temperature has biotherapeutic implications since it acts as a lung surfactant. Therefore, it can help treat respiratory distress syndromes by sitting on collapsed alveoli in the lungs and reducing the region's air-water interfacial tension.

Mentor(s):

You Yeon Won, College of Engineering, Chemical Engineering

Poster Presentation Abstract Number: 45 :: Life Sciences

College of Engineering

Investigation of Mycobacteriophage Delylah using Computational Programming and Protein Bioinformatics Tools

Author(s):

Ella Ditslear, College of Engineering

Lillian Hough, College of Engineering

Brian Kim, College of Engineering

Sydney Cooper, College of Engineering

Benjamin Burns, College of Engineering

Abstract:

Bacteriophages are viruses that infect bacteria and research regarding their applications is rapidly progressing. But, how can one manipulate a phage without analyzing their entity? It is essential to understand the structure and composition of bacteriophage genomes in order to reach full utilization potential and comprehension.

The purpose is to annotate the start sites and functions of genes 68-131 in phage Delylah (22,456 - 80,023 base pairs) to give opportunities for further bacteriophage research. We are focusing on two projects: computational biology and bioinformatics. The computational biology project inputs DNA gene information and outputs mutations found between Delylah and comparable gene DNA sequences from other phage. The bioinformatics project compares unknown protein structures to known protein structures to predict similarities and function.

Database PECAAN determines start sites and functions of each Delylah gene. Python coding is used in the computational aspect to detect and categorize mutations within gene sequences. These programs are made over the course of several months to determine the differences between Delylah and homologous genes. Bioinformatics uses programs like PyMOL and Phyre2 to find similarities from input protein through databases and confirmed structures. Proteins that are similar in structure likely have similar functions, which allows us to predict the function of unknown proteins based on these similarities.

We are expecting to fine-tune the computational biology code and determine function based on structure to add to the overall bacteriophage databases, provide an efficient program to classify mutations, and determine protein functions based on similarities in structure.

Mentor(s):

Kari Clase, College of Engineering, Agriculture & Biological Engineering

Emily Kerstiens, Purdue University

Gillian Smith, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 46 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Enhancing workplace safety with Machine Learning Sensor IoT Edge Nodes

Author(s):

Alice Dragnea, College of Engineering

Sraven Saradhi, College of Engineering

Rohil Senapati, College of Engineering

Aakash Sivasankar, College of Engineering

Haani Tharak, College of Engineering

Abstract:

According to the Bureau of Labor Statistics, 5,333 fatal occupational injuries occurred among workers in 2019, the highest since 2007. Our project aims to reduce the severity of workplace injuries and frequency of fatalities by developing a learning IoT node containing a series of sensors to monitor workplace factors and predict hazardous situations.

The current goal is to develop a rapid flexible prototyping platform. This platform will use an STM32F4 Arduino MCU to manage sensors communicating over RFC1662 with a single board computer running machine learning algorithms in Python connected by Ethernet to the cloud. The learning algorithm will analyze data locally and in the cloud to predict dangerous situations, and alert nearby individuals to the hazard.

Our work is focused on particles of size 10 microns (<10 μm), denoted Particulate Matter 10 (PM10.0). Previous research found these particles constitute the primary respiratory health risk to workers, for they disperse themselves throughout the lower respiratory system. Using the Indoor Air Quality and Inhalation Exposure (IAQX) simulation toolkit provided by the United States EPA, we will be able to model and test particle disposition at the Bechtel Innovation and Design Center (BIDC). Previously, we found that wood dust is optimal for testing our models because it can be categorized into bins of PM1.0, PM2.5, PM10.0, and it is easily sourced. A learning model will be developed based on the IAQX, which will be used by the single board computer to analyze data sent from the cluster of sensors through the microcontrollers.

Mentor(s):

Matthew Swabey, Bechtel Innovation Design Center

Poster Presentation Abstract Number: 47 :: Life Sciences

College of Engineering

An Analysis of Cluster C2 Mycobacteriophage ScoobyDoobyDoo

Author(s):

Samuel Enweonwu, College of Engineering

Grace Cook, College of Engineering, Honors College

William Delacruz, College of Agriculture

Taylor Sorrell, College of Engineering

Abstract:

New genomes are sequenced everyday, but not all the genes are easily annotated or well understood. Bacteriophages, which contain an assortment of genes, are bacteria that selectively kill targeted bacteria. The purpose of this project is to identify genes of interest in a mycobacteriophage named ScoobyDoobyDoo. To do so we must fully annotate the ScoobyDoobyDoo genome. The genes were divided into several groups that were individually annotated. These groups were then analyzed using computer programs to find the start sequence and predicted function. The DNA sequence was analyzed with other DNA sequences using DNA master, PhagesDB, and NCBI Blast. One crucial piece of evidence we used was coding potential by using Genemark, which identifies portions in the DNA sequence for a gene's presence. From the information gathered in those programs, we can make assumptions on the structure and function of unannotated genes. Using predictive structure algorithms such as Phyre2, we took an amino acid sequence and determined a likely structure and function for the protein and later used Pymol in order to visualize it. Thus, we have been able to provide more context for the auto-annotation calls that have been made for these genes. Another approach to further understand a gene was analysis of its evolution using phylogeny. This was done by comparing three different phages in 12 different clusters to create phylogenetic trees and splitstrees. ScoobyDoobyDoo is in cluster C2 which is relatively unknown and a deeper understanding of this phage will contribute to the phage library.

Mentor(s):

Kari Clase, College of Engineering, Agriculture & Biological Engineering

Gillian Smith, Purdue University

Emily Kerstiens, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 48 :: Social Sciences/Humanities/Education

College of Engineering

Human Neurological and Physical Reactions to High Intensity Environments

Author(s):

Bora Ercan, College of Engineering

Deepthi Kumar, College of Engineering

Eugene Lee, College of Engineering, Honors College

Kevin Davis, University of Dayton

Abstract:

In current times, it is important to understand how different strains of workload affect a person's body and health especially in this day and age where people are working through a variety of difficult circumstances. Therefore, the purpose of this study was to understand how a person responds to a variance in workloads through different sets of questions. Users are put through a game simulation and placed on a map with different checkpoints. In the game, the player has a car and can drive around the map to different checkpoints and answer questions at each checkpoint. At each checkpoint, the user is presented with a set of either arithmetic or verbal questions. There are a total of 10 arithmetic questions ordered in 5 unique difficulty levels with 2 questions per level. There are a total of 6 verbal questions ordered in 3 unique difficulty levels with 2 questions per level. While the user is answering the questions, measurements of certain body functions such as brain activity, heart rate, and eye movement will be used to observe how the body responds to different workloads. In regard to the measurements, the devices utilized were heart rate monitors, eye-tracking devices, and EEG. In conclusion, the study is looking to draw conclusions about the data between different workloads and how body functions react as a response to see if any correlations can be made.

Mentor(s):

Denny Yu, College of Engineering, Industrial Engineering

Jack Hu, Air Force Research Lab

Poster Presentation Abstract Number: 49 :: Physical Sciences

College of Engineering

Machine Learning to Predict Properties of High Entropy Alloys

Author(s):

Mackinzie Farnell, College of Engineering, Honors College

Abstract:

High entropy alloys (HEAs) are metal alloys that contain five or more elements with roughly equal concentrations and are of interest due to their unsurpassed mechanical properties and ability to be tailored to specific applications. However, it is difficult to model properties of HEAs because they have a wide range of local atomic environments. We use neural networks to predict local atomic properties in HEAs, including relaxed vacancy formation energy, cohesive energy, pressure, and Voronoi volume. The network's inputs are unrelaxed bispectrum coefficients, which describe the local environment of each atom, and central atom descriptors, which describe the properties of the atom we predict on. Our networks are trained on the CoCrFeNi face-centered cubic (FCC) alloy and exhibit good accuracy on training and testing data. The model error is within 0.06 eV for relaxed vacancy formation energy and cohesive energy, 1.2 GPa for pressure, 0.02 Å3 for Voronoi volume predictions on testing data. The networks also predict properties of structures with compositions that differ from the trained composition and have some ability to predict on atoms not in the training system. These models predict HEA properties at a hundredth of the computational cost of current atomic simulations, which may allow future work to use atomic properties to model macroscale material properties.

Mentor(s):

Zachary McClure, College of Engineering, Materials Eng

Alejandro Strachan, Purdue University

Poster Presentation Abstract Number: 50 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

SWARM Simulation Platform

Author(s):

Tyler Fedrizzi, College of Engineering

Aprit Amin, College of Engineering

Marvin Mui, College of Engineering

Pranav Karthikeyan, College of Engineering

Nathan Matthews, College of Engineering

Heera Choi, Polytechnic Institute

Rohan Potdar, College of Engineering

Cole Kniffen, College of Engineering

Abstract:

The SWARM Simulation platform provides a collaborative system to design, implement, and evaluate multi-agent (drone swarm) control algorithms. SWARM combines advancements in cloud-computing infrastructure, autonomous agent control, and web-based applications to deliver an innovative algorithm design and evaluation portal. By leveraging the power of Amazon Web Services, SWARM is a scalable, realistic and user-friendly simulator, which enables academic researchers and industry partners from around the world to collaboratively develop and test new swarm algorithms. Through the addition of pre-built scenarios specific control algorithms can be designed and evaluated, thereby establishing a common benchmark for the robotics and control systems communities to create specific tools, techniques and procedures for autonomous collaboration and control. Simplified user-interfaces are provided through a web-based application, allowing for the generation of complex control algorithms through simple dialog boxes. For each simulation, a set of predefined algorithms for basic drone swarm control methods are provided, such as obstacle avoidance, path planning and communication between drones. Upon completion of a simulation, a data analysis toolbox provides users with a robust platform to evaluate the performance of their algorithms, along with a detailed report of overall performance. With input from top researchers in the automatic controls field at Purdue University, additional features are currently being designed and incorporated into SWARM to support current research. In the near future, a collaborative space will be provided for researchers at multiple institutions to share research, collaborate on specific solutions to provided scenarios, and allow for the incorporation of real-world test beds.

Mentor(s):

Shreyas Sundaram, College of Engineering, Electrical & Computer Engineering

Shaoshuai Mou, Purdue University

Poster Presentation Abstract Number: 51 :: Mathematical/Computation Sciences

College of Engineering

Inkjet Black Neutrality Metric

Author(s):

Nathan Fei, College of Engineering, Honors College

Abstract:

The purpose of this study is to develop a process to come up with a way to measure the color neutrality of black inkjet inks. In this case, “neutrality” in black ink represents the lack of bluish or brownish tinges in grayscale prints resulting from this black ink. By being able to create a metric, developing new inks will be easier as there can be explicit specifications in terms of the metric, rather than having to repeatedly gage customer acceptance. This study analyzed a collection of black ink formulations by printing gradients, recording the inks’ colors at each level of lightness (L*) by using a spectrophotometer. The resulting color profiles were compared to existing customer data to develop several metrics for consideration. A resulting metric based on varying the weighting of different lightness levels was selected, as it reliably predicts customer satisfaction for the existing customer data. Steps forward would include collecting more customer input on various ink formulations and more systematically generating a metric.

Mentor(s):

Aaron Rosen, Not a Purdue West Lafayette Employee

Natasha Duncan, Purdue University

Poster Presentation Abstract Number: 52 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

SoCET - Wireless Transceiver

Author(s):

Charles Franchville, College of Engineering

Nada Alruwaii, College of Engineering

Abstract:

The most recent chips produced by the SoCET team have not included any peripherals for wireless communication, a staple on most modern microcontrollers. The benefits of including wireless communication on our chip is the capability to send and receive data remotely, and to integrate our chip in wireless IoT applications. The targeted band for this design is the IMS 915 MHz band. In order to achieve this standard, team members have designed a Low Noise Amplifier (achieved gain of ~32 dB, with Noise Figure of 0.95 dB), and are currently working on an Analog Mixer and Power Amplifier. The digital transceiver module is responsible for decoding the incoming analog waveform into a digital signal in the receiver, and vice versa in the transmitter. The digital receiver works by timing the period of the analog waveform and comparing the length of a period to a user – configured threshold value. This comparison is used to determine whether the data represented by the signal is a ‘1’ or a ‘0.’ In the transmitter module, a ROM is indexed to create 2 signals: a high – frequency sinusoidal wave and low – frequency sinusoidal wave. Data is loaded to the transmitter module via a FIFO and is then sent serially to the select line of a multiplexer. The multiplexer switches between the high and low frequency signals based on the value of the bit being sent. The wireless radio is targeted to be taped out on the next AFTx chip fabricated through MIT Lincoln Labs.

Mentor(s):

Mark Johnson, College of Engineering, Electrical & Computer Engineering

Sutton Hathorn, Purdue University

Poster Presentation Abstract Number: 53 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Using the SkyWater Open Source PDK and OpenLANE to automate the RTL to GDSII flow

Author(s):

Dakota Funke, College of Engineering

Abstract:

Having been able to successfully install the SkyWater open source PDK Project in addition to the OpenLANE toolchain, the Design Flow Team has been working on being able to successfully create a clean layout of our latest work the AFTx06 System on Chip. Although not yet fully implemented, initial tests on other designs have been successful, with future plans to tape-out using the SkyWater PDK as well as any other Open Source PDKs that are provided. Much of the presentation will focus on the methodology for how to implement both a commercial flow and this open-source flow. Afterwards, the audience should be able to understand the aims and current progress of the OpenLANE process, as well as understand the drive behind its development and what is hoped to be achieved by an automated RTL to GDSII flow. Some of the challenges included in this project involve moving from a 90 nm to 130 nm process node, which runs the same design on the same chip size but requiring a larger design area and some of the digital design of the System on Chip needing to be altered. As we are now IO bound, having less than half of the I/O pads that we did on our last tape-out. In addition to all of this, there was also the issue of needing to transfer much of our System Verilog code to Verilog, in order to actually work with the OpenLANE toolchain.

Mentor(s):

Mark Johnson, College of Engineering, Electrical & Computer Engineering

John Martinuk, Purdue University

Poster Presentation Abstract Number: 54 :: Mathematical/Computation Sciences

College of Engineering

Video Analytics for Animals

Author(s):

Elizabeth Gauthier, College of Engineering, Honors College

Xinyi Feng, College of Engineering

Abstract:

In our project, we explore whether automated video analytics methods can identify abnormal behavior of a turkey. We will use data from a turkey tracker developed by our graduate student mentor to compare a healthy group of turkeys to several unhealthy groups of turkeys. The goal is to provide a tool for turkey researchers to more easily identify sick poultry. In addition, we will add functionality to a visualization tool initially developed by a previous VIP team member. In particular, we will extend the visualization tool to allow more flexible inputs, to compare data across multiple groups, and to perform statistical analysis. These

improvements will provide turkey researchers additional methods to explore, interact with, and understand the data regarding the turkeys' movements and their underlying health conditions.

Mentor(s):

Amy Reibman, College of Engineering, Electrical & Computer Engineering

Shengtai Ju, Purdue University

Poster Presentation Abstract Number: 55 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Improved geometric method for more accurately characterizing spherical bearing properties through testing

Author(s):

Zachary George, College of Engineering, Honors College

Abstract:

Disclaimer: Due to proprietary information and ITAR security restrictions, concepts/descriptions are kept abstract/generic.

Spherical bearings appear in a variety of industry applications. Ideally the location of the pivot point of such a bearing would be at the dead center of the contraption. However, due to various design constraints as well as manufacturing imperfections, the bearings often rotate around a point that is off-center. Furthermore, the pivot point can move location depending on the current rotation angle and even rotation speed. Thus, characterizing the motion of the pivot point is important to understand the true bounds and required clearances around the bearing. The testing of spherical bearings involves measuring the center line of an attached effector. The traditional method used to calculate the pivot point location is to take the intersection of this rotated centerline with its equal, but oppositely rotated, centerline. This approach has some fundamental flaws in that it effectively negates any horizontal pivot point movement. A deeper and more exaggerated analysis shows that the resultant pivot point location does not actually represent the point the bearing is rotating around. A new geometric method is proposed here that accurately determines the exact pivot point that the bearing rotates around. The results from the newly calculated data reveals both a non-zero horizontal pivot point offset and a vertical pivot point offset that better encapsulates the physical behavior of the bearing.

Mentor(s):

Ben Knight

Poster Presentation Abstract Number: 56 :: Mathematical/Computation Sciences

College of Engineering

Modeling Deactivation of Aflatoxin Through Small-Scale Extrusion

Author(s):

Ian Gonzalez, College of Engineering

Abstract:

Abstract redacted.

Mentor(s):

Martin Okos, College of Engineering, Agriculture & Biological Engineering

Troy Tonner, Purdue University

Poster Presentation Abstract Number: 57 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Implications of Alternative Lane Assignment Methodologies for Airport Security Queues

Author(s):

Adam Gottwald, College of Engineering, Honors College

Zachary Marshall, College of Engineering, Honors College

Zachary George, College of Engineering, Honors College

Caleb Patrick, College of Engineering, Honors College

Abstract:

Abstract redacted.

Mentor(s):

John Mott, Polytechnic Institute, Aviation & Transportation Technology

Poster Presentation Abstract Number: 58 :: Physical Sciences

College of Engineering

Continuous Liquid-Liquid Extraction for Lomustine Intermediate

Author(s):

Devna Grover, College of Engineering

Abstract:

Lomustine, which is a chemotherapy drug that treats Hodgkin's Lymphoma and brain tumors, had a price increase of 1400% in 2014. The increased price raised concerns that the potentially lifesaving drug may not be prescribed to patients. The objective of this project is to develop a new end-to-end manufacturing process that enables the in-house manufacturing of Lomustine. The poster aims to determine key process parameters for a Liquid-liquid extraction unit operation. The hypothesis for the unit operation is that a minimum impurity profile can be achieved in the organic phase of continuous flow liquid-liquid extraction by varying critical process parameters. This profile was determined by implementing solvent selection, designing a conducive design of experiments, and analyzing the experimental results with high-pressure liquid chromatography (HPLC). The process was repeated and edited to accommodate learnings through the experiments conducted. Partition Coefficient calculated experimentally showed the best value at 0.36.The percentage of extraction of impurities was also calculated at 82%, which showcased a clear decrease in the impurity of the main process stream. The researchers anticipate that with a purer product stream, the manufacturing process will have less byproduct formation.

Mentor(s):

Jaron Mackey, College of Engineering, Chemical Engineering

Poster Presentation Abstract Number: 59 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Propellant Management System Design for the Zero-Gravity FEMTA Thruster Experiment

Author(s):

Mark Hartigan, College of Engineering

Ojasvi Bairagi, College of Engineering

Martin Degener, College of Engineering

Anirudh Govindhan, College of Engineering

Alan Johnson, College of Engineering

Juyeon Park, College of Engineering

Jaymin Patel, College of Engineering

Abstract:

The increasing popularity of small satellites necessitates the development of small-scale propulsion and attitude control systems. The Film-Evaporation MEMS Tunable Array (FEMTA) is a micro-propulsion device that generates thrust by inducing film-boiling of ultra-pure deionized water in a micron-scale capillary. This design offers lower volume, mass, and power constraints than many other chemical and electrical micro-propulsion thrusters. For the thrusters to function, a steady propellant flow and back-pressure are required. The propellant management system utilizes hydrofluroether (HFE) to inflate a flexible diaphragm, which generates the necessary propellant fluid properties. The Propellant Management Experiment will test and collect data for this system on-board a Blue Origin New Shepard zero-gravity flight in 2022. The system consists of 3 main components: The propellant tanks, the sensor manifold, and the collection chamber. The propellant tanks store the propellant and HFE. The sensor manifold consolidates the sensors which record critical performance metrics. The collection chamber captures the propellant at the end of the loop. All of the propellant management system components were manufactured after rounds of design optimization in the first half of this semester. The team plans to assemble the system for a full loop test. In order to test the flight computer and to verify design decisions, a virtual environment of the propellant management system was created. This model was designed to simulate the components of the flow system under both ideal and non-ideal experimental conditions. Incompressible mass flow through an orifice and the Hertz-Knudsen mass transfer equation governs the model.

Mentor(s):

Katherine Fowee, College of Engineering, Aeronautics & Astronautics

Alina Alexeenko, Purdue University

Steven Pugia, Purdue University

Poster Presentation Abstract Number: 60 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Zero-Gravity Measurement of Thrust from a FEMTA Device Through Plasma Spectroscopy

Author(s):

Mark Hartigan, College of Engineering

Alan Johnson, College of Engineering

Jak Kinsella, College of Engineering

Daniel Qi, College of Engineering

Bridget Cavanaugh, College of Engineering

Caroline Duemling, College of Engineering

Jordan Soberg, College of Engineering

Caleb Kracke-Bock, College of Engineering

Doruk Ayhan, College of Engineering

Matthew Bransky, College of Engineering

Abstract:

Film Evaporation MEMS (Micro-Electromechanical System) Tunable Array, or FEMTA, is a novel micropropulsion device for small satellites. FEMTA uses the surface tension of liquid water as a valve to control vacuum boiling and produce thrust through a low-power and small-footprint system. The FEMTA Thruster Experiment is being devised to test and measure the thrust output of FEMTA in a zero-gravity environment on Blue Origin's New Shepard rocket in 2022. Due to the minimal water vapor discharge of the FEMTA device, a special means of thrust measurement was developed. The chosen design consists of firing water vapor into a cathode charged to a breakdown voltage of roughly 400-500V, transformed up from New Shepard's 27V supply voltage. This generates a plasma that can be measured through plasma spectroscopy. To ensure compliance with Blue Origin's policy on payload electromagnetic interference (EMI), a software defined radio (SDR) is being programmed to scan the local electromagnetic spectrum. When completed, the SDR will detect potentially damaging high frequency radio signals emitted from the plasma experiment as well as the other on-board high-voltage electronics to ensure that our experiment is safe to fly. Tests on a physical prototype are currently being prepared in order to experimentally validate the current design.

In order to verify and direct these experimental procedures, a Direct-Simulation Monte Carlo (DSMC) model was created using the SPARTA software. This simulation used the variable soft shell collision model to predict the thrust and pressure limitations of the FEMTA thruster under the experimental conditions.

Mentor(s):

Katherine Fowee, College of Engineering, Aeronautics & Astronautics

Alina Alexeenko, Purdue University

Steven Pugia, Purdue University

Poster Presentation Abstract Number: 61 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Software & Electronics Components of FEMTA Experiment Simulation Box

Author(s):

Mark Hartigan, College of Engineering

Gouri Bellad, College of Engineering

Ethan Binkley, College of Engineering

Matthew Kane, College of Engineering

Ethan Kessel, College of Engineering

Eric Mesina, College of Engineering

Vishal Ravi, College of Engineering

Evan Rittner, College of Engineering

Jacob Valdez, College of Engineering

Ethan Wich, College of Engineering

Abstract:

The Film-Evaporation MEMS Tunable Array (FEMTA) is a propulsion system designed for nanosatellite attitude control. The FEMTA Suborbital Flight Experiment consists of the FEMTA thruster plasma and propellant management experiments, designed to measure generated thrust and test a propellant delivery system. Early in 2022, these systems will be tested aboard a Blue Origin New Shepard vehicle. Purdue Engineering students are developing a simulation box (Sim-Box) to validate the experiment's systems. The Sim-Box is designed to simulate sensor output produced by the experiment components: propellant flow, tank pressure, and temperatures. The simulated environment will test the flight computer's response to user-controlled scenarios prior to launch. The Sim-Box and flight computer will be placed in a vacuum chamber to replicate the final testing environment. The Sim-Box electronics system includes a Raspberry Pi as the primary computer, an Arduino Uno for simulating the digital sensors, and digital-to-analog converters (DACs) paired with operational amplifiers to simulate the analog sensors. The Sim-Box software includes a simulation of the propellant management experiment to generate sensor data, and a configurable interface for controlling event timing and sensor failures. By the end of the semester, the two sub-teams plan to test the flight computer with the entire Sim-Box suite. In addition to making progress on the Sim-Box system, students developed software unit tests for the flight computer sensors in the Exp programming language. These tests are intended to verify the performance of the sensors on-board the experiment.

Mentor(s):

Katherine Fowee, College of Engineering, Aeronautics & Astronautics

Alina Alexeenko, Purdue University

Steven Pugia, Purdue University

Poster Presentation Abstract Number: 62 :: Physical Sciences

College of Engineering

Numerical and experimental characterization of flexible structures with embedded dilatant materials

Author(s):

Noah Herbert, College of Engineering

Abstract:

Abstract redacted.

Mentor(s):

James Gibert, College of Engineering, Mechanical Engineering

Francesco Danzi, Purdue University

Poster Presentation Abstract Number: 63 :: Mathematical/Computation Sciences

College of Engineering

VIP Project Rekor

Author(s):

Brandon Hernadnez, College of Engineering

Abstract:

Software Supply Chain compromises are a rising threat that, as evidenced with the recent Solar Winds hack, can have devastating impact on even top-security agencies of the US government. To combat Software Supply Chain attacks, The Project Rekor, now renamed to Sigstore, VIP Team is collaborating with the open source Sigstore community in their efforts to protect the open source software supply chain by cryptographically signing their software contributions. Software supply chain security is a rising area of focus for anyone involved in the development and release of software. Due to the heavy dependence on open source software libraries, software products are often targeted through their open source components.l Further, a compromise on a single library in the supply chain will affect all projects that currently use said library. To combat this, Sigstore is creating a software signing service that allows developers to cryptographically sign and contribute artifact meta-information. Through these, artifact trustworthiness can be viewed and verified by anyone through a transparency log. This gives way to the ability to continuously monitor the log for potentially suspicious behavior. The VIP Team is currently working towards creating a supply chain transparency monitor to continuously scan and audit transparency logs to inform users when there is potentially malicious behavior. The certificate transparency monitor will be able to serve as a starting point in future renditions that may require further specialized capabilities.

Mentor(s):

Santiago Torres-Arias, College of Engineering, Electrical & Computer Engineering

Poster Presentation Abstract Number: 64 :: Physical Sciences

College of Engineering

Maneuverability and laser data transmission of a cubesat to ground station

Author(s):

Brian Jeffers, College of Engineering

Xinzhe Xu, College of Engineering

Kyler Kappes, College of Engineering

Sebastian Bell, College of Engineering

Maya Havens, College of Engineering

Adam Frank, College of Engineering

Abstract:

The main goal of the TracSat project is to utilize laser communication between a cubesat system and a ground station system in order to maneuver the cubesat and transmit video of the orbited object from the cubesat to the groundstation. This goal arose due to the desire to learn more about how to maneuver cubesats in space and conduct Attitude Control System analyses without needing for the cubesat to be in space. This is done by the use of a near frictionless table and levitation system designed to produce almost zero friction, an 8-nozzle propulsion system to allow for translational and rotational movement, and the utilization of LiDAR, IMU, Camera, and PID Controllers to aid the cubesat to approach, circle, and leave the videoed object. As of now, the entirety of the project is currently not finished, but most parts are machined and are in the process of being tested to meet performance requirements. Since the process of making a cubesat that can withstand the intense rigors of space, coupled with the cost of sending a payload into orbit can be incredibly expensive, this project shows that it can be very useful for General Atomics in doing this research without needing to be in space.

Mentor(s):

Alexey Shashurin, College of Engineering, Aeronautics & Astronautics

Glynn Smith, Purdue University

Pol Francesch, Purdue University

Poster Presentation Abstract Number: 65 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Efficient Photocatalysis Using SiO2-TiO2 Hybrid Inverse Opals

Author(s):

Seunghyo Jeon, College of Engineering

Abstract:

From solar cells to wastewater treatment, photocatalysis has a wide range of applications. Among various available materials, TiO_2 is the most commonly used photocatalyst. However, the material is only active at certain ultraviolet (UV) wavelengths, limiting its utilization of solar light. A type of iso-porous nanostructure called inverse opal(IO), which has the ability to manipulate light, can help solve this problem. In this study, we attempt to improve the photocatalytic performance of TiO_2 inverse opals by creating SiO_2-TiO_2 hybrid inverse opals. We fabricated SiO_2- TiO_2 hybrid inverse opal structures of varying SiO_2-TiO_2 ratios and pore sizes using the sol-gel method. The IO structures were then submerged in methylene blue solution and subjected to UV light to undergo photocatalysis. Samples of the solution were taken at specified intervals and pollutant concentrations were measured using ultraviolet-visible spectroscopy. The addition of SiO_2 could help photocatalysis in two ways. First, the absorptivity of SiO_2 can help create more sites for the TiO_2 to react with pollutants. Also, SiO_2 can improve the structural fidelity of the inverse opals. This reduces defects and improves the orderliness of the pores, which are crucial for the slow photon effect. The results will provide insights on optimizing the SiO_2-TiO_2 ratio and pore size to improve pollutant removal rate. The findings of this study will allow for the fabrication of robust and more efficient photocatalytic structures for applications in environmental and energy fields.

Mentor(s):

Yuhang Fang, College of Engineering, Mechanical Engineering

David Warsinger, College of Engineering

Poster Presentation Abstract Number: 66 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Assessing Experienced Nurse Decision-Making to Inform Nurse Education

Author(s):

Yongte Joo, College of Engineering

Passawit Puangseree, College of Engineering

Abstract:

Background

In healthcare, failure to identify patient deterioration can cause adverse events and even mortality. Expert nurses utilize intuitive decision-making (DM) processes to quickly comprehend and accurately diagnose clinical situations in order to provide appropriate care to patients. Thus, it is integral that we study the factors that affect experienced nurse DM. Accordingly, the purpose of this study is to assess experienced nurse DM during simulated patient care scenarios.

Methods

Experienced nurses (i.e., greater than 2 years of clinical experience post-training) are being recruited to participate in two, 15-20 minute simulated patient care scenarios to assess their DM. The scenarios were designed by study team members with experience in nursing, simulation, and human factors engineering and represent straight-forward (i.e., treatment of a patient suffering a stroke) and more complex (i.e., caring for two patients suffering from complications due to COVID-19) clinical scenarios. Nurse DM is being assessed using electroencephalogram (EEG), eye-tracking, a heart rate monitor (i.e., to assess stress), and microphone (i.e., to capture audio features).

Implications of Findings

Key features of experienced nurse DM will be extracted from these sensors and used to develop a mixed-reality cognitive aid device (i.e., HoloLens 2), which will ultimately inform training of nursing students. We believe distilling information from our initial study of experienced nurse DM will allow us to identify relevant sources of information in the simulated patient care setting that could be displayed to nurse trainees using the HoloLens 2 and augment their DM processes.

Mentor(s):

Denny Yu, College of Engineering, Industrial Engineering

Nicholas Anton, Indiana University

Guoyang Zhou, Purdue University

Poster Presentation Abstract Number: 67 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Image Processing and Photogrametry for NASA Solar Cruiser Mission

Author(s):

Hamzah Kamel, College of Engineering

Jack Myers, College of Engineering

William Oberley, College of Engineering

Pume Tuchinda, College of Engineering

Abstract:

NASA Marshall Center is collaborating with a student team at Purdue University to demonstrate the functionality of the imaging system of the solar sail set to be launched in 2025. Solar sails are thin sheets of reflective material that use the momentum of photons from the Sun to propel into space. The mission is set to deploy a solar sail at the L1 Lagrange point between the Earth and the sun. The team is divided into two sub teams consisting of hardware and image processing. The Image Processing team is responsible for filtering out blurred images on-board, and ground post-processing such as image stitching, and three-dimensional mapping. The team is divided into four sub teams, each focusing on specific parts of the project, consisting of image classification, distortion correction, image stitching, and three-dimensional mapping. The image classification and distortion correction team are responsible for filtering out images and correcting them on board, resulting in them expecting to be operated using very low power. The images that are filtered out are downlinked to earth to perform ground post-processing such as image stitching and three-dimensional mapping to determine image analysis on the sail. These include determining the optical force pushing on the sail or whether there are tears on the sail, so the orientation of the sail can be adjusted and maintain its trajectory between the L1 Lagrange point. We expect change and restructuring as our team evolves to meet the guidelines provided by NASA.

Mentor(s):

Katherine Fowee, College of Engineering, Aeronautics & Astronautics

Alina Alexeenko, Purdue University

Yung-Hsiang Lu, Purdue University

Anthony Cofer, Purdue University

Poster Presentation Abstract Number: 68 :: Life Sciences

College of Engineering

Title : Characterization of Mycobacteriophage DaddyDaniels Gene 1 as a Cellular Energy Modulator

Author(s):

Evangelia Kaplanis, College of Health & Human Sciences

Jacob Paris, College of Engineering

Abigail Ekeigwe - Graduate Student, College of Engineering

Gentry Fleck,

Abstract:

Cellular energy modulation is important for the thriving of organisms. DaddyDaniels gene 1 has a functional annotation call as an adenylate kinase which is an important enzyme for regulating energy expenditure at cellular levels. This project seeks to characterize DaddyDaniels gene 1,using genetic profiling, bioinformatics, and phylogenetic lineage.

Python was used to conduct comparative genetic profiling of DaddyDaniels gene 1 with Lasso gene 1, a gene with similar function. The Phylogenetic lineage analysis was conducted using PhyML and Splitstree involving the comparison of gene 1 in several phages from clusters B1, B4, B5, and DR with DaddyDaniels. Phyre2 and PyMOL were used to predict the structure - function relationships in DaddyDaniels gene 1.

Python identified 12 mutations between genes 1 in DaddyDaniels and Lasso. This information will help researchers track mutational trends in genes responsible for cellular energy modulation. The research also chronicled the evolution of DaddyDaniels gene 1, with phylogenetic trees representing potential lineages. Phyre2 and PyMOL predicted the model and function of DaddyDaniels gene1 as a transferase enzyme. Transferases are an umbrella family for adenylate kinase, thus confirming the functional annotation.

Holistic elucidation of DaddyDanniels gene 1 using genetic profiling, bioinformatics, and phylogenetic lineage contributes to scientists' knowledge of mechanisms for stabilizing genes responsible for cellular energy modulation.

Mentor(s):

Kari Clase, College of Engineering, Agriculture & Biological Engineering

Gillian Smith, Purdue University

Gentry Fleck, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 69 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Electromechanical Stretching Measurement System for Soft Robotics

Author(s):

Sihun Kim, College of Engineering, Honors College

Abstract:

Electronic devices that consist of soft materials could transform applications in medicine, prosthetics, and robotics to augment such experiences. The soft materials' properties are favorable in their flexibility and maneuverability. However, soft robotics and soft actuators pose challenges to traditional manufacturing technologies. Therefore additive manufacturing, or 3-D printing, is a novel method to manufacture such devices and understanding the material properties of these printed electronic devices are essential. In this study, an electromechanical stretching measurement system for soft robotics research is presented to combine typically disparate mechanical and electrical measurement systems. The system will consist of two linear stages to apply mechanical stresses, a load cell to measure forces, and a multimeter to measure electrical properties. An effective measurement system will enable a holistic analysis of the material and potential for improvement of specific material properties.

Mentor(s):

Alex Chortos, College of Engineering, Mechanical Engineering

Poster Presentation Abstract Number: 70 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

2021 Spring CAM2 Drone Video Team: A Low-Power Computer Vision Competition for Evaluating Multi-Class Multi-Object Tracking

Author(s):

Ayden Kocher, College of Engineering

Justin Qualley, College of Engineering

Matthew Wen, College of Engineering

Indraadityan Logamurugan, College of Engineering

Anand Chari, College of Engineering, Honors College

Yasin Kubilay Sahin, College of Engineering

Gary Zancanelli, College of Engineering

Ziteng Jiao, College of Science

Abstract:

With recent advancements, drone technology can be applied to a variety of problems, especially situations that demand a portable, vision based solution. We propose a competition with emphasis on low power computer vision solutions for these drone applications. Low power is emphasized as drones and similar camera equipped tools are primarily limited by their battery lives. The needs of a competition infrastructure to accelerate progress have been proven by the strong interests and large participation in online computer vision competitions. In 2018, the IEEE Low-Power Image Recognition Challenge had more than 100 solutions submitted, and from 2015 to 2018 the accuracy of the champion's scores increased more than 24 times. The problem, however, is that the data is restricted to images, and no video data is available to test competitors on more advanced computer vision problems. That is why we are creating a competition that asks competitors to perform multi-object multi-class tracking of objectsin UAV video. Our provided sample solution generates detections from Yolov5 and passes them to DeepSort for tracking. Yolov5 and DeepSort were chosen due to their efficient operation to accuracy. After tracking is performed, we compare our results against manually labeled frames from the same videos. Competitor's submissions are then evaluated online where their solution's accuracyby the power consumed is calculated. The final results will be posted to the competition's website and a formal presentation of the winning solutions will be developed for others to understand and build upon.

Mentor(s):

Yung-Hsiang Lu, College of Engineering, Electrical & Computer Engineering

Qiang Qiu, Purdue University

Wei Zakharov, Purdue University

Xiao Hu, Purdue University

Poster Presentation Abstract Number: 71 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

License Plate Detection for Mobile Applications

Author(s):

Bryson Laken, College of Engineering, Honors College

Eli Coltin, School of Management

Surya Perla, College of Engineering

Po Ying Huang, College of Engineering

Yoo Hyun Kim, College of Engineering

Aditya Srikanth, College of Engineering

Bo-Yang Wu, College of Engineering

Hasan Sultan, College of Engineering

Eshaan Minocha, College of Engineering

Elbek Naxarov, College of Engineering

Maximilliam Manzhousov, College of Engineering

Maxwell Ritter, College of Engineering

Sidd Mitra, College of Engineering

Abstract:

The purpose of this project was to apply image processing to license plate images to determine the license plate's numbers. This group created an Android mobile application that allows the user to take pictures of license plates, send it to the server, and then receive the license plate number back on the app. The server looks for an incoming request to process an image from the app. Once this request is made, the server calls a function to store the image locally on the server, call the algorithm, and then wait for the algorithm to return the characters detected in the image. This response is sent back to the device that made the request. The algorithm uses an image passed to it by the server and determines where the license plate is in the image using license plate localization techniques. Then, character segmentation techniques are used to locate the specific characters in the license plate. Lastly, the direction of each pixel is calculated and the result is used as input for the neural network to determine what character it is. After all characters are recognized, the result will be sent to the server. By combining a mobile application, server, and image processing algorithm, this team's purpose was to create a functioning method to identify license plates using a mobile phone. The completion of this project allowed for a learning opportunity for students on the project as well as a foundation for future projects about similar topics.

Mentor(s):

Edward Delp, College of Engineering, Electrical & Computer Engineering

Carla Zoltowski, Purdue University

Poster Presentation Abstract Number: 72 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Hardware Components of FEMTA Experiment Simulation Box

Author(s):

Max Lantz, College of Engineering

Olukunle Akinleye, College of Engineering

Jack Christiansen, College of Engineering

Gage Gardinier, College of Engineering

Jasper Jones, College of Engineering

Mark Melvin, College of Engineering

Tyler Nord, College of Engineering

Neha Pal, College of Engineering

Sara Swanlund, College of Engineering

Ben Zielinski, College of Engineering

Abstract:

The Film-Evaporation MEMS Tunable Array (FEMTA) is a microthruster designed for attitude control of CubeSats; the FEMTA experiment will be launched as part of the payload of a suborbital Blue Origin New Shepard vehicle. The experiment's mission is to collect data on the thruster and the propellant management system's performance in microgravity and vacuum environments. To verify the proper function of the experiment, it must undergo ground tests under the stresses of spaceflight prior to the launch of the experiment. For this purpose, the Simulation Box was developed. Sensor data must be replicated by the Sim-Box for the flight computer as well as a convincing replication of the experiment payload container conditions with the vacuum, thermal, and vibration tests. To determine the optimal materials for the Sim-Box, a trade study was conducted by the team. This led to the selection of aluminum for structure and polycarbonate for experiment visibility. The box has been designed with removable sides, allowing for the user to easily alter the design for visibility and structural concerns. Materials have been acquired for the final design and the team has begun fabrication. The next steps required for progress on the sim-box are to complete construction and integration with the rest of the FEMTA suborbital flight experiment.

Mentor(s):

Katherine Fowee, College of Engineering, Aeronautics & Astronautics

Alina Alexeenko, Purdue University

Steven Pugia, Purdue University

Poster Presentation Abstract Number: 73 :: Physical Sciences

College of Engineering

Design of a Time-Interval Analyzer for Photon Statistics and Quantum Optics Experiments

Author(s):

Patrick Leib, College of Engineering, Honors College

Rohan Potdar, College of Engineering, Honors College

Nicholas Petersen, College of Science

Abstract:

Emerging developments in quantum technology hold much promise for advancements in the 21st century. The challenge in working with quantum states is distinguishing quantum events from classical ones. Our experiments will analyze this distinction by measuring the difference in time between two-photon events using photon arrival time tags. Using a nonlinear crystal and laser light, we will split photons from classical laser light into child photons (energy entangled pairs), which are then detected by two single-photon detectors with their arrival times recorded. If two photons are detected with the same time difference and high regularity, it is evidence of truly quantum behavior, called a coincidence. From there, a distribution can be built using coincident events, which are non-classical events, to identify and better understand the presence of quantum events.

To accomplish the task of time tagging photon events, an in-house measuring instrument is built -- a time interval analyzer (TIA). Single-photon detectors produce an electrical signal when a photon strikes them. Given two of these signals, the TIA will measure and record the time difference between electrical signals and send this information to a computer. The TIA is built from a System on Chip (SoC) coded to the experiment specifications from an external computer via the USB interface. The requirements for data collection placed by the photon source do not allow any SoC to accomplish this task. We determined that the clock speed of the SoC should be at least 200MHz. Once this requirement was satisfied, an in-house TIA was built.

Mentor(s):

Lucas Cohen, College of Engineering, Electrical & Computer Engineering

Navin Lingaraju, Purdue University

Andrew Weiner, Purdue University

Poster Presentation Abstract Number: 74 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Lane Detection

Author(s):

Jirath Lertviwatkul, College of Engineering

Ben Sukboontip, College of Engineering

Vishnu Banna, College of Engineering

Harsh Ranawat, College of Engineering

Abstract:

Lane detection is an integral part of autonomous driving systems. The purpose of this project is to use a neural network approach to detect lanes with a scalable approach. Specifically, we take images from the car's dashboard camera and detect lanes and objects from the images. Our method uses a backbone with the dilated residual network to learn generic information about the road and the objects on the road without the burden of instance separation. Next, we swap out the segmentation head for three different heads: object detectors, lane key-points, and safe drivable-area segments. The goal of the three heads is for them to be cascaded together such that the information encoded for one task can inform the predictions for other tasks. In this case, the output of the object detector head is passed to the key-point lane detection head as input, and the output of the key point lane detection head is passed to the safe drivable-area segmentation head as input. The output of the model is then evaluated using a voting system, pairing points on the lane to the points on the ground truth. By the end of the project, we aim to have a lane detection algorithm that takes in images of a road from the dashboard camera and processes the image to detect the lanes, drivable areas, and the objects on the road at a general speed of 1 to 2 frames-per-second.

Mentor(s):

Edward Delp, College of Engineering, Electrical & Computer Engineering

Carla Zoltowski, Purdue University

Poster Presentation Abstract Number: 75 :: Life Sciences

College of Engineering

Genome Annotation and Functional Analysis of Mycobacteriophage Izajani

Author(s):

Jacob Loncar, College of Engineering

Haley Bunnell, College of Engineering

Jacob Klein-Cohen, College of Engineering

Shruthi Garimella, College of Engineering

Abstract:

Bacteriophage are viruses which kill very specific bacterial hosts. There are approximately 10^31 bacteriophages in existence, with countless different varieties that all target a particular species of bacteria. They hold potential as tools against bacterial diseases, and investigating and documenting them brings us closer to utilizing them. We set out to examine and annotate the genome of the Myoviridae mycobacteriophage Izajani which is part of the C1 cluster. We used this information to learn more about how certain protein structures contribute to certain functions, how these genes stemmed from other types of phage, and examine the mutations within those genes. In order to complete this examination, we have combined results and explored the annotation process of genomes. Our team has focused efforts into several programs and methods to analyze the proteins. Through the use of Phyre2 and PyMOL we have been able to observe predicted structures of certain genes within this genome and examine how these structures would contribute to carrying out their predicted functions. Using Python, we have examined similar genes to determine the location and type of mutations present. Finally, the programs SplitsTrees and phyML were used in order to observe relationships between clusters and evolutionary trends for the genes. Through examining and annotating these genes, we have determined their locations within the genome and protein function, allowing a greater understanding of the processes and components present in bacteriophage, and how they vary between closely related members.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Gillian Smith, Purdue University

Emily Kerstiens, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 76 :: Physical Sciences

College of Engineering

Ferromagnetic Resonance Performance Verification of the NanOsc Rotating Co-planar Waveguide for use with the Quantum Design Dynacool PPMS System

Author(s):

Jacob Luta, College of Engineering, Honors College

Abstract:

This study serves as a performance verification of the NanOsc rotator coplanar waveguide (CPW) for use with the DynaCool PPMS in characterizing the ferromagnetic resonance properties of thin film materials. We perform a 2 - 18 GHz in-plane (IP) analysis on a 10 nm NiFe test sample with in-plane magnetic anisotropy. This evaluation was cross-referenced with a sample test on a fixed IP CPW sample mount, provided by NanOsc. Postprocessing was accomplished with PhaseFMR software. The rotator's IP analysis closely matched that of the fixed CPW. However, sharp reductions in signal transmission were observed for measurements utilizing the rotator at 2.8, 3.8, 5.3, 6.4, 8, 10.5, 13 GHz, and frequencies greater than 15 GHz. We do not recommend measuring resonances at these frequencies while performing analyses with the rotator. Impedance mismatch may cause the observed transmission errors, as a flexible coaxial line unique to the rotator was used to interface with the system's CryoFMR probe. Additional iteration of the rotator CPW design is necessary to mitigate this signal absorption. Further studies must determine the validity of this hypothesis and incorporate error estimation for each measurement. As a recommendation, future designs should limit use of this flexible coaxial cabling.

Mentor(s):

Neil Dilley, Discovery Park, Birck Nanotechnology

Poster Presentation Abstract Number: 77 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

A Waypoint-Based Approach towards Autonomous Driving

Author(s):

Aref Malek, College of Science

Mikail Khan, College of Science

Alec Pannunzio, College of Engineering

Vignesh Ramachandran, College of Engineering

Dominic Holifield, College of Engineering

Ismail Hussein, College of Engineering

Sudarmadhi Rabindran, College of Engineering

Jason Park, College of Engineering

Abstract:

In the domain of autonomous driving, many initial approaches to the problem involve a direct prediction of steering and throttle from an image. Our previous experience last semester taught us that this direct prediction of steering+throttle data has very poor generalization and cannot scale long term. In order to create a more efficient approach to this problem, we intend to utilize a waypoint approach to driving - meaning our neural network will generate “paths” to drive on, rather than utilizing one steering angle and throttle combination for every frame taken in.

In order to achieve this, we would obviously need a neural network in order to generate our paths, but we would also need a mechanism to convert this generated path into driving data. In our approach, we utilize a PID controller that calculates the optimal route based on a given number of waypoints. With these two in combination, we are able to allow our network to “see” the road ahead of it, allowing for a smoother and more controlled driving experience.

Mentor(s):

Aly El-Gamal, College of Engineering, Electrical & Computer Engineering

Shakti Wadekhar, Purdue University

Poster Presentation Abstract Number: 78 :: Mathematical/Computation Sciences

College of Engineering

Solar Sail - Image processing team

Author(s):

Greivin Martinez, College of Engineering

Abstract:

The NASA Solar Cruiser is a planned spacecraft that will study the Sun while propelled by a solar sail. The craft’s nearly 1672 meters squared solar sail will demonstrate the ability to use solar radiation as propulsion and facilitate views of the Sun not easily accessible with current technology. Therefore, the camera needs to be well-engineered, well-designed, and well-programmed so that the spacecraft can show excellent results. The spacecraft is planned to be launched in 2025. This study aims to improve the computer vision and image processing of the NASA Solar Cruiser camera. The image processing team is currently working on finding efficient and appropriate code that will be useful for computer vision and image enhancement and classification. Some of our current activities include working with a Python library called OpenCV to classify an image's blurriness, looking into ways that neural networks can enhance computer vision, and blind image blur estimation via deep learning.

Mentor(s):

Caleb Tung, College of Engineering, Electrical & Computer Engineering

Poster Presentation Abstract Number: 79 :: Mathematical/Computation Sciences

College of Engineering

VIP: System-on-Chip Extensible Technologies (SoCET)

Author(s):

John Martinuk, College of Engineering

Chris Priebe, College of Engineering

Owen Prince, College of Engineering, Honors College

Agrim Bharat, College of Engineering

Joseph Chun, College of Engineering

Samuel Elkin, College of Engineering

Seth Feikert, College of Engineering

Aidan Fisher, College of Engineering

Stephen Iwu, College of Engineering

Seojune Jung, College of Engineering

Jimmy Kleszynski, College of Engineering

Yuchan Lee, College of Engineering

Lawrence Lo, College of Engineering

Malcom McClymont, College of Engineering

Roan Numa, College of Engineering

Thwandall Philemon, College of Engineering

Andrew Smenyak, College of Engineering

James Smith, College of Engineering

Tin Tran, College of Engineering

Matthew Waldren, College of Engineering

Andrew Wang, College of Engineering

Brian Zwiener, College of Engineering

Abstract:

The SoCET team is comprised of +50 members, across 10 sub-teams, collectively working towards the development of a System-On-Chip (SoC). The recently formed Rad-Hard sub-team is studying methods for simulating the effects of ionizing gamma rays passing through the layout of a chip. The digital design students are adding RISCV extensions for compressed instructions and single-precision floating point arithmetic. The verification teams are building the Universal Verification Methodology (UVM), Formal verification (FV), and FPGA environments to validate the functionality of the recently developed I2C and SPI peripherals. Moreover, the Analog team is creating a wireless radio, a digital-to-analog converter (DAC), as well as a Low Dropout (LDO) linear regulator. The PCB sub-team is designing a board to mount our latest chip, AFTx05, with the option to connect the SoC to the header pins of an FPGA. The Compiler team is currently focused on creating LVM passes to utilize the, previously designed, SparCE machine learning architecture more efficiently. The Software members are implementing a software development platform which leverages an FPGA with a CPU tracker implanted and working towards running the Rust OS on a future chip iteration. The design flow team is getting acquainted with the open source Electron Design Automation (EDA) suite, openLane, which will be used to tapeout the next SoCET chip. The ICI team is creating a chiplet protocol intended to improve manufacturing yield with the use of redundancy. Finally, the SAFE sub-team is prototyping a security architecture to mitigate both supply-chain and spectre-like attacks.

Mentor(s):

John Martinuk, College of Engineering, Electrical & Computer Engineering

Mark Johnson, Purdue University

Sutton Hathorn, Purdue University

Matthew Swabey, Purdue University

Poster Presentation Abstract Number: 80 :: Physical Sciences

College of Engineering

3D Modeling of Geostationary Satellites

Author(s):

Ellouise Moehring, College of Engineering

Abstract:

The growing volume of space debris has become a serious issue in recent years. The purpose our research is to improve space situational awareness (SSA), defined by the European Space Agency (ESA) as the “ability to view, understand, and predict the physical location of natural and humanmade objects in orbit around the Earth.” The objective of this project is to aid in satellite characterization in creating 3D models of known geostationary satellites. Because of the distances of the satellites to a ground-based sensor only non-resolved image without any details are available, hence satellites cannot readily be identified or characterized using ground optics. The light of an orbiting object is collected in a time series, a so-called light curve, with our telescope, the Purdue Optical Ground Station (POGS), and the 3D models are used to compute the time series of the light intensity reflected off the satellite. The computed data is then matched to the data from the telescope and identified as a satellites or used to characterize material or shape changes, or to extract attitude motion. Through careful surveillance and observation, the impact of space debris on active and future satellite missions can be reduced.

Mentor(s):

Carolin Frueh, College of Engineering, Aeronautics & Astronautics

Daigo Kobayashi, Purdue University

Poster Presentation Abstract Number: 81 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

5G wave characteristics

Author(s):

Steven Mueller, College of Engineering

Chris Verghese, College of Engineering

Justin Zhang, College of Engineering

Abstract:

5G is the newest and most advanced method of wireless communication, and is well known due to its low latency, high speed, and high data capacity. However, there are issues such as high installation cost, low wave range, and the obstructive nature of the waves. We are researching carrier synchronization, 5G channel simulation, Alamouti codes, and reports on 5G characteristics, all of which is used to better understand the implementation of 5G.

Carrier synchronization is the process by which the signal receiver accounts for the frequency and phase of the received wave. We researched how the function of carrier synchronization can be analyzed and simulated by MATLAB code which can be used to better understand 5G. The 5G simulator was created by New York University and it simulates how 5G waves would propagate through a specific environment. Currently, we have read through the 70-page User Manual to understand all 49 input parameters, output figures, and how to model specific situations. We have done entry-level research on Alamouti space-time block code, a high-speed communication scheme implemented for MIMO (Multiple Input Multiple Output), which takes statistics and mathematics to account for varying transmission channel variations. Finally, we have researched the usage of mmWave, massive MIMO as well as a duplex to transceive signals on the same frequency.

Through our research, we hope to gain expertise on the characteristics of 5G waves in order to better understand how these communication waves function.

Mentor(s):

Chih-Chun Wang, College of Engineering, Electrical & Computer Engineering

Poster Presentation Abstract Number: 82 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Developing a Performance Face Mask

Author(s):

Cole Nielsen, College of Engineering, Honors College

Max Kwan, College of Engineering, Honors College

Soham Joshi, College of Engineering, Honors College

Dana Boucher, College of Engineering, Honors College

Abstract:

With the COVID-19 pandemic making it difficult for athletes to properly exercise while wearing a mask, there is a need to understand what makes an effective mask design for use in athletic activities. This question was addressed first by testing a number of masks already used by the general public with a variety of different design features to determine which designs were beneficial for the athlete use case. Blood oxygen level and heart rate were measured throughout a number of treadmill runs at various speeds for each mask to create a rough determination of performance. With this information in hand, the features that lead to better athletic mask performance could be understood and a novel design was created that incorporates these elements. Additionally, the design features that improve athletic performance were presented in a way that aids customers in making a purchasing selection. Although the closure of many design labs on Purdue’s campus due to the pandemic made the actual prototyping of this mask difficult, the conceptual process was still pursued. Ultimately, this resulted in an on-paper design being created alongside the improved understanding of mask performance for already existing products.

Mentor(s):

Steven Wereley, College of Engineering, Mechanical Engineering

Poster Presentation Abstract Number: 83 :: Physical Sciences

College of Engineering

Earth and Remote Sensing GUI

Author(s):

Chidubem Okoli, College of Engineering

Jude Pinto, College of Engineering

Abstract:

Tasked to make a MATLAB GUI for the Specular Code file that was given to us. The code's main objective is to calculate the specular point, which is also known as the point that the reflected ray intersects with the ground. This then creates a graph of the Frenzel Zone, which is an ellipse around the specular point that visualizes the area the signal of opportunity (SoOp) measurement averages over. The GUI should be able to take input information for the start and end days along with the receiver location and the time that the receiver is in those locations (longitude, latitude, height and ground above sea level).

Mentor(s):

Eric Smith, College of Engineering, Aeronautics & Astronautics

James Garrison, Purdue

Poster Presentation Abstract Number: 84 :: Mathematical/Computation Sciences

College of Engineering

Earth History Visualization

Author(s):

Sree Keerthana Panuganti, College of Engineering

Suyash Mishra, College of Engineering

Abstract:

The geologic record captures Earth’s history and the vast number of a countries unique geological formations. Accessing all of this country-specific geology is a hassle since each country has a different way of storing this information. Our research, in conjunction with the Deep-Time Digital Earth program of the International Union of Geological Sciences (under UNESCO), has focused on the development of a multi-database searching website to extract formations’ locations with its rock-type and environment from multiple different countries across different geological time periods.

Currently, we have focused on improving accessibility to Southeast Asian geology with help from experts in China, India, Vietnam, Thailand, and Australia, who are helping us to transform geojson data of specific formations into a polygon display of formations that move the patterns over a period of time. Our website currently allows for users to filter out formations across India, China, and Thailand with various geological time periods. Once a user sees the results of the request they sent, they can click on a particular formation button and get redirected to a webpage with additional details from the appropriate country’s database that the formation came from.

By the end of this semester, users will have the opportunity to filter out formations with subdivisions of time - age and stage, see a visual display of the formation’s location on a map and how it moves, and observe with a quick glance what stage a formation is in through color-coded search results. Once all of this is done with Southeast Asia partners, similar tasks will occur with other countries. Ultimately, the combined efforts will allow global users to better access information on geographical Earth's history.

Mentor(s):

James Ogg, Not a Purdue West Lafayette Employee

Aaron Ault, Purdue University

Poster Presentation Abstract Number: 85 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

NeoSMART: A Neonatal Thermal Management System with Integrated Vital Signs Monitoring

Author(s):

Alyson Pickering, College of Engineering

Kevin Alessandro Bautista, College of Engineering

Akio Fujita, College of Engineering, Honors College

Abstract:

The goal of NeoWarm is to augment a common method of combatting hypothermia in premature infants: Kangaroo Mother Care (KMC), where the newborn is swaddled bare chested to the caregiver. The device will include temperature regulation and vital signs monitoring to ensure the safety of the infant in the carrier. Our device will improve KMC as it will not only work in the swaddled position but also allows the caregiver to take breaks and safely leave the infant in the device's "stand-alone mode," As vital signs monitoring is a large part of the project, our technological aim is to develop the ability to collect and analyze accurate heart rate and respiration data. We are using sensors to measure temperature as well as heart rate and respiration using both photoplethysmography (PPG) and the electrocardiogram (ECG). To date, we have developed prototype printed-circuit boards to measure heart rate, respiration, and temperature. The ECG board has been tested and has shown the capability to measure an adult ECG with qualitatively good signal integrity, allowing us to determine heart rate and heart rate variability. This board contains the capability to dynamically adjust the signal gain to ensure we are capturing the best ECG signal without any input from the user. Further work is necessary to test the PPG and temperature regulation designs and to coordinate the different sensing abilities into a single comprehensive measuring unit.

Mentor(s):

Jacqueline Linnes, College of Engineering, Biomedical Engineering

Orlando Hoilett, Purdue University

Nicholas Bluhm, Purdue University

Sherri Bucher, Indiana University

Poster Presentation Abstract Number: 86 :: Mathematical/Computation Sciences

College of Engineering

SAFE - Secure Architectural Framework Enhancement

Author(s):

Raghul Prakash, College of Engineering

Andre Hatushikano, College of Engineering

Enes Shaltami, College of Engineering

Sen Wang, College of Engineering

Ruoyi Chen, College of Engineering

Tuhin Sarkar, College of Engineering

Abstract:

Our work for this project is to come up with a working prototype of SAFE architected by Dr. David Mayhew. Computer security has become increasingly important with various vulnerabilities and exploits found periodically in kernel and application software based on attacks that involve memory-based attacks, side-channel attacks, privilege escalation attacks, and packet sniffing attacks on network systems. These inherent software problems cannot be patched by software alone for it is like adding fuel to fire. The only way to solve this would be to make use of hardware-enforced containerization and segmentation using a redefined memory model. This is where Dr. Mayhew's SAFE model comes in. It preserves existing computer architecture models but modifies the memory model from the L1 cache up to the hard-disk drive. It completely replaces the microkernel found in modern operating systems with cache-based hardware containerization technology. It has a Process Management Unit (PMU) that is in charge of messaging and scheduling, a Secure-Networking Engine (SNE) that replaces the conventional networking stack with socket-based communication at the physical transport layer, a Cache Hierarchy (CH) that is a hardware-memory management system and a Last-Level Store (LLS) that is a pseudonym for a hard-disk drive. It preserves application software by translating OS syscalls that normally invoke a software kernel in modern operating systems with a SAFE adaptation layer that replaces them with message notifications that unify hardware interrupts and signaling found in legacy operating systems. This preserves legacy software and processor architectures and enforces maximum computer security.

Mentor(s):

David Mayhew

David Mayhew, Universant Processors

John Martinuk, Purdue University

Christopher Chiminski, Purdue University

Poster Presentation Abstract Number: 87 :: Life Sciences

College of Engineering

Development of Novel Elastin like Polypeptide Constructs for Improved Epithelial Growth Factor Receptor Binding

Author(s):

Madhu Prakash, College of Engineering, Honors College

Abstract:

Abstract redacted.

Mentor(s):

Aayush Aayush, College of Science, Chemistry

David Thompson, Purdue University

Poster Presentation Abstract Number: 88 :: Mathematical/Computation Sciences

College of Engineering

Withdrawn.

Poster Presentation Abstract Number: 89 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Implementation of a Static Wireless Charging System (SWCS) for Electric Vehicles: An Efficient and Equitable System Using Cycloconverters

Author(s):

Sachi Rajadnya, College of Engineering

Ethan Welp, College of Engineering

Kevin Stankiewicz, College of Engineering

Trevor Hylen, College of Engineering

Cooper MacNicholl, College of Engineering

Abstract:

The increasing scarcity of fossil fuels is driving the transition from a carbon based energy economy to an electric one. This increase in demand has sparked interest in developing convenient methods to charge transportation systems such as electric vehicles (EV). Wireless inductive power transfer (WIPT) is a way to wirelessly transfer energy through the use of coupling coils, which in this case, will happen statically. However, implementing this system brings up concerns about infrastructure feasibility: whether users can consider this wireless charging system to be efficient enough to use alongside alternative charging methods. Current WIPT uses multiple cascading power electronic converters to reach high frequencies suitable for power transfer. This study views the use of a cycloconverter instead, a singular converter that allows for the same WIPT with less loss of power. This includes a small tradeoff of having a less reliable control system to maintain desired output, which is tested in Pathwave Advanced Design System, a circuit simulator. This more efficient wireless charging system will appeal to the convenience of charging an EV in public spaces. This in turn reduces implementation and design cost for manufacturers, and reduces operating cost for distributors.

No mentors.

Poster Presentation Abstract Number: 90 :: Mathematical/Computation Sciences

College of Engineering

Motion analysis for estimating lifting loads using few-shot learning

Author(s):

Sahana Rayan, College of Science

Abstract:

Excessive physical loads in lifting induce a significant amount of workplace injuries. Researchers have been developing AI models for estimating lifting loads using body motion features. However, each person's body motion can vary across different lifts because of factors such as muscle fatigue and attention. This Intra-individual variability can impact AI models' implementation and require practitioners to observe and collect data from a worker multiple times. However, collecting and labeling large scale of data from workers are expensive. Few-shot learning and GAN techniques provide a potential solution for building a robust AI model with strong generalization capability on a small dataset. This study aims to accurately predict lifting risks through recorded videos and improve the model's ability to generalize despite the problem of variability and a small data set. 30 subjects repeatedly performed 81 lifts with three different load levels and three different task types in our experiment. Then, we randomly selected 9 lifts from each subject to train the model and the rest 72 lifts were used to evaluate the model. We implemented the Triplet net loss function to train an efficient 3DCNN model extracting motion features from videos. Then, a GAN model was used to generate fake embedded features for further enhancing the generalization ability of the model. For evaluating the proposed method, we trained a 3DCNN model without any treatments as the baseline model. Our pilot results demonstrated that the proposed method significantly improves the generalization ability of the 3DCNN model in predicting lifting loads with a small dataset.

Mentor(s):

Denny Yu, College of Engineering, Industrial Engineering

Guoyang Zhou, Purdue University

Poster Presentation Abstract Number: 91 :: Life Sciences

College of Engineering

Analysis of Orange Corn Hardness to Predict Food Product Applications

Author(s):

Sean Renwick, College of Engineering, Honors College

Abstract:

Utilizing high-carotenoid orange corn instead of regular white or yellow corn in food has the potential to deliver more health-benefiting nutrients to consumers. However, the usability of a new corn variety in food product development is highly dependent on its endosperm texture characteristics. The purpose of this research was to understand how to better quantify the ratio of hard (vitreous) versus soft (starchy) endosperm in different genotypes of high-carotenoid orange corn. In this study, 94 maize genotypes (36 inbreds and 58 hybrids) were analyzed. ImageJ bioimaging macros were used to determine the hard and soft endosperms' cross-sectional areas and create an approximate ratio. Each genotype was milled and run through a Rapid Visco Analyzer to establish its pasting properties. It has been found that the hard endosperm in the selected orange corn genotypes range from 11% to 59%. Although data collection has not been completed, the information collected thus far will help better explain the effects of kernel starch composition on orange corn's food processing characteristics. These results will be combined with other measures, such total starch, zeins protein content, and amylose/amylopectin ratio to develop more comprehensive models to help predict candidate genotypes of orange corn's food processing characteristics. If there is a strong correlation between RVA, starch content, protein content and ImageJ endosperm ratios, it may be possible to predict a maize variety's endosperm ratio with RVA. This could significantly reduce the time and subjectivity in hardness testing needed in orange corn breeding and the food industry applications.

Mentor(s):

Darwin Ortiz, College of Agriculture, Agronomy

Torbert Rocheford, Purdue University

Poster Presentation Abstract Number: 92 :: Physical Sciences

College of Engineering

Optimization of the Enhanced Centrifuge Method to Quantify the Effect of Particle and Surface Properties Towards van der Waals Particle Adhesion

Author(s):

Tyler Roberts, College of Engineering, Honors College

Abstract:

The enhanced centrifuge method has shown to be effective in characterizing the effect of particulate and surface properties towards powder adhesion through tunable parameters called effective Hamaker constants. This method involves measuring the adhesion of a powder across the entire particle size distribution by tracking the particle adhesion across multiple force increments. The resultant effective Hamaker constants provide valuable information as they quantify the effect of the particle properties and surface roughness towards the adhesion. The purpose of this work was to study how altering the number of force increments measured in an experiment skews the resultant effective Hamaker constants. *In silico* experiments were employed to calculate the adhesion force between assumed spherical particles and a solid surface for a given size distribution of particles, producing the adhesion force between the particles and surface in a van der Waals force dominated regime. The force distribution was then discretized into force increments to mimic a centrifuge experiment. The purpose of this simulation was to determine the optimum force increment step to minimize experiment time without skewing the resultant effective Hamaker constants. This simulation work is valuable as it provides a guide on how to execute the enhanced centrifuge in a timely, efficient manner while simultaneously generating sound results.

Mentor(s):

Stephen Beaudoin, College of Engineering, Chemical Engineering

Caralyn Stevenson, College of Engineering, Chemical Engineering

Poster Presentation Abstract Number: 93 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Visualization of Live 3D Data

Author(s):

Elliott Schmittenberg, College of Engineering, Honors College

William Lynch, College of Engineering

Alexandra Loyot, College of Engineering

Aaron Fritz, College of Engineering

Abstract:

This project explores manipulating 3D camera data in the Unity Game Engine to visualize 3D images in Virtual Reality (VR). Using the XYZT Lab's existing proprietary scanning technology, the team's goal is to create a 3D model that can be viewed on commercial Head Mounted Displays (HMDs) such as the Oculus Rift S and Quest platforms. The Holoteam has successfully converted data from the 3D camera/projector system into a procedural 3D mesh using C# scripts which is presented in a virtual playspace that can be interacted with by the VR system. Currently, the team is working on transitioning this technology to video formats from still frames which will allow real-time 3D video to be viewable from an HMD. Next steps will include taking live data from the 3D imaging sensor and importing that data into Unity in real time, thus enabling that data to be displayed virtually as data is received.

Mentor(s):

Song Zhang, College of Engineering, Mechanical Engineering

Poster Presentation Abstract Number: 94 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Mental Health Analysis Using Series Anomaly Detection

Author(s):

Shelly Schwartz, College of Science

Muhammad Abdulbaqi,

Wenxi Zhang,

Yujia Zheng,

Abstract:

As the usage of mobile devices becomes more integrated in the daily lives of individuals, the potential to monitor and analyze human behaviors through the use of ubiquitous sensing devices becomes increasingly realistic. Ubiquitous sensing can provide insights into a person’s sleep and exercise patterns, communication, and travel habits, which can be used to infer mental health status. However, a critical aspect of analyzing human behaviors is to distinguish between significant and insignificant information or even misinformation. This gives rise to the importance of developing AI-based anomaly detection tools to analyze sensor data. Often sensor data are represented as time-series data, for example, wifi and Bluetooth connectivity or battery level over time. In this research project, we will use time series anomaly detection models to assess and monitor mental health given data that smartphone sensors generate. There are various techniques to go about accomplishing this task. One said algorithm that we will be implementing is a sliding window to extract sub-sequences from a series that might be potentially abnormal, using K-Nearest-Neighbor clustering to determine what sequences those may be. Observations that fall outside a predicted confidence interval (PCI) for a specific window of time will be deemed as an anomaly. Predicted observations (used to find PCI) will be calculated using Auto Regression and then compared with the actual observation. The anticipated machine learning analytics tool has the potential to benefit high-risk population groups by facilitating the expeditious and accurate detection or warning of their risky behaviors.

Mentor(s):

Nan Kong, College of Engineering, Biomedical Engineering

Poster Presentation Abstract Number: 95 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Identifying Gear Transition Decisions for Optimal Acceleration

Author(s):

Sajon Seaberg, College of Engineering

Adriana Hisham, College of Engineering

Praveene Raguparan, College of Engineering

Dominick Caponigro, College of Engineering

Abstract:

The Indy Autonomous Challenge seeks to test the limits of automated vehicle software. The challenge requires teams to perfect an autonomous driving algorithm for an Indy Lights Dallara race car to race at the Indiana Motor Speedway against other collegiate teams across the globe. Our team, composed of four undergraduate student researchers, is assisting the Black & Gold Autonomous Racing team to identify the optimal gear transition decisions for optimal acceleration. Acceleration is crucial in a race where competitors have comparable top speeds as faster acceleration can reach top speed at a quicker rate. To maximize acceleration in the vehicle, we must maximize the power and resulting torque outputs of the engine. Changing gears allows the engine to utilize its maximum power more efficiently to output more torque and therefore gain more acceleration. When changing to a higher gear, an amount of energy is lost as the transition occurs, thus reducing power output efficiency. Our VIP team will create and analyze gear-changing models in MATLAB to identify the optimum conditions for gear changes. We seek to determine the specific conditions in which the optimum acceleration occurs. Our research team aims to gain a greater understanding of acceleration optimization allowing for faster and more competitive race times.

Mentor(s):

Aly El Gamal, College of Engineering, Electrical & Computer Engineering

Rohan Manna, Purdue University

Vishnu Chellapandi, Purdue University

Poster Presentation Abstract Number: 96 :: Mathematical/Computation Sciences

College of Engineering

Food Classification

Author(s):

Robert Sego, College of Engineering

Cole Stecyk, College of Engineering

Aryan Tyagi, College of Engineering

Prekshaa Veeraragavan, College of Engineering

Alexander Vives, College of Engineering

Tiffany Yu, College of Engineering

Alex Dufour, College of Engineering

Abstract:

The purpose of this project is to automatically classify images of food and estimate the calorie count of any typical meal. With the rise of obesity and food allergies, there is a necessity for people to develop good eating habits. Typically, this requires prior knowledge about the nutritional value of a dish, but this information is often not easily accessible outside of prepackaged meals. An unfamiliar dish might contain ingredients harmful to the consumer, such as peanut or fish oil for those with allergies. In order to address these issues, we will create a model that can segment up to five individual food items within images containing multiple dishes, such as those within the UNIMIB 2016 dataset, using saturation and morphological filters. We will then analyze the segmented regions of interest with a Convolutional Neural Network model to classify food items from 101 different classes with approximately 80% accuracy. We will then present caloric and nutritional data associated with the classified food to the user. Our project is similar in scope to the TADA Project, and has extensive applications in mobile software, diet planning, and healthcare.

Mentor(s):

Carla Zoltowski, College of Engineering, Electrical & Computer Engineering

Edward Delp, Purdue University

Poster Presentation Abstract Number: 97 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Disinfecting Robot – COVID19 Response Project-A-Modular Integration

Author(s):

Dineel Selvakumar, College of Engineering

Wesley Cragen, College of Engineering

Sam Graham, College of Engineering

Yi Xie, College of Engineering

Abstract:

The purpose of this project is to find a safe and efficient way to properly clean a room that has potentially been exposed to the corona virus; to benefit those who must use the room for their personal reason. The project has developed two different methods for controlling the virus that includes ultraviolet radiation and Bernoulli's air filtration, and both of these methods will be tested in classrooms and housing for people who were infected by the virus. A prototype for the Ultra-Violet radiation has been manufactured, and testing has demonstrated effective use of the Ultraviolet radiation on the virus. This test takes large sample of points accumulated by the UV light and displays a range of colors. These colors show the amount of exposure from the virus where red and yellow determines underexposure while blue and black determines overexposure. Even though these prototypes have been developed, innovation must be done to impact the efficiency of corona virus containment and creating a more user-friendly design for the consumer. These innovations include making the payload of the robot robust in its hardware design and easily accessible to the customer and innovate the battery of the robot by incorporating a wireless charging module into the system. While these project are innovated in their perspectives, the team must also ensure wireless access to the robot, design the robot to function no matter the payload, work with NAV team to validate the effectiveness of the payload modules, and maintain robot maintenance and upkeep.

Mentor(s):

Richard Voyles, Polytechnic Institute, Engineering Technology

Poster Presentation Abstract Number: 98 :: Life Sciences

College of Engineering

Annotation and Functional Analysis of Mycobacteriophage Izajani Genome

Author(s):

Julia Simler, College of Engineering

Garret Manquen, College of Engineering

Lauren Jozwiak, College of Engineering

Emma Lietzke, College of Engineering

Abstract:

Classified as the most abundant organisms on Earth, bacteriophages are viruses that infect and kill their bacterial hosts. Recently, bacteriophage research in the biotechnology field has peaked due to the potential uses of phage therapy. However, little is known regarding bacteriophage and much is left to be discovered, inciting further research. This project focuses on Izajani, a C1 cluster phage in the Myoviridae family found at Purdue University. The goal of this project is to annotate Izajani's genes between 2344 bp and 16782 bp to compile new information about the structure, function, and evolution of Izajani using annotation and bioinformatics tools.

To analyze our group's genome section, we determined the best start sites for the genes from information generated in DNA Master, Starterator, GeneMark, Phamerator, and PECAAN, and then determined possible functions of Izajani's genes by running BLASTs from NCBI, PhagesDB, and HHPred. To investigate the relationship between structure and function, the amino acid sequences of various genes in Izajani were run through Phyre2 to predict structures using sequence comparison and later visualized in PyMOL to allow for better visualization and analysis of these predicted structures. In order to analyze evolutionary differences and traits, phyIML and Splitstree were used to compare the same protein from different phages in diverse clusters in an effort to observe relationships that can be used to find evolutionary differences within the same protein. Through this research, scientific knowledge of bacteriophage has grown and can be used to advance research in the biotechnology field.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Gillian Smith, Purdue University

Emily Kerstiens, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 99 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

The Role of Worker Cognitive Biases in Electrical Safety Performance: an fNIRS Study in a Mixed-Reality Environment

Author(s):

Makayla Simpson, College of Engineering

Kaylee Dillard, College of Engineering

Abstract:

Many efforts have been made to reduce the number of injuries occurring in the electrical construction industry, but this sector experiences one of the highest fatality rates among all sectors. The construction industry has implemented safety training, standards, and personal protective equipment to lower the amount of injuries but it is not enough. The purpose of our research is to examine the risk-taking behavior of line workers and how it affects their safety performance, decision dynamics, and productivity on the job. Utilizing mixed-reality combined with wearable sensors , including, location-tracking sensors, wireless neuropsychological and cognitive brain monitoring (fNIRS), eye-tracker, photoplethysmography (PPG) and galvanic skin response (GSR); will be used to track the participants motions, positions, musculoskeletal data, and psychological responses. The use of mixed reality will make the experience as real as possible making the participant have naturalistic behaviors. Participants are exposed to a virtual scenario in which they must perform a series of tasks involving electrical power lines. Our focus is to determine whether workers compensate for the levels of safety and by behaving in a riskier fashion and identify if demographic and psychographic factors may affect the likelihood to have at-risk behaviors. Due to the amount of personal equipment provided, workers may alter their behavior and over-rely on the safety measures employed, which could therefore result in injury or death. Once the tasks are completed, all data from the wearable sensors and fNIRS will be compiled and analyzed. Following our study, we may find that safety managers may consider implementing a more in-depth training for workers and provide them with a better understanding of the risks involved with working on power and utility lines.

Mentor(s):

Sogand Hasanzadeh, College of Engineering, Civil Engineering

Poster Presentation Abstract Number: 100 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Sparce Optimizations For a Compiler in LLVM

Author(s):

Vidush Singhal, College of Engineering

James Zampa,

Kirshanthan Sundararajah,

Charitha Saumya,

Christopher Chiminski,

Abstract:

As machine learning enters more diverse industries, there is a need to reduce the computational power required to run machine learning models. Sparsity aware Core Extensions (SparCE) take advantage of zeros in machine learning models, a common aspect of convolutional neural networks (CNNs). Sen (2017) found SparCE optimizations have an average of 19-31% reduction in application-level execution time and a 17-29% reduction in overall power consumption. This work will add support for these SparCE optimization into the LLVM compiler. This work uses a combination of machine IR passes in LLVM and python to identify instructions that may have sparsity at runtime and loads the proper information such that the SparCE optimization can be utilized. We plan to validate the functionality of LLVM by using a CPU Tracker to help identify if instructions were skipped. Our implementation can be used by future programmers to create applications which utilize SparCE. Future work can use this platform to add further functionality and optimizations to the LLVM compiler to enable us to skip greater instructions

Mentor(s):

Dr. Mark Johnson, College of Engineering, Electrical & Computer Engineering

John Martunik, Purdue

Poster Presentation Abstract Number: 101 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Development of Thermal Transfer System of Cyber-Physical Test-Bed for Resilient Extra-Terrestrial Habitats

Author(s):

Shantanu Sinha, College of Engineering

Abstract:

Future exploration of space will require the creation of habitats resilient to inhospitable and unforeseen conditions. Additional challenges ranging from maintaining systems during long crew absences (dormant states) to managing responses during catastrophic situations must also be addressed to ensure the safety of components and crew alike. Purdue University's Resilient Extra-Terrestrial Habitat Institute (RETHi) is creating the foundational work to enable the development of such habitats. Hence, there is the need to study and evaluate these designs in a harsh environment. To this end, a multi-physics cyber-physical testbed is in development at the Herrick Laboratories. When completed, the testbed will be capable of simulating a breadth of hazardous conditions including exposure to extreme temperatures. A thermal transfer system is being constructed to replicate the thermal conditions observed on the moon's surface. To enable proper evaluation and simulation, the system will also be made to interact with structural and robotic elements. The team behind the thermal transfer system is building and testing a thermal transfer loop that will contain an ethylene-glycol solution to evenly distribute temperatures for domes that will be part of the testbed. A dedicated experimental test-stand is employed to determine the parameters to achieve uniform distribution of temperatures on a single panel. This setup will also be used to conduct shakedown tests to confirm the performance of all elements, both digital and physical. The results of these experiments will help us scale the application of the thermal transfer loop from one panel to an entire, multi-paneled dome.

Mentor(s):

Davide Ziviani, College of Engineering, Mechanical Engineering

Orkan Kurtulus, Center for High Performance Buildings

Jaewon Park, Graduate School of Engineering - Mechanical

Poster Presentation Abstract Number: 102 :: Mathematical/Computation Sciences

College of Engineering

Pacejka Tire Model at High Speeds for Autonomous Vehicles

Author(s):

Samuel Smith, College of Engineering

Quinton Austin, College of Engineering

Kirunda Kunyiha, College of Engineering

Abstract:

A group of undergraduate students is working on assisting the Black and Gold Autonomous Racing team on the completion of the Indy Autonomous Challenge (IAC). High-speed autonomous driving presents new challenges, and this team is researching the Pacejka Tire Model that looks at the forces acting on the tires of the vehicle. The forces acting on the tire include the lateral, longitudinal, and aligning moment. The team spent the first half of the semester researching the model, its parameters, as well as brainstorming how to approach the model. The second half of the semester was spent creating the code, which used parameters based on the actual autonomous go-kart. The inputs are longitudinal slip percentage, slip angle, and aligning moment. The longitudinal slip percentage is used to calculate lateral forces and the slip angle is used to calculate longitudinal forces acting on the tires. The model works by using the input values to develop ratios and equations that calculate the forces acting on a tire in a given configuration during driving. The purpose of this model is to improve the understanding of the forces acting on the tires, as well as predict the optimal longitudinal slip percentage and slip angle when the vehicle is braking, accelerating, and turning.

Mentor(s):

Aly El Gamal, College of Engineering, Electrical & Computer Engineering

Manuel Mar Valencia, Purdue University

Shyam Kannan, Purdue University

Poster Presentation Abstract Number: 103 :: Life Sciences

College of Engineering

An Analysis of Mycobacteriophage Scoobydoobydoo

Author(s):

Samuel Spence, College of Engineering

Yug Rao, College of Engineering

Ryan Richard, College of Engineering

Anthony Hegarty, College of Engineering

Abstract:

Bacteriophages are essentially viruses for bacteria. They attach onto a bacterial cell, and hijack the cellular machinery in order to reproduce. We have been studying these phages and their genomes in order to find out more about what each gene does.

In order to annotate the genes of phages correctly a variety of databases and reports are used to determine the start site and function. Phage databases and softwares are able to help confirm the start site and potential function of a gene after it has been auto-annotated in our software.

Once the genes are called throughout the genome, several programs were used to further analyze the structure and function of the proteins through a three pronged approach. First, a Python program was used to identify and classify the mutations in the base pair sequence of specific genes, to gain insight about where mutations occur. The evolutionary process of the genome was also traced using phylogeny programs, and the structures of similar proteins were then visualized and analyzed.

Bacteriophages are a great source for a ton of genetic information, as there are many different types with different functions. The specific phage we are annotating has only two known close relatives, so the work we are doing is very new, and could provide valuable information on bacteriophage genetics, and add to the current database for bacteriophages.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Gillian Smith, Purdue University

Emily Kerstiens, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 104 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Comparing alternative power transfer methods for charging battery powered devices

Author(s):

Kevin Stankiewicz, College of Engineering

Abstract:

With the increasing number of battery powered devices being produced today, there is a need for efficient and effective charging. To support this increase in demand, this experiment observed some differences between wireless and wired power transfers to the battery in a cell-phone. The battery charge rate and radiated emissions were collected for both forms of power transfer. To determine relative efficiency, the cell phone battery voltage was repeatedly discharged to 60% and the time required to charge to 80% was measured for each method. During the charging operations, a spectrum analyzer with appropriate sensing probes was used to measure the radiated emissions of the charging devices. Both compliant and unexpected emissions were observed for each set up. It was found that, during charging operations, the chargers radiated emissions met the FCC limits for intentional and unintentional radiators and they can be classified as safe with regard to electromagnetic compatibility. If the wireless system were to be considered an unintentional radiator, the FCC limits could be exceeded in the near field. As expected, the wired charging system was more efficient than the wireless method.

Mentor(s):

Barrett Robinson, College of Engineering, Electrical & Computer Engineering

Poster Presentation Abstract Number: 105 :: Life Sciences

College of Engineering

Analyzing A Bacteriophage Genome and The Relationship Between Evolution, Mutations, and Structure

Author(s):

Alexa Stern, College of Engineering

Jenna Bradford, College of Engineering

Holly Weilbaker, College of Science

Shea Morrissey, College of Engineering

Ekta Singh, College of Engineering

Abstract:

This project explores the genome of a cluster C1 bacteriophage discovered in the local area, SilverDipper. Bacteriophages are the most commonly found organism on Earth, so understanding their genetic makeup and function is crucial for applying them to scientific innovations. The phage's genome is in the process of being annotated to ascertain each gene's precise locus and function. In addition, three different supplementary projects were undertaken in order to further understand the interaction between mutations, structure, function, and evolution in this phage. PyMOL and Phyre2, programs that output a visual representation of a protein based on the amino acid sequence, aided in relating the structure of the protein to its function. MATLAB was used to identify mutations in similar phage genomes in order to find how they are involved in evolution and show up in phage proteins. Using replicates of two comparison algorithms, PhyML and Splitstree, related gene products were compared in order to trace how differences in sequences lead to evolutionary divergence between phage and phage clusters. Results are expected to be able to be compared between projects to trace how evolutionary relationships are impacted by the mutations found between gene products. How mutations can accumulate, influence functions, and impact evolutionary relationships will be investigated through this project's methods.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Emily Kerstiens, Purdue University

Gillian Smith, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 106 :: Mathematical/Computation Sciences

College of Engineering

SafeRegex Tools Team

Author(s):

Albert Sun, College of Engineering

Xin Wang, College of Engineering

Manish Kannan, College of Science

Abstract:

Regular expressions, also referred to as regexes, are tools becoming more prevalent with the increasing popularity of big data processing. However, regular expression matching within most programming languages is inefficiently implemented through naïve depth-first backtracking algorithms instead of breadth-first parallel processing. Backtracking algorithms are inherently vulnerable to fully traversing massive backtracking trees generated by vulnerable regular expressions. Malicious third parties can utilize specially crafted attack inputs to exploit the polynomial and exponential worst-case matching time of these regular expressions to induce catastrophic backtracking behavior and cause regex denial-of-service (ReDoS for short). The complex and lengthy nature of some regular expressions makes them cumbersome to diagnose and debug. Thus, the research of SafeRegex revolves around designing a JavaScript package for regular expression analysis and providing a convenient web service for debugging and testing. The SafeRegex tools team is tasked with developing the underlying package responsible for analyzing a given regular expression for any vulnerabilities. This involves first parsing said regular expression into an AST tree and then converting the tree to its equivalent finite automata construction. The underlying nodes and their transitions are analyzed for any patterns which could indicate vulnerability. Future implementations within the package also include the highlighting of vulnerable features within a regular expression, the generation of a “patched” regular expression which performs identically but without any inherent vulnerabilities. Through anonymous package metrics, we plan to conduct research on overall package performance and the most frequent vulnerabilities detected through the use of the package.

Mentor(s):

James Davis, College of Engineering, Electrical & Computer Engineering

Poster Presentation Abstract Number: 107 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

cArgo: A Novel Argonaute Mediated Microfluidic COVID-19 Diagnostic Device

Author(s):

Hailey Szadowski, College of Engineering, Honors College

Miles Thompson, College of Engineering, Honors College

Andres Dextre, College of Engineering

Matthew Chan, College of Engineering, Honors College

Abstract:

The COVID-19 pandemic has strained global diagnostic capacities and highlighted the limitations of conventional lab-based assays, which can take between 1-14 days to receive conclusive results. Current on-site kits have false-negative rates as high as 33%. In an effort to provide accurate, non-invasive, affordable, and rapid Point of Care(POC) testing for COVID-19 and other emerging pandemics, Purdue iGEM is working on a research project called cArgo: A COVID-19 Argonaute mediated saliva-based diagnostic device. The purpose of this project is to study the use of Argonaute proteins found in Thermus thermophilus bacteria (TtAgo) to develop a saliva-based rapid and accurate microfluidic COVID-19 diagnostic device. The diagnostic device works as such: Saliva is inputted into the chip and viral RNA is extracted from it. The RNA is then amplified, converted into double-stranded DNA (dsDNA), and cleaved by TtAgo producing single-stranded DNA fragments(ssDNA). These ssDNA fragments bind to molecular beacons emitting a quantifiable fluorescent signal for conclusive result determination. With limited to no access to wet lab, the team used programming to optimize the biologics of the device, developed CAD models of the microfluidic chip, modeled the adsorption kinetics of chitosan, and developed a heating circuit for the chip. Through the research project, the team consulted experts regarding the device’s design and safety and spearheaded an intercollegiate synthetic biology educational initiative. Coupling the biologics of cArgo with chip barcoding and app integration, the team hopes to revolutionize POC diagnostics while making data more accessible for simultaneous viral detection and contact tracing.

Mentor(s):

Mark Johnson, College of Engineering, Electrical & Computer Engineering

Poster Presentation Abstract Number: 108 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Carbon Dioxide Removal Technologies in Space: An Investigation of Thermodynamic Performance of The Carbon Dioxide Removal Assembly

Author(s):

Meghan Thai, College of Engineering

Abstract:

Astronauts on the Apollo 13 mission faced a life-threatening situation when the carbon dioxide (CO2) scrubbers became overloaded. With the CO2 levels rising, NASA engineers had to quickly find a solution for the filtration system to save the astronauts. Since the assembly of the International Space Station (ISS), the Carbon Dioxide Removal Assembly (CDRA) has been keeping astronauts alive for the past two decades. However, it is a large contributor to the power consumption of the entire habitat system. A more robust system is necessary for advancement in interplanetary travel to the Moon and Mars. The CDRA removes CO2 from the cabin air through a continuous adsorption process that uses molecular sieve beds. The main components include: two desiccant beds, two CO2 sorbent beds, an air blower, and a precooler. A better understanding of component level performance is needed for the development of future CO2 removal systems. The present study uses thermodynamic exergy analysis to measure the performance of each CDRA component and identify the major sources of inefficiency. The results indicate that the molecular seive beds are major contributors to lost work within the CDRA. However, the sum of exergy destruction in the desiccant beds is greater than the sorbent beds. This indicates the greatest source of lost work comes from the necessary step of removing water prior to the removal of CO2 from the flow stream. The thermodynamic losses of the CDRA components are not well understood, and this study aims to quantify the exergetic performance parameters.

Mentor(s):

Debraliz Isaac-Aragones, Purdue University, Mechanical Engineering

David Warsinger, Purdue University, Mechanical Engineering

Justin Weibel, Purdue University, Mechanical Engineering

Poster Presentation Abstract Number: 109 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Development of a Modular End-Effector System and Mapping for Autonomous Robotic Maintenance and Repair of Resilient Extraterrestrial Habitats

Author(s):

Agathiya Tharun, College of Engineering

Eric Mesina, College of Engineering

Abstract:

As the future of mankind lies in space exploration, a system to support exploratory astronauts while on extraterrestrial surfaces is an important aspect of space exploration that should be considered. The NASA funded research project to establish the resilient extraterrestrial habitats institute (RETHi) has three main goals: developing resilient habitats that can adapt to threats, developing intelligent awareness networks that can detect and diagnose issues, and constructing autonomous robots that can inspect, maintain, and repair issues in the habitats independently or in collaboration with humans. Due to the variety of anticipated tasks that the robots must carry out, specific end-effectors for the robot to use for specific types of tasks are being developed. Therefore, a modular end-effector system, that will be compatible with the space robots, is being designed. Various end-effectors, such as grippers, along with a modular camera system, can be affixed to the system. Using resources offered at the Purdue Bechtel Innovation Design Center, such as 3D printers and CNC machines, prototypes of the designs are being developed. A Fetch mobile manipulation robot is being used to simulate the robots in space for testing purposes of the end-effector system and the autonomous localization, mapping, and navigation software. A successful robot will be able to autonomously navigate to a repair site, choose the appropriate end-effectors and tools needed, and complete the repair or maintenance task.

Keywords: RETHi, space, extraterrestrial habitats, NASA, repair, robots, autonomous

Mentor(s):

David Cappelleri, College of Engineering, Mechanical Engineering

Juncheng Li, College of Engineering, Mechanical Engineering

Poster Presentation Abstract Number: 110 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Covid Robot Prototyping and Entrepreneurship: Robot Path-Planning

Author(s):

Jordan VanArsdale, College of Engineering

Jiahao Zhu, College of Engineering

Guo Yu, College of Engineering

Avneesh Viswanath, College of Engineering

Abstract:

To confront the COVID-19 virus, our team seeks to integrate well-proven technologies and develop new innovations to bring alive a new robot to help safely open campus at Purdue. Our main objective is to protect students, faculty and staff at the universities and K-12 schools (C-PREP). Interviews were conducted to find other potential customers, such as companies and libraries as well.

Our team's focus is on the path planning of the robot. The robot must be mindful of the reach of the UV-C light to disinfect all surfaces that might have been touched by any inhabitants, which will be programmed using ROS. Also, we have an optimization module to help select via points in the trajectory, which will be programmed in Matlab.

The robots are supposed to detect and avoid static objects with only legs in the LIDAR scene. Functions of detecting and adding ghost obstacles to the map are also required.

The robot must not run into people and other objects while enroute to a room for disinfection. It must be proved to be safe to operate to Purdue REM (safety team).

Our project focuses on fine-tuning the obstacle avoidance programming to ensure the robot does not collide with objects during the cleaning process. The most important goal is being able to avoid static legged furniture that the Lidar sensors on the robot currently cannot detect accurately.

Mentor(s):

Richard Voyles, Polytechnic Institute, Engineering Technology

Jon Heidegger, Purdue University

Poster Presentation Abstract Number: 111 :: Mathematical/Computation Sciences

College of Engineering

Modeling Trajectory of Autonomous Vehicles within a Frenet Frame

Author(s):

Timothy Vander Woude, College of Engineering

Nathan Yakupkovic, College of Engineering

Jayson Stansbury, College of Engineering

Srikeerthan Annepu, College of Engineering

Abstract:

Our team is assisting the Black & Gold Autonomous Racing team in competing in the Indy Autonomous Challenge. The team is currently using an autonomous algorithm to control the vehicle in simulation, but would like to look into a strategy using the Frenet Frame to assist in navigation. Our VIP team is looking to research this model and apply it to a simulated vehicle. This method uses a cost function that weighs minimal jerk and time to find the best trajectory. This ensures that the vehicle will stay on a smooth path without jarring the occupants, and take the path that has less time required to take. The algorithm prioritizes maintaining trajectory rather than reiteration. Maintaining a trajectory will allow the vehicle to not overshoot or undershoot the centerline, like reiteration does. It chooses the optimal path at the beginning point and follows it all the way through, if nothing stops it, which minimizes mid-maneuver changes. This trajectory planning method can be used for braking, overtaking and following other vehicles during the Indy Autonomous Challenge race. A Frenet Frame model can be created using Python, and then integrated into the driving simulator VRX. The model will go through many iterations, improving its ability to navigate the further as the project progresses.

Mentor(s):

Aly El Gamal, College of Engineering, Electrical & Computer Engineering

Manuel Marr, Purdue University

Poster Presentation Abstract Number: 112 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Robotic Exploration Submarine

Author(s):

Aidan Velleca, College of Engineering

Noah Michelini, College of Engineering

Michael Kerley, College of Engineering

Abby Nunn, College of Engineering

Riya Mahajan, College of Engineering

Abstract:

Abstract redacted.

Mentor(s):

Eric Nauman, College of Engineering, Mechanical Engineering

Poster Presentation Abstract Number: 113 :: Mathematical/Computation Sciences

College of Engineering

Smart Cities: NLP Project

Author(s):

Nikkhil Vijaya Sankar, College of Engineering

Abstract:

Every year devastating events such as natural disasters happen that leave city infrastructure in ruins. When devastating events occur surveyors are sent out to record the damage to building infrastructure. Frequently, these surveyors record their findings by writing things down relating to the damage, for example, “Damage Level” is often written down with a specified level. It takes a very long time to analyze the data recorded as it is not recorded in a central computer database but instead on paper forms. Additionally, the data recorded can vary greatly from person to person making it difficult for a computer to interpret. The team’s solution to this problem is to modify an existing end-to-end Natural Language Processing (NLP) architecture which will be able to both locate the recorded information on an image of the destruction reports as well as recognize the text meaning. This solution will decrease the time required to review recorded information in the destruction reports because a computer will be able to do it automatically and output the results in a readable format. Currently, the implemented solution is able to clean the image files provided and locate as well as recognize the words seen in an image by using Python's Tesseract Model. The implementation performs best with computer text and we are currently training the ocr model for handwritten information. With the solution the analysis of destruction reports will become much faster and help will be delivered to the struggling areas much quicker.

Mentor(s):

Tarutal Mondal, College of Engineering, Civil Engineering

Poster Presentation Abstract Number: 114 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Slight of Hand

Author(s):

Malvika Viswanathan, College of Engineering

Dainong Hu, College of Engineering

Tong Yan, College of Engineering

Alexander Fink, College of Engineering

Matthew Li, College of Engineering

Karsten Hilgarth, College of Engineering

Reid Schene, College of Engineering

Abstract:

Our project aims to translate American Sign Language into English which can be understood easily by people. We will be scanning a video of a hand, processing the 3D data of the hand, and identifying gestures. To scan a video, we are using the lab sensor in Prof. Zhang's lab. This project is spread out over two semesters. In the first semester we set up our project. It was entirely based on image processing. In the second semester, we used the 3D hand data for hand gesture recognition to translate ASL. For this goal, we worked on trying different methods for hand gesture recognition. This was to test out which method would give out better and more efficient results. We came up with two methods . The first method used a convex hull where it identified the fingertips and extreme points. Using these points, a polygon was drawn, tracing the contour, and counting the number of fingers. The second method was to use Google's MediaPipe library which is a machine learning library with inbuilt hand models. Through this method, we were able to identify the joints and wrist of the hand. The joints and wrists were then connected and thus the hand was traced. Our goal is to write functions to identify the state of a finger, whether it is open, curled or closed. Using these functions, we can write different if – else – if conditions to identify the gesture of the hand.

Mentor(s):

Song Zhang, College of Engineering, Mechanical Engineering

Yi-Hong Liao, Purdue University

Poster Presentation Abstract Number: 115 :: Life Sciences

College of Engineering

Analyzing Mutations and Their Effects Using Computational Programs

Author(s):

David Wagner, College of Engineering

Hyunbeen Lee, College of Engineering

Abstract:

For our research topic, we decided to analyze the effects of mutations with regard to protein structure between pairs of genes with the same functional assignment. To begin this process, the genes of interest were selected from our assigned phage to annotate, SilverDipper. Once we found genes within a few set parameters (including their function call), homologs were selected to contrast their sequence by using Phamerator and PhagesDB. Then, a script using multiple discrete Python functions was written to compare the DNA sequences of the homologs. Comparison included the number, location, and type of mutations. Mutations such as translations, transversions, nonsynonymous, and synonymous are detected by this program. Lastly, Phyre2's protein prediction algorithm will generate a predicted protein structure. This will allow us to analyze and visualize the protein's geometric characteristics using Pymol. We will pinpoint and highlight the specific amino acids that were generated by mutations and analyze their impacts on protein's general structure.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Emily Kerstiens, Purdue University

Aaron Gin, Purdue University

Poster Presentation Abstract Number: 116 :: Life Sciences

College of Engineering

Bacteriophage Computational and Structural Analysis

Author(s):

Quintin Walter, College of Engineering

George Sides, College of Engineering

David Schaeper, College of Science

Aaron Gin, College of Engineering

Abstract:

For this project, we are studying bacteriophages, which are viruses that target bacteria and insert their DNA to hijack their replication mechanisms to reproduce and kill the bacteria. Specifically, we will be analyzing DaddyDaniels, a phage within the B1 cluster.

The purpose of this research is to relate proteins with unknown function to proteins with known functions using PyMol and Phyre2. PyMol uses .pdb files from the Protein Data Bank to generate and analyze 3-D maps of a protein. Alongside PyMol, we also utilize Phyre2 which gives more in-depth descriptions of each protein with multiple templates, functions, and structures. Each protein has a unique structure and function, so we can use these programs to determine the structure and relate this to the function, and find any similarities between two proteins. The goal of the second portion is to glean knowledge about the mutation tendencies of bacteriophages through determining the quantity and location of mutations. This is accomplished through a program that compares homologous genes from different phages to determine the quantity of the different types of mutations in the genes. Because this research is still in progress, the only results are not verified. There are however some trends that are appearing, like a very small transversion to translation ratio. So far, we have not run into many implications, although we can anticipate that our results will improve annotation quality and the utilization of phages as a whole.

Mentor(s):

Lauren Novak, College of Engineering, Agriculture & Biological Engineering

Emily Kerstiens, Purdue University

Gillian Smith, Purdue University

Kari Clase, Purdue University

Poster Presentation Abstract Number: 117 :: Mathematical/Computation Sciences

College of Engineering

Video Analysis of Human Behavior

Author(s):

Tong Wang, College of Engineering, Honors College

Ronak Sinha, College of Engineering

Oluwanifemi Omotoso, College of Engineering

Apoorva Gupta, College of Science

Abstract:

This research project is the video analysis of human behavior, and the intent of this project is to study human behavior in open and closed spaces to accurately model humans over time. The main goal is to make an efficient re-identification pipeline through which if a person walks into the camera and is given an ID number and then leaves the area, they are given the same ID number on re-entering that space. The method that we use to do this is the main component of the re-identification pipeline. Another aspect of the pipeline is 2D mapping, which converts coordinates from the camera feed to geographic coordinates, latitude and longitude, and plots the position on a satellite generated by the Google Maps API. The mapping contains two linear steps, perspective transformation and unit conversion. Perspective transformation converts a point on the three dimensional camera view to a point on the satellite image. Unit conversion converts the mapped pixel coordinate on the image to latitude and longitude. The system outputs a text document which includes the geographic coordinates as well as a visual image demonstrating the path each person has taken.

Mentor(s):

David Barbarash, College of Agriculture, Horticulture & Landscape Architecture

Poster Presentation Abstract Number: 118 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Teleoperation for Disinfecting Robots

Author(s):

Christopher Wang, College of Engineering

Harry Lee, College of Engineering, Honors College

Abstract:

The consequences of the Covid-19 pandemic brought about a need for a more efficient and effective way to disinfect indoor environments. A promising method is through autonomous disinfecting robots. If properly implemented, it will not only be more efficient than humans but also more effective at killing viruses. The main purposes of using autonomous robots for disinfection are to reduce exposure to the virus for janitorial staff members and to reduce human labor. While utilizing robots can prevent human errors, there are also unexpected challenges. At this time, the robot is able to retrieve a map and predetermined paths in order to autonomously run a disinfection cycle around an environment. However, if there are any unexpected obstacles, it is unable to navigate around it and continue on its original path. The teleoperation team is tackling this challenge by figuring out how to control the robot at a distance to assist the robot in overcoming unexpected challenges. Our goal as a team is to provide an interface for the operator to have an understanding of the environment the robot is currently in. In order to accomplish this goal, we are testing the scripts locally to see if our code is working and then integrating the code onto a remote desktop. Through tools such as Python, SQL, and ROS, we will create a program that will allow a smooth transition between autonomous and remotely controlled by providing the operator with the necessary information and functions.

Mentor(s):

Richard Voyles, Polytechnic Institute, Engineering Technology

Jonathan Heidegger, Purdue University

Haoguang Yang, Purdue University

Poster Presentation Abstract Number: 119 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Development of User-Friendly Visualization Engine for GPS Traces

Author(s):

Zongdao Wen, College of Engineering

Shuihan Liu, College of Engineering

Edmund Chau, College of Engineering

Mitchell Witt, College of Science

Abstract:

With the predominance of Global Position System (GPS) users around the globe, data collected from users can further be analyzed to determine one's underlying abnormal behavior. Thus, there is a significant need to develop and implement machine learning analytics platforms for abnormal behavior detection. In this project, we developed a visualization engine on GPS trajectories of some “at-risk” populations which can help case managers of the “at-risk” population detect abnormal behaviors. We developed our interface using the Python modules PyQt5 and Folium to visualize GPS data. Some features that our interface provides include GPS data filtering based on customizable measurements (i.e time, location, speed), most frequent location visited, homestay percentage, real-time feedback from the operator to the anomaly detection model, and graphic display of specific metrics (i.e. histograms, bar charts, line charts). All of these features are presented so as to make analysis swift and intuitive for the operator to conduct and give effective feedback to the anomaly detection model. This platform utilizes GPS trajectory data to track individuals' by analyzing features such as location, time, and speed. Our development will contribute to the development of a visual analytics platform for anomaly detection based on GPS trace data.

Mentor(s):

Nan Kong, College of Engineering, Biomedical Engineering

Poster Presentation Abstract Number: 120 :: Mathematical/Computation Sciences

College of Engineering

A Modular Software Suite for the Pre-Clinical Development and Validation of Autonomic Nerve Control Protocols for Personalized Bioelectronic Medical Devices

Author(s):

Damen Wilson, College of Engineering

Abstract:

Many modern diseases involve autonomic disturbance/dysfunction, including diabetes, gastroparesis, and autoimmune inflammatory diseases, which one day may be treated with bioelectronic medical devices designed to regulate neural communication between the brain and body. To properly regulate this, real-time physiological feedback is needed from both the nerve fibers that are the target of stimulation and the tissues/organs that receive these neural messages. Another challenge in developing these devices is that they must be first proven in pre-clinical animal models, starting with rodents. Previous studies lack real-time physiological feedback for tuning of vagal nerve stimulation (VNS), which creates highly-variable, blunted treatment effects, riddled with undesirable side effects. To this end, we have developed a suite of tools for the development and validation of new VNS bioelectronic therapies. Our nerve control system and algorithm development interface can record any physiological signal of choice in rodents, e.g. heart, stomach, vagus nerve, etc., which then is used to create closed loop nerve and physiological control with application-specific analytics, such as heart rate variability, electrogastrogram, and skin sympathetic nerve activity analyses. Here, we present our MATLAB-based research software prototype and demonstrate its utility in an application that aims to accelerate gastric emptying using closed-loop feedback stimulus delivery. This research tool provides a new way to understand VNS by monitoring synchronized rodent organ activity with closed loop stimulation control. Our modular software has the potential to create prodigious strides in bioelectronic medical device development to ultimately bring effective and safe therapeutics to autonomic dysfunction patients in need.

Mentor(s):

Matthew Ward, College of Engineering, Biomedical Engineering

Thomas Nowak, Indiana University Health

Thomas Everett, Indiana University School of Medicine

Terry Powley, Purdue University

Isaac Clements, BioCircuit Technologies

Michael McKinnon, BioCircuit Technologies

Poster Presentation Abstract Number: 121 :: Life Sciences

College of Engineering

An Investigation of Mycobacteriophage Delylah

Author(s):

Brice Wuthrich, College of Pharmacy

Jianjun Lang, College of Science

Kendall Schwarz, College of Engineering

Zach Walnista, College of Engineering

Anita Gopalrathnam, College of Engineering

Abstract:

As antibiotic resistance remains a challenge for combating bacterial infections, alternative treatments are being investigated. Among these are phage therapies that utilize viruses that infect bacteria (bacteriophage) to curb infections. To ensure the safety of these treatments and optimize their efficacy, it is important to have a deep understanding of phage genomes. The purpose of this investigation was to characterize genes and gene products of mycobacteriophage Delylah. Genes between base pairs 80,023 and 128,413 were annotated to determine the correct start site and potential function of each gene. Bioinformatics programs including PECAAN, DNAMaster, and Phamerator were used to gather and assemble information on Delylah's genome. Utilizing various prediction-based modeling software such as Phyre2 and PyMOL, analysis of amino acid sequences of genes 148 and 166 was performed to model their potential structures and function. Two similar gene pairs from Delylah and Delilah: Delylah 188 (start at 101120), Deliah 186 (start at 101140), Delylah 189 (start at 101236), and Deliah 187 (start at 101256) were compared in order to analyze their mutations. A specific python program was created to count the mutation number and count mutation number. Each mutation was classified by comparing their specific base pair. A phylogeny analysis on a gene was performed in order to determine genetic relationships and evolutionary history between Delylah and other phages of the same and different clusters. Different phylogenetic trees were constructed to make conclusions regarding evolutionary relationships and genomic similarity between the sequences of the different phages in the clusters.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Gillian Smith, Purdue University

Emily Kerstiens, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 122 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

SafeRegex Infrastructure Team Accomplishments and Goals

Author(s):

Yaxuan Xiong, College of Science

Pranav Kannan Hariharane, College of Science

Sriram Sai Anasuri, College of Science

Youngjun Yoo, College of Science

Abstract:

With large amounts of data being created every day, regular expressions are becoming more essential as we need simple ways to process this data. Modern regular expression engines implement slow algorithms on certain inputs which enables attackers to damage a website with a ReDoS (regular expression denial of service) attack. The purpose of our research is to provide a convenient web service allowing users to detect and fix vulnerable regular expressions in their code. The web service will provide a responsive interface where users can utilize a ReDoS detector specific to different programming languages. If a user provides a vulnerable regular expression, the web service will provide a visualization of the regular expression, explanations on how it's dangerous, and suggestions for how to make it safe. The biggest challenge we face is visualizing the runtime analysis of regular expressions and explaining their vulnerabilities through finite automaton diagrams. To increase the website's efficiency, a database that stores information about regular expressions that have been input by previous users is implemented. Therefore, the web application can avoid processing repetitive input. After our web service is ready, it will be deployed publicly. We plan to document how our website is used to investigate the types of regular expressions that user input, the most popular tools in our toolkit, and any performance problems that arise.

Mentor(s):

James C Davis, College of Engineering, Electrical & Computer Engineering

Poster Presentation Abstract Number: 123 :: Mathematical/Computation Sciences

College of Engineering

Multicore RISC-V design with coherent cache

Author(s):

Jiahao Xu, College of Engineering

Abstract:

RISC-V is an open-source hardware raised in 2010. “RISC” is the short for “Reduced Instruction set computer”. Compared with x86-64 CISC architecture (Complex Instruction Set Computer), which is widely applied on personal computer nowadays, RISC processors usually have advantages on performance, size, and power usage.

We are implementing a multi-core RISC-V processor. The cores will have a shared cache, and this will make synchronization be a main challenge for this design. For example, we have no guarantee on the order of instruction’s execution when multi-threading, and this may cause some synchronization hazards: sometimes the data that program gets are outdated, wrong, or even uninitialized if the use instruction is executed before the initialization. To solve these hazards, we will evaluate the current cache design and synchronization options, select, implement, and improve them in our design. Also, we are trying to make this shared cache generic to any number of cores, which means modifying the number of cores can be easily done.

Mentor(s):

Mark Johnson, College of Engineering, Electrical & Computer Engineering

Cole Nelson, Purdue University

Poster Presentation Abstract Number: 124 :: Life Sciences

College of Engineering

Using Multiple Functional Analysis Tools to Investigate Mycobacteriophage Izajani Proteins

Author(s):

Isabelle Yates, College of Engineering

Parker van Emmerik, College of Engineering

Emme Longman, College of Engineering

Rachel Damge, College of Engineering, Honors College

Abstract:

Bacteriophages are viruses that infect and replicate within bacteria. They are the most abundant organisms, outnumbering bacteria approximately ten to one. Due to the massive amount of phages, we only understand a fraction of phage diversity and even discovered phages lack a full understanding of gene function. Discovering and annotating new phages will expand scientific knowledge of bacteriophage and contribute to the wide array of phage applications. In this project, the unique phage Izajani was investigated. This phage was discovered in West Lafayette, IN at Purdue University and is a part of the C1 cluster, part of the Myoviridae family. This project focused on specific identified gene functions with start sites and function calls determined through the annotating programs PECAAN and DNA Master. The specific gene functions were tail tape measure protein, ThyX-like thymidylate synthase, and nucleotidyltransferase. In addition to start sites and functions, the programs Splitstree, Phyre2, and Python are used to visualize and understand the sequences of the genes being analyzed. Splitstree helps with the visualization of the change in a certain gene over time, Phyre2 is used to analyze the protein's structure and therefore can be used to compare similar genes from the same pham, and a written Python program is utilized to analyze the gene sequence and look for mutations by comparing the gene to similar ones. By comparing multiple proteins in Izajani to those with similar protein function in other genomes, the conservation of genomes can be determined and our understanding of Izajani is expanded.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Gillian Smith, Purdue University

Emily Kerstiens, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 125 :: Mathematical/Computation Sciences

College of Engineering

Program Analysis

Author(s):

Grace Yeh, College of Engineering

Abstract:

The purpose of Program Analysis research is to develop an enhanced grading system and submission platform for students taking programming courses such as ECE264 Advanced C Programming. The grading system would check students' code for memory leaks, various memory issues and provide accurate error messages such as those pertaining to additional whitespace and unused variables. The submission platform takes the form of a website where students submit their assignment in the corresponding folder. The research team comprises of both the frontend and backend teams. The frontend team works on the user interface (UI) design and conducts UI testing with Pytest and Django. The backend team works on database storage and the grading mechanism. Currently, the frontend team is finalizing the assignment submission set-up and researching methods to test Google OAuth 2.0. The backend team is developing a timeout system with Python's multi-processing module to account for submissions with infinite loops or consecutive unsuccessful submissions. The team aims to deliver a fully functional grading system for students to use in the upcoming Fall 2021 semester.

Special Note: This project was updated to a new project.

Mentor(s):

Yung-Hsiang Lu, College of Engineering, Electrical & Computer Engineering Engineering

Caleb Tung, College of Engineering, Electrical & Computer Engineering Engineering

Poster Presentation Abstract Number: 126 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Multi-Material 3D Printer

Author(s):

Christina Yu, College of Engineering, Honors College

Abstract:

The emergence of 3D printing has provided opportunities to create soft and stretchable electronics in 3D form factors that can simulate or interact with biological systems. The purpose of this project is to implement a versatile 3D printing system that can simultaneously print multiple materials in 3D layouts that mimic biological systems. Current 3D printers for these applications are expensive and proprietary, limiting the use of customizable setups during printing. Our approach was to modify a ShopBot Desktop CNC machine to function as a multi-material 3D printer. Replacing the control board on the ShopBot allowed for additional control of three different z-axis actuators that will each hold their own printhead for material dispensing. This new multi-material 3D printer design will be adaptable, making it easy to customize the setup depending on the needs of the experiment. These multifunctional materials could be used in applications such as wearable systems or bio-integrated electronics and provide innovative solutions to current issues impacting health care.

Mentor(s):

Alex Chortos, College of Engineering, Mechanical Engineering

Poster Presentation Abstract Number: 127 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

AMP Purdue Electrical team

Author(s):

Yue Yu, College of Engineering

Ming Chin Lee, College of Engineering

Hayagreev Sarvabhouman, College of Engineering

Michael Fuchs, College of Engineering

Abstract:

The purpose of VIP Autonomous Motorsports Purdue Electrical Team is to develop the electrical system of the autonomous car according to Indy Autonomous Challenge (IAC) specifications. High speed autonomous driving requires precise electrical control systems towards which our team is working to design fully autonomous steering, throttle, and braking systems. This semester we are working on redesigning the wiring of the entire electrical system of the car that will enhance its efficiency and extensibility. Our activities in the first half of the semester were mostly related to documentation and learning in addition to understanding the current electrical system of the car. In the second half of the semester, we intend to start the physical work on the car that includes upgrading the wiring and testing the electrical system extensively. Additionally, the senior members of the team are training the freshmen members on electrical engineering design skills on software platforms like KiCAD. The senior members are organizing lecture sessions to teach freshmen members about electrical component interfacing and use of electrical engineering software tools with the goal to impart basic knowledge that can help freshmen members to spearhead simple electrical system design projects.

Mentor(s):

Aly El Gamal, College of Engineering, Electrical & Computer Engineering

Yahya Javed, Purdue University

Poster Presentation Abstract Number: 128 :: Physical Sciences

College of Engineering

Soft and Compressible Dielectric Elastomer Actuator Using Submicron Silicone Elastomer with Camphor as Porogen.

Author(s):

Wardah Yusra, College of Engineering

Abstract:

Dielectric elastomer actuator (DEA), otherwise known as artificial muscles, has vast potential in integrating technological systems with biological structures. DEAs exhibit large strains, fast response time, high efficiency, and low cost, making them suitable as actuators in autonomous soft robots, acoustic actuators, and wearable devices. This work aims to create soft and compressible elastomers with strain-stiffening behavior for DEA, compared to incompressible non-porous DEA, by introducing submicron pores. However, the properties of being soft and compressible compromise and reduce the electrical breakdown field strength which could lead to catastrophic failure and safety issues. We believe that smaller pores in elastomers will result in higher breakdown strength. This hypothesis is related to the Paschen-law gas-discharge behavior that predicts higher breakdown strengths with smaller pore sizes. We fabricate porous polydimethylsiloxane (PDMS) through the sublimation of Camphor embedded in solid crosslinked PDMS elastomers. The sublimation of deposited Camphor, which acts as the porogen, leaves submicron pores where the Camphor used to be in the PDMS elastomer. We expect the product to be soft, compressible, have submicron pores, show strain-stiffening behavior, and suitable rheology for 3D printing. 3D printing offers versatility in producing material with complex geometry. This research project aims to improve the breakdown field in soft and compressible DEA as well as facilitating many other opportunities in biomimetic applications such as skin-inspired electronics and prosthetics.

Mentor(s):

Alex Chortos, College of Engineering, Mechanical Engineering

Poster Presentation Abstract Number: 129 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Automated Design Verification

Author(s):

Yuxin Zhang,

Haoming Duan,

Zihan Liu,

Ahmet Akkaya,

Abstract:

The focus of this project is to build an automated, physical testbed combining FPGA emulation, UVM, and FV to rigorously verify the functionality of a digital design before it is sent out for fabrication. Field-Programmable Gate Arrays (FPGAs) are devices used to emulate a digital design in the real, physical world; however, verification teams typically simulate, in software, more testcases than they emulate with an FPGA. These software simulations can take a very long time when using a pseudo-random testcase generator like Mentor Graphics' Universal Verification Methodology (UVM) which is a great tool for finding the corner cases when the time to simulate all possible inputs becomes impractical. It takes software longer to simulate a testcase than for hardware to emulate the testcase; software must run multiple instructions to calculate each gate's output while the hardware emulation simply lets the current flow through its physical gates. If the UVM sequences drive the inputs of a physical FPGA, then it would require less run time, which means more testcases can be evaluated before a tapeout deadline. To further improve the verification rigor, the predictor & scoreboard UVM components can be supplemented with assertions made using Formal Verification (FV), a tool which uses mathematical induction to prove defined, undesired outputs will never occur under normal operation (ex: no bit-flipping from solar radiation). With these tools combined, we will create a new test methodology so that a greater number of testcases can be evaluated on the physical implementation of a digital design to be submitted for an expensive fabrication run and the outputs of these testcases will be scrutinized to a high degree with the use of two separate models of expected behavior.

Mentor(s):

John Martinuk, College of Engineering, Electrical & Computer Engineering

Poster Presentation Abstract Number: 130 :: Mathematical/Computation Sciences

College of Engineering

Non-idealities and errors in Communication Systems: Characteristics and Solutions

Author(s):

Xiangyu Zhang, College of Engineering

Shuihan Liu, College of Engineering

Mohamed Ibrahim, College of Engineering

Justin Zhang, College of Engineering

Abstract:

Communication system analysis and development has led to the design of highly sophisticated communication systems that are able to achieve high data rates and low latencies. However, there is a considerable jump between theory and implementation when creating a communication system due to several non-idealities such as synchronization errors and challenging transmission environments. This project will survey the several types of sources of error in communication systems, explain their characteristics, and suggest potential solutions to these errors or strategies to mitigate them.

To observe and characterize these non-idealities, several simulations will be performed using GNURadio, a widely used open-source package that is used for radio data processing. In addition, experiments will be performed using two software defined radios, USRP N210 and the RTL-SDR, to implement a basic digital communication link, observe any errors and mitigate these errors as needed. Channel non-idealities will be simulated assuming certain mathematical models, e.g. Rayleigh distribution, to allow us to observe the characteristics of this mathematical model as it pertains to the performance of the communication system. Performance improvements will be analyzed in the form of observing differences in bit-error-rate plots.

Mentor(s):

Chih-Chun Wang, College of Engineering, Electrical & Computer Engineering

David Love, Purdue University

James Krogmeier, Purdue University

Poster Presentation Abstract Number: 131 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Image Processing for Bacterial Colony Count

Author(s):

Boyu Zhou, College of Engineering

Xinhao Quan, College of Engineering

Nathan Matthews, College of Engineering

Abstract:

The purpose of this study is to understand how computers can be used to count bacterial colonies on a petri dish using machine learning. Bacterial colony counting is very important in hospitals and biomedical research labs, they are a cheap and fast way to determine the effectiveness of a drug or to find out if a tissue contains a certain type of bacteria. However, manual counting can be hard and inaccurate, as colonies grow randomly and a petri dish can sometimes grow more than 500 colonies, in which case human counting without any tools is almost impossible. There are some tools to help human count colonies, such as screens to magnify the petri dish and counters to keep track of the numbers, but it is still time consuming. There are also fully automated counters, which can be as expensive as tens of thousands of dollars. This is why we are attempting to create a MATLAB algorithm that can take an image of a petri dish taken with your phone, and automatically count the number of colonies in the image. We have had some impressive results so far, in our test images, our algorithm is consistently producing results that are under 1 percent error. We are currently in the process of testing and refining the algorithm with real life images and we expect the percent error with real life images to be under 10 percent.

Mentor(s):

Euiwon Bae, College of Engineering, Mechanical Engineering

Poster Presentation Abstract Number: 132 :: Life Sciences

College of Engineering

Using Computational Methodologies to Better Understand the Evolutionary History of Select Proteins within Bacteriophages

Author(s):

Clarisse Zigan, College of Engineering

Zada Anderson, College of Engineering

Daphne Fauber, Polytechnic Institute

Jessica Wandling, College of Engineering

Kaitlyn Niebrugge, College of Engineering

Abstract:

Bacteriophage, often informally called phage, are viruses that infect and replicate within bacterial hosts. The target phage of this project, SilverDipper, is in a draft form as the genome has not yet been finalized. The base pair range 1343 through 23897 has been annotated and analyzed in order to confirm gene contents and functions. In addition to annotating these genes, particular gene comparisons between SilverDipper and fully annotated phage were completed to analyze mutations between both known function and no known function genes. Through the analysis of various mutations, such as transitions, transversions, synonymous, and nonsynonymous ones, conclusions can be drawn to explain the evolutionary path of a phage gene. These results may also help researchers manipulate phage for different applications. By researching the relationship between mutations and phylogeny, we expect to have a more holistic understanding of how select phages and their genes evolved. Better understanding of the evolutionary history of select bacteriophages allows researchers to potentially identify currently unknown functions in related genes, thus further contributing to the open-source phage database facilitated through the SEA-PHAGES program.

Mentor(s):

Kari Clase, College of Agriculture, Agricultural & Biological Engineering

Emily Kerstiens, Purdue University

Gillian Smith, Purdue University

Lauren Novak, Purdue University

Poster Presentation Abstract Number: 133 :: Social Sciences/Humanities/Education

College of Engineering

Data Mining of Geologic Timescale Databases

Author(s):

Joshu Zubik, College of Engineering

Peter Zhu, College of Engineering

Abstract:

:

The Earth is an ancient planet filled with mysteries yet to be uncovered. In the complex ancient Earth system is nigh impossible to know how everything affected everything else. This, however, does not mean there are not clues left that could enable us to discover what truly had happened. Geologists are working toward compiling global data sets to better define the past. However, it is surprising to learn that there are no public databases that are enable users to easily apply simple data mining tools to assist in comparing and evaluating different data sets.

The TimeScale Creator suite is currently the largest publicly available, global geological database. It contains extensive information about evolution of life, carbon-oxygen and other isotopes, sea level, temperature, asteroid impacts, volcanism and other sets with a standardized time scale.

Our team is adding data-mining features to this system, such as enabling the user to (1) overlay graphs of different datasets, and (2) to statistically compare one set to another with a sliding-window analysis of the coefficient of determination, a value which shows us the correlation between the two curves. Both enable easier analysis on the relationship between the data sets, such as the carbon-cycle with temperature or with sea-level.

This project gives the ability for the user to better understand the complex relationships that exist from the geological record; thereby giving us more insights into our future world.

Mentor(s):

James Ogg, Not a Purdue West Lafayette Employee

Aaron Ault, Purdue University

Poster Presentation Abstract Number: 134 :: Life Sciences

College of Health and Human Sciences

Investigating the Impact that a Change in Mn Exposure has on Mood in Welders

Author(s):

Khunsha Ahmed, College of Health & Human Sciences, Honors College

Abstract:

Chronic occupational exposure to manganese (Mn) can lead to many deficits, with mood symptoms being reported as one of the earliest. Previously, we reported a high prevalence (49%) of mood symptoms in a cohort of 45 welders exposed to welding fumes, with some mood categories being correlated to exposure metrics. The goal of this study was to assess how psychological symptoms changed over 3 years in a subset of 15 of these welders. The Brief Symptom Inventory (BSI) was administered at both times, with 9 psychological categories. Exposure assessment was repeated using personal air sampling at work and Mn levels in toenail clippings were determined using ICP-MS as a marker of exposure over the past year. Statistical analysis was completed using a repeated-measure ANOVA and Spearman's Rank correlation test to note significant changes or associations. Although past-year exposure was significantly reduced ($p < 0.05$), no statistically significant changes in scores were found for any psychological category. Changes in the subdomains of hostility (HOS) and psychoticism (PSY) were significantly associated with cumulative Mn exposure at time point 1 (HOS, PSY: rho 0.64, $p < 0.05$), showing that they can be predicted by the lifetime cumulative exposure to Mn. Additionally, the positive correlation of obsessive-compulsive (OC) behavior with toenail Mn reported for timepoint 1 (rho = 0.34, p=0.024) was reproduced for timepoint 2. In conclusion, psychological symptoms are persistent over a time span of 3 years, even if occupational Mn exposure is reduced. (Supported by NIH R01 ES020529)

Mentor(s):

Ulrike Dydak, College of Health & Human Sciences, Health Sciences

Humberto Monsivais, Purdue University

Daniel Foti, Purdue University

Roslyn Harold, Purdue University

Poster Presentation Abstract Number: 135 :: Life Sciences

College of Health and Human Sciences

Evaluating Atrazine Neuroendocrine Toxicity on the Hypothalamus

Author(s):

Isabelle Akoro, College of Health & Human Sciences

Abstract:

Atrazine is a herbicide used throughout the Midwest to prevent broadleaf weeds in crops. The US EPA has set the maximum contaminant level at 3 ppb (µg/L) in drinking water. Atrazine is an endocrine disrupter interfering with the function of hormones and disrupting normal physiology and homeostasis throughout development and the life course of an organism. Previous studies using the zebrafish model system showed that an embryonic atrazine exposure resulted in expression alterations in genes associated with neurological and reproductive system development and function, cell cycle, and cancer. Based on these findings, this study focused on the neuroendocrine system, which is responsible for maintaining proper functioning of multiple endocrine axes. The goal is to characterize how atrazine alters the neuroendocrine system during development that could lead to the alterations reported on multiple endocrine axes. Specific focus is on hypothalamic targets including arginine vasopressin, corticotropin-releasing hormone, growth hormone releasing hormone, gonadotropin-releasing hormone, oxytocin, somatostatin 1, somatostatin 3, and thyrotropin-releasing hormone. Zebrafish were exposed to four different atrazine concentrations (0, 0.3, 3, or 30 ppb) during embryogenesis (1-72 hours post fertilization) and collected for RNA isolation, cDNA synthesis, and gene expression analysis using quantitative PCR (qPCR). Primers for qPCR were designed and confirmed to target the hypothalamic targets using in silico PCR. Primers were synthesized and confirmed to amplify DNA fragments of expected size using PCR. Different concentrations of cDNA were tested to determine optimal amount to use in qPCR for each hypothalamic gene. qPCR is now being completed to determine if atrazine exposure alters expression of these hypothalamic targets.

Mentor(s):

Jennifer Freeman, College of Health & Human Sciences, Health Sciences

Janiel Ahkin Chin Tai, Health and Human Sciences and School of Health Sciences

Sydney Stradtman, Health and Human Sciences and School of Health Sciences

Poster Presentation Abstract Number: 136 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Understanding Responses to Personality Questions

Author(s):

Zach Babb, College of Health & Human Sciences

Abstract:

Diagnostic and Statistical manual Fifth Edition (DSM-5) includes an alternative model of personality disorder (AMPD) that conceptualizes PD in terms of maladaptive traits. For example, the historical concept of Schizotypal PD is conceptualized largely in terms of a trait dimension known as psychoticism, which includes magical ideation, unusual thinking, and perceptual aberrations that are lower in severity than the delusions and hallucinations of psychosis. While the model has garnered relatively strong empirical support, one predominant measure of psychoticism, the Personality Inventory for DSM-5 (PID-5) has been criticized for having poor discriminant validity. Specifically, the PID-5 psychoticism scale correlates quite highly with many other markers of psychopathology, even those which are conceptually distinct. One possible reason for this is that the items are being misunderstood by respondents, perhaps because they are too vague (“Others seem to think I’m quite odd or unusual”), such that respondents may answer affirmatively for reasons other than the presence of the trait being assessed.

To understand how PID-5 psychoticism relates to assessment we screened for participants who subscribed to elevated levels of psychoticism on the PID-5. We then interviewed these individuals on those items to understand the reason for their elevated responses. These interviews elucidated elevated levels of psychoticism for reasons that were not consistent with psychoticism. This finding supported our hypothesis that, PID-5 psychoticism currently overestimates present pathology. Ongoing work will determine if adjusted scores facilitate a more accurate assessment of Psychoticism. Ultimately, these findings will be used to suggest revisions to the PID-5 scale.

Mentor(s):

Doug Samuel, College of Health & Human Sciences, Psychological Studies

Poster Presentation Abstract Number: 137 :: Life Sciences

College of Health and Human Sciences

Cobra Venom Factor Suppresses Activation of the Complement C3 in a Rat Model of Epilepsy

Author(s):

Ruth Bambo, College of Science

Abstract:

Status epilepticus (SE) is a clinical emergency in which a seizure persists for at least 30 minutes and significantly increases the risk of subsequent development of unprovoked spontaneous seizures and temporal lobe epilepsy (TLE). TLE is associated with hippocampal injury including neuronal death and microgliosis that contributes to the development of cognitive impairments. The classical complement pathway is part of the innate immune system that promotes inflammation, and tags pathogens and cellular debris for removal by phagocytes including microglia. We recently reported that complement components, C1q and C3, are elevated after an episode of SE, so to determine if complement contributes to SE-induced brain injury in this study, we tested whether cobra venom factor (CVF) treatment in rats suppresses SE-induced C3 activation in the hippocampus. SE was induced in rats with pilocarpine injections (i.p.). Two weeks after SE, vehicle- or CVF at two different doses (100- and 500 mg/kg) was given to rats. Then we harvested the hippocampus and extracted the protein for western blot analyses using antibodies against the complement C3. We found that the protein levels of C3 were significantly reduced in the CVF-treated groups compared to those treated with the vehicle solution. Both doses of 100 and 500 mg/kg suppressed C3 levels similarly. Our findings suggest that signaling of the complement pathway at the level of C3 can be inhibited with CVF. Therefore, CVF can be used as a tool to study the role of C3 in the pathology of SE and epilepsy.

Mentor(s):

Amy Brewster, College of Health & Human Sciences, Psychological Studies

Poster Presentation Abstract Number: 138 :: Life Sciences

College of Health and Human Sciences

Prolonged and Sustained Pulmonary Inflammation in Metabolic Mice Following Silver Nanoparticle Exposure

Author(s):

Katelyn Biggs, College of Health & Human Sciences

Abstract:

This research explores how increased exposures to silver nanoparticles affect people with metabolic syndrome. Inhalation is the most common method of exposure to silver nanoparticles and metabolic syndrome in the US has been on the rise. There are minimal epidemiological studies indicating that metabolic syndrome results in more sensitivity to exposures. Previous animal studies done in the lab have indicated an exacerbated acute inflammatory response in metabolic animals compared to healthy animals following nanoparticle exposure. This study exposed two populations of mice (with a metabolic diet and a healthy diet) through the method of oropharyngeal aspiration using saline or 50ug of 20 nm silver nanoparticles. Then lung fluid samples (BALF) were collected at the time points one, three, seven, and twenty-one days to assess for indications of inflammation. To assess inflammation, the neutrophils in the samples were counted and dark-field imaging was used to observe silver nanoparticles in the macrophages and neutrophils. The mice with metabolic syndrome showed increased amounts of neutrophils in the lung fluids (BALF) for longer periods of time as well as more nanoparticles in the macrophages and neutrophils for prolonged periods of time. This shows enhanced and sustained inflammation following nanoparticle exposure, meaning this population is more likely to obtain disease due to the increased amounts of inflammation. There is a large population with metabolic syndrome, meaning that exposure regulations need to be determined to include this population. This would fill the current gaps and may assist with creating therapeutical treatments to target the susceptible population.

Mentor(s):

Jonathan Shannahan, College of Health & Human Sciences, Health Sciences

Saeed Alqahtani, Purdue University

Poster Presentation Abstract Number: 139 :: Physical Sciences

College of Health and Human Sciences

Total Synthesis of the SCB-Family of γ-Butyrolactones: A Key Class of Natural Product Regulating Hormones in Streptomyces

Author(s):

Grace Buechel, College of Health & Human Sciences

Abstract:

Natural products (NPs) isolated from the soil bacteria Streptomyces have played a vital role in drug discovery and have led to medicines including antibiotics, antifungals, anticancer agents, and many others. Recently, discovery of novel bioactive NPs using conventional methods has failed as supported by high rates of rediscovery. Uncharacterized NP biosynthetic gene clusters exist in diverse Streptomyces and do not account for known NPs, suggesting an untapped source of structurally diverse and bioactive NPs. γ-Butyrolactones serve as one of few Streptomyces signaling molecules that activate NP production. Herein, progress towards the stereoselective synthesis of the SCB class of γ-butyrolactones is reported. Our approach is efficient in that it is four steps and does not require the use of protecting groups. This strategy will aid in the characterization of biosynthetic gene clusters and elucidation of novel NPs.

Mentor(s):

Christina Martinez Brokaw, College of Science, Chemistry

Elizabeth Parkinson, Purdue University

Poster Presentation Abstract Number: 140 :: Life Sciences

College of Health and Human Sciences

MASK COMPLIANCY AT PURDUE UNIVERSITY IN THE FALL OF 2020

Author(s):

Kenneth Burnell, College of Health & Human Sciences

Abstract:

Due to the COVID-19 Pandemic, institutions have implemented new protocols to slow the spread of COVID-19. There are currently limited data reflecting the effectiveness of these protocols, so the purpose of this study was to determine mask wearing compliance on Purdue University's campus.

Observers were stationed inside or outside frequently traveled locations on Purdue's campus (PMU, WALC, CREC) in fall 2020. Data were collected on location, date, mask wearing (correct, incorrect, none), student status (student vs nonstudent) and gender (male vs female). Chi-square tests were used to compare rates of correctly wearing masks (vs not) among different groups. A total of 24 hours of data were collected, which represents observations of 7236 people.

The total compliance among all those observed was 91% (standard deviation (SD)= 0.29%). Women had a higher compliance rate of 92% (SD=0.26%) compared to 89% (SD= 0.31%) for males, $p<0.001$. The student compliance rate was 91% (SD=0.29%) compared to 88% (SD=0.33%) for non-students, $p<0.001$. Mask compliance was also found to be significantly higher among those observed inside with a 96% (SD=0.19%), compared to 88% for outside (SD=0.32%), $p <0.001$.

While there were characteristics that were significantly associated with higher mask compliance, the overall mask compliancy rate was very high over the duration of this study. Future research might consider how mask compliancy may be affected by time of year and weather.

Mentor(s):

Ellen Wells, College of Health & Human Sciences, Health Sciences

Poster Presentation Abstract Number: 141 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Parents Perspective of Autistic Youth Participation in 4-H

Author(s):

Emily Carlson, College of Health & Human Sciences

Abstract:

Background. Youth with disabilities benefit greatly from participation in extracurricular activities, though they are much less likely to join an after-school activity. Lack of accommodations and parental concerns about stereotyping can contribute to disabled youth not having the chance to participate (Taylor-Winney et al., 2018). The purpose of the present study was to understand specific challenges faced by families of autistic youth participating in 4-H.

Method. Participants in this study were seven parents of autistic youth living in Indiana. Youth were under the age of 18 and had participated or are currently participating in 4-H. Interviews were done in-person and through video conferencing. Interviews were coded using a grounded theory approach within Nvivo (12, QSR International).

Results. All parents had concerns about their child's participation in 4-H, ranging from safety concerns to worries that their child may not be able to socialize with peers. Parents also felt overwhelmed by the procedures and tasks required when enrolling their child in 4-H, especially if they were new to the culture of 4-H.

Implications. The findings of this study suggest that parents of autistic 4-H participants would benefit from increased training for volunteers, club leaders, and extension educators. Findings from this study will be used to inform the development of new training materials for 4-H volunteers, club leaders, and extension educators, as well as supports for parents with children on the autism spectrum.

Mentor(s):

Carolyn McCormick, College of Health & Human Sciences, Human Development & Family Studies

Poster Presentation Abstract Number: 142 :: Life Sciences

College of Health and Human Sciences

Developmental behavioral alterations following lead (Pb exposure) in the zebrafish model system

Author(s):

Jenny Chen, College of Health & Human Sciences

Abstract:

Lead (Pb) is a toxic heavy metal that can be found in drinking water, dust, and soil. Environmental exposure to lead has been associated with neurological alterations in both adults and children. This study used the zebrafish model to investigate the developmental toxicity effects of exposure to nonlethal concentrations of lead from 1-120 hours post fertilization. The concentrations used were 0 ppb, 10 ppb, 50 ppb, 100 ppb, 500 ppb, and 1,000 ppb. The visual motor response test was used to assess toxicity effects of lead through changes in behavior. Phasic data was collected and analyzed using a repeated measures ANOVA. Phasic behavior data showed hyperactivity through increased velocity and distance moved in all of the dark phases for the 10 ppb treatment group. Larvae in the 50 ppb treatment group showed hyperactivity in the second light phase through increased velocity, time spent moving, and distance travelled. Hypoactivity, depicted through decreased velocity, distance moved, and time spent moving occurred in the 100 ppb treatment group in the first light phase. Larvae in the 500 ppb treatment group only exhibited a decreased time spent moving in the first two dark phases and first light phase. The 1000 ppb treatment group spent less time swimming only in the first dark phase. These findings indicate zebrafish larvae exposed to lead early in development display various changes in behavior and locomotive activity depending on exposure concentration. Changes in behavior may be indicative of improper central nervous system development, specifically sensory-motor pathways in the brain.

Mentor(s):

Jennifer Freeman, College of Health & Human Sciences, Health Sciences

Keturah Kiper, Purdue University

Poster Presentation Abstract Number: 143 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

The Association of Challenging Behaviors in Children with Angelman Syndrome on Caregiver Anxiety, Stress, and Depression

Author(s):

Elizabeth Cowden, College of Health & Human Sciences

Claire Blake, College of Science

Isabella Bucklew, College of Health & Human Sciences

Abstract:

Angelman syndrome (AS) is an untreatable genetic deficiency which involves a delay in developmental and cognitive abilities. Prior work suggests children with AS exhibit more challenging behaviors than “low risk” controls. These behaviors require higher levels of care and likely impact their caregiver’s mental health. Understanding which caregivers may be at risk for negative mental health outcomes is important for improving caregiver well-being and quality of life. This study examines the associations between challenging behaviors in children with AS and caregiver depression, anxiety, and stress levels. Twenty-two caregivers of children with AS participated in this telehealth-based intervention study. Caregivers completed the Depression, Anxiety and Stress Scale (DASS-21) and the Child Behavior Checklist (CBCL). The DASS-21 is a 21-question survey measuring depression, anxiety, and stress. The CBCL includes 99 survey items and assesses behavioral and emotional characteristics in children. We hypothesized that caregivers of children with more challenging behaviors would have higher DASS-21 scores. Data collection is complete, and final analysis will use Spearman correlations to examine these associations. This study contributes to the limited literature surrounding how challenging behaviors of children with AS impact caregiver mental health, with the potential to guide future intervention.

Mentor(s):

Bridgette Kelleher, College of Health & Human Sciences, Psychological Sciences

Riley Felicicicchia, Purdue University

Tyra Protho, Purdue University

Poster Presentation Abstract Number: 144 :: Life Sciences

College of Health and Human Sciences

Perspectives on COVID-19 Policies in Relation to COVID-19 Positivity Among Peers

Author(s):

Perry Curtis, College of Health & Human Sciences

Meredith Robbins, College of Health & Human Sciences

Belle Hinshaw, College of Health & Human Sciences

Abstract:

The Protect Purdue guidelines have mandated various preventive measures in response to the COVID-19 pandemic. Some research has been completed regarding student response to pandemic preventive measures, but these have explored a limited number of predictive factors. Therefore, the goal for this analysis was to determine the correlation between the type of individuals a subject knew who tested positive for COVID-19 and their opinions regarding selected COVID-19 prevention measures. We conducted an online survey to reach a multitude of students with varying backgrounds, demographics, and experiences. The survey asked if a subject knew anyone who had tested positive and let them select family, friend, someone else, themselves, none, or a combination of selections. The survey proceeded with 13 questions asking their opinion regarding selected prevention measures or activities. The data were analyzed using ANOVA tests in Stata. There were 646 respondents who completed the survey and 6% tested positive themselves, 25% had a family member test positive, 52% had a friend test positive, 40% knew someone else, and 21% knew none. Respondents who tested positive themselves or had a friend test positive were more likely to agree with statements consistent with the Protect Purdue guidelines; a statistically significant difference was observed in 10 of the 13 statements. However, there were no significant differences based on family members testing positive. These findings suggest that relationships with COVID-19 positive individuals are correlated with opinions regarding preventive actions. These findings may help inform future prevention efforts, particularly in a university setting.

Mentor(s):

Ellen Wells, College of Health & Human Sciences, Health Sciences

Poster Presentation Abstract Number: 145 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Associations between experiences of discrimination and control beliefs: Racial differences in a national sample

Author(s):

Sarra Debbabi, College of Science, Honors College

Abstract:

African Americans in the United States are often exposed to discrimination and may experience adverse outcomes. Exposure to prolonged or severe discrimination may affect an individual's perceptions of the control they have over events in their lives. Broadly, primary control beliefs (CBs) concern the extent to which one believes one can deal directly with an event to reduce its potential impact; secondary CBs, contrastingly, center on managing one's response to an event (Heckhausen & Shulz, 2010). African American women and Chinese women report the highest levels of everyday discrimination (Lewis, 2011) and blacks report a lower sense of control than whites (Shaw & Krause, 2002). We hypothesized greater exposure to discrimination would be associated with greater prevalence of 2* CBs among African Americans compared to Whites. We also hypothesized religious participation or spirituality would moderate the association of exposure to discrimination with CBs. Data were from the second wave of the Midlife in the US (MIDUS) study (N = 3,997). Results of linear regression models (LRMs) showed blacks reported higher rates of 2* control when exposed to discrimination and had higher rates of 2* control compared to whites when moderated by religion, as hypothesized. When analyzing the relationship between race and 1* CBs, blacks were shown to have higher rates of 1* control than whites, which is something we would like to explore further. We also intend to continue analyzing the MIDUS data to assess the results of other discrimination types (age, sex, etc).

Mentor(s):

Elliot Friedman, College of Health & Human Sciences, Human Development & Family Studies

Poster Presentation Abstract Number: 146 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Sleep behaviours in infants with speech and language issues

Author(s):

Hetvi Desai, College of Health & Human Sciences

Abstract:

Sleep behaviors and problems are associated with difficulties in attention, behavior, memory, learning, and physical and mental health. There are several elements of sleep including duration, onset, offset, and wakefulness after sleep onset (WASO). This study explores the relationship between elements of sleep quality (specifically, duration and WASO) and language development in infants ages 15 to 30 months. Pulling from a larger perspective developmental study of infant siblings, this study assessed how early sleep behaviors are correlated with speech concerns across time. We hypothesized that children with lower sleep quality are more likely to have language concerns. With terms for guardian education and child gender, this study assessed group differences in sleep across infants/toddlers with (group 1) and without (group 2) language concerns using MANOVA. Our hypothesis was not supported – sleep quality was comparable across the two groups. Future research may look beyond sleep quality to incorporate aspects of sleep pathology or parent-perceived sleep problems. Overall, this study does not support the concept that normative variations in sleep are associated with competence in the language domain.

Mentor(s):

Amy Schwichtenberg, College of Health & Human Sciences, Human Development & Family Studies

Poster Presentation Abstract Number: 147 :: Life Sciences

College of Health and Human Sciences

Measuring in vivo Glutamate Concentrations: A Comparison of Different MRS Approaches

Author(s):

Philip Durham, College of Health & Human Sciences

Abstract:

Glutamate (Glu) is the main excitatory neurotransmitter and plays an important role in many neuropsychiatric disorders. Magnetic Resonance Spectroscopy (MRS) is able to measure the concentration of Glu in the human brain in vivo and thus is being used in many research studies that are interested in changes in Glu. However, across the literature as well as across MRS studies at Purdue, many different MRS protocols are being used for single voxel Glu assessments, and it is not clear how well these are comparable, or which is optimal. This study's goal was to compare the concentrations, group differences, and variance of three different MRS methods acquired in the same subjects and brain region. Data was obtained from 15 female carriers of the Fragile-X mutation and 13 female control subjects without the mutation at the 3T Prisma Siemens MRI scanner at Purdue. Results were compared for the following sequences: sLASER (TE=35ms), MEGA-sLASER (TE=68 ms) edited spectra, HERMES (TE=80 ms) edited spectra. Mean concentrations were 5.73/6.41 mM, 3.40/3.40 mM, and 2.51/2.74 mM for the control/carrier groups with the 3 methods, respectively. The sLASER sequence produced the lowest coefficient of variance (8.09%) in the control group, had a low mean fitting error (4.33%) and was the only sequence that showed a significant difference between the control and carrier groups ($p = 0.002$). Thus, sLASER has shown to produce more consistent data and thus also seems more reliable in detecting group differences in glutamate concentrations than MEGA-sLASER or HERMES.

Mentor(s):

Ulrike Dydak, College of Health & Human Sciences, Health Sciences

Daniel Foti, Purdue University

Xiaopeng Zhou, Purdue University

Humberto Monsivais, Purdue University

Poster Presentation Abstract Number: 148 :: Life Sciences

College of Health and Human Sciences

Using Synchrotron X-ray Fluorescence to Analyze Metal Distribution in Human Teeth

Author(s):

Sai Dwibhashyam, College of Health & Human Sciences

Abstract:

Teeth have been used to investigate exposure of metals such as lead throughout a subject's life. Unlike biomarkers such as blood, hair, and toenails, which have a half-life in the order of weeks or months, teeth have a half-life in the order of years (Arora et al, 2006). Enamel is the hardest and most mineralized substance in the human body (Lacruz et al, 2017). The goal of this study is to evaluate the presence of metals near the pre-natal and post-natal lines in the enamel of teeth using synchrotron x-ray fluorescence (XRF), which provides a resolution in the order of micrometers. Previous studies have used laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), which provides a resolution of about 20 nm. In the present study, our lab examined incisor teeth from adults and children collected in the 1950's. The teeth were analyzed using Synchrotron XRF in the Advanced Photon Source (APS) facility at Argonne National Laboratory, and the elemental distribution of metals in the enamel and dentine of the teeth was determined. We expect to see a difference in the distribution of metals between the areas separated by the enamel-dentin junction as well as between the pre-natal and post-natal lines of the enamel. Preliminary analysis of the teeth shows multiple deposits containing aluminum, titanium, chromium, manganese, iron, cobalt, and lead near the pre-natal line of the enamel. Understanding where metals are deposited near the enamel may shed light on where metals are distributed in a subject's tooth throughout their life.

Mentor(s):

Linda Nie, College of Health & Human Sciences, Health Sciences

Poster Presentation Abstract Number: 149 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

No relationship between working memory & dopamine function as measured by spontaneous eyeblink rate in healthy young adults

Author(s):

Ashley Egler, College of Science, Honors College

Abstract:

Dopamine is a neurotransmitter that plays a role in an individual's working memory capacity. Poor dopamine function is associated with many health issues, including ADHD and Parkinson's disease. Research suggests that there is a relationship between dopamine functioning and spontaneous eyeblink rate. If a strong relationship is identified, spontaneous eyeblink rate could be used as an early detection method for diseases caused by dopamine deficiencies. The purpose of this study was to examine the relationship between eyeblink rate and working memory to add supporting evidence to current literature. We hypothesized that spontaneous eyeblink rate would be positively associated with working memory scores. The study measured the spontaneous eyeblink rate of N = 361 individuals using an EyeLink 1000 Plus eye tracker. Participants completed two tasks to assess their visuospatial (symmetry span) and verbal (operation span) working memory abilities. Their scores on these tasks were aggregated into an overall working memory score. The results do not support a significant linear relationship between spontaneous eyeblink rate and working memory.

Mentor(s):

Thomas Redick, College of Health & Human Sciences, Psychological Sciences

Poster Presentation Abstract Number: 150 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

The Role of Community Organizations in Immigrant Success in the Greater Lafayette, IN Area

Author(s):

Anne Marie Foley, College of Health & Human Sciences, Honors College

Abstract:

Due to the absence of governmental services for immigrant integration, civic and community groups have become critical in this regard (Waters & Pineau, 2015). Studies show that challenges to immigrant integration can be overcome by social and religious support systems in the community (May et. al., 2015). This study asks two questions: in the Greater Lafayette area, which has a relatively short history of immigration, what are the needs of immigrants and what role do local community organizations play in meeting these needs thereby contributing to immigrant integration? In this attempt, we collected both survey and interview data from community organization leaders and members of the immigrant community in the Greater Lafayette area, between October 2020 and March 2021. Based on interviews with eight community organizations, we find that a range of services (including healthcare, financial, and legal) are available to all community members, regardless of immigration status; however, services are primarily limited to English-speakers. Survey results of immigrants indicate that most respondents rely on family and friends for assistance, and few are aware that resources exist in the community. Together, these results suggest a disconnect between the provision of resources and the knowledge of their availability by immigrants in the community, and that organizations within the community play a minor role in integrating immigrants in the Greater Lafayette area. The conclusions of the study are limited due to the small sample size. Future studies should expand the sample size.

Mentor(s):

Natasha Duncan, Honors College

Poster Presentation Abstract Number: 151 :: Life Sciences

College of Health and Human Sciences

Relationship between MRI Markers of Brain Metal Levels and Exposure to Welding Fumes

Author(s):

Grace Francis, College of Science, Honors College

Abstract:

Exposure to manganese (Mn) in welding fumes can cause neurotoxicity associated with cognitive and motor impairment. Therefore, the interest in understanding and measuring metal deposition in the brain is high. Quantitative Magnetic Resonance Imaging (MRI) allows for the assessment of brain metal levels by measuring the relaxation time T1 as proxy for brain Mn, and the relaxation rate R2* as proxy for brain iron (Fe). The purpose of this study is to determine the relationship between exposure to Mn and Fe and T1 and R2* MRI markers in different brain regions. Brain MRIs were acquired from eleven welders from a truck trailer factory. Cumulative exposure indices (CEIs) were calculated for the past year (CEI1Yr) and the past 3 months (CEI3m) from personal air sampling and a work history questionnaire. T1 and R2* were calculated for four regions of interest (ROIs): The globus pallidus (GP), putamen (Put), substantia nigra (SN) and frontal white matter (FWM). Spearman Correlations were performed to test for correlations between the MRI markers and exposure indices. While no correlation was found between T1 (proxy for Mn) and Mn exposure CEIs, significant correlations were found both for the globus pallidus and the putamen R2* values (proxy for Fe): CEI-Mn1Yr-GP (R=0.63, p= 0.044), CEI-Mn1Yr-Put (R=0.66, p= 0.031), CEI-Mn3m-GP (R=0.57, p= 0.071), and CEI-Mn3m-Put (R=0.62, p= 0.048). This strong relationship between brain Fe and Mn exposure may be explained by the fixed ratio of Mn and Fe in welding fumes and a very strong correlation between Mn and Fe exposure.

Mentor(s):

Ulrike Dydak, College of Health & Human Sciences, Health Sciences

Humberto Monsivais, Purdue University

Chang Lee, Purdue University

Jae Park, Purdue University

Poster Presentation Abstract Number: 152 :: Life Sciences

College of Health and Human Sciences

Nuclear Security Culture Assessment of University Population

Author(s):

Naomi German, College of Health & Human Sciences

Destiny White, College of Engineering

Abstract:

The assessment of organizational nuclear security culture has been heavily underdeveloped despite the awareness surrounding the topic; this is especially true for non-nuclear facilities such as medical facilities and academic institutions. In order to identify the level of awareness surrounding the threats at these facilities a campus wide survey was utilized to collect responses to assess the nuclear security culture. Three though three hundred thirty-six (3,336) responses were collected, which included non-radioactive material users consisting of students, faculty, and staff. The survey was broken down into three categories: general awareness (GA), school specific awareness (SSA), and behavior response awareness (BR). Additional demographics were collected to distinguish between the diverse population and to discern between the different attitudes present at an academic institution. These demographics included: gender, age, work-status, degree, ethnicity, and nationality. Across all three survey categories, the results demonstrated that there was significance between the demographic categories of gender, age, work-status, degree, and ethnicity in correspondence with the mean response scores. In order to predict the impact the demographics had on an individual's response to the survey, an ordinal logistic regression was implemented. Contradictory results were encountered between the general awareness and behavior-response awareness category in the school-response awareness section of the survey. Results from this survey contribute to the understanding of the discrepancies of nuclear and radioactive security awareness present in an academic institution. However, this may not be representative of all non-nuclear academic facilities, therefore future additional studies at universities need to be conducted in order to contribute to the understanding of the level of security culture present at these facilities.

Mentor(s):

Jason Harris, College of Health & Human Sciences, Health Sciences

Poster Presentation Abstract Number: 153 :: Life Sciences

College of Health and Human Sciences

A Mouse Striatal Cell Lineage Demonstrates Media Type Specific Differences in Sensitivity to Methylmercury Exposure

Author(s):

Madeline Henley, College of Health & Human Sciences

Abstract:

Methylmercury (MeHg) is a potent developmental neurotoxicant. MeHg exposure can occur through fish consumption, yet fish is considered a vital food source for development. We aim to examine human neuronal lineage sensitivity to MeHg throughout development using a stem cell model. This *in vitro* setting involves application of media type varieties to stem cells for neuronal lineage differentiation. Each differentiation stage requires a different media type; thus, media type is a potential confounding variable. Therefore, prior to testing human neuronal lineage sensitivity, we aimed to define, in a controlled setting, media type differences with MeHg exposure. Using a single mouse striatal cell line, cells were exposed to 0, 2, 4, and 6μM of MeHg in various human stem cell neuronal differentiation media types. Our data indicated significant differences in cell sensitivity to MeHg according to media type, with a notable difference between differentiation Day 0-4 and Studer N2 media types. To test if differences in sensitivity correlated with differences in intracellular mercury (Hg) levels, we evaluated cellular Hg levels after 1μM exposure in the same media types. No correlation was found between cell survival and cellular Hg levels, indicating media type specific differences in cell sensitivity were not due to cellular Hg uptake levels. This data further suggests decreased cell survival was due to either increased metabolic rate or cell growth rate differences. Subsequent studies will evaluate how individual cell properties affect MeHg uptake and excretion while media type specific differences with other cell types is evaluated.

Mentor(s):

Aaron Bowman, College of Health & Human Sciences, Health Sciences

Lisa Prince, Purdue University

Morgan Thomas, Purdue University

Anke Tukker, Purdue University

Poster Presentation Abstract Number: 154 :: Life Sciences

College of Health and Human Sciences

Student Opinions on the Protect Purdue Guidelines Based on Class and Residence

Author(s):

Belle Hinshaw, College of Health & Human Sciences

Meredith Robbins, College of Health & Human Sciences

Perry Curtis, College of Health & Human Sciences

Abstract:

Purdue University established Protect Purdue Guidelines to reduce COVID-19 virus transmission; however, student perspectives on the guidelines are not well understood. The primary objective of this analysis is to describe student opinions of the guidelines based on their class and residence. Students at Purdue were invited to complete an online survey in fall 2020 consisting of demographic questions and 13 questions regarding opinions on COVID-19 preventive measures. Demographics included class (freshman, sophomore, junior, senior, 5th-year senior, graduate) and residence (in-state, out-of-state, international). Opinion questions were based on a Likert scale. Statistical analyses were completed on Stata 16.1 using oneway ANOVA to determine if student opinion varied by class and residence. A p-value <0.05 was considered statistically significant. Out of the 646 responses with complete data, 399 (61.76%) reported in-state residence, 189 (29.26%) reported out-of-state residence, and 58 (8.98%) reported international residence. The respondents' class was: 129 (19.97%) freshman; 125 (19.35%) sophomores; 102 (15.79%) juniors; 90 (13.93%) seniors; 11 (1.70%) 5th-year seniors; and 189 (29.26%) graduate students. There were statistically significant differences in student opinion by class for 6 questions and by residence for 7 questions. For example, graduate and international students were most likely to disagree with the statement "I am comfortable not socially distancing if I have a mask on" (p=0.00 (graduate), p=0.00 (international)). Responses for other questions had similar patterns. Overall, there was a high level of agreement with preventive statements, but graduate and international students were more likely to agree with statements consistent with protective measures.

Mentor(s):

Ellen Wells, College of Health & Human Sciences, Health Sciences

Poster Presentation Abstract Number: 155 :: Life Sciences

College of Health and Human Sciences

Is self-diagnosed lactose intolerance real? Recruitment for lactose intolerance results only 16% of subjects verified with symptoms.

Author(s):

Rachel Hyun, College of Health & Human Sciences

Tara Kazemi, College of Health & Human Sciences

Abstract:

This poster focuses on the recruitment process of milk intolerant subjects and how they meet or fail to meet the criteria. Analyzing the number of participants who did not meet the criteria but perceive themselves as lactose intolerant proves as an unnecessary aversion to dairy products. Avoiding milk causes a deficit in an important source of dietary calcium and other nutrients, leading to poor bone health. Introducing milk back into one's diet would increase calcium consumption and proper bone health. Methods: First, interested subjects completed an initial phone screening to assess their eligibility. Some major reasons for subject exclusion from the initial phone screening are no avoidance of milk (in the past month) and the use of concurrent lactose intolerant therapies. If a participant used concurrent therapy(ies) or other products free of the therapy or product to be re-screened for eligibility. Like laxatives, Pepto Bismol®, or Lactaid Dietary Supplements® used for symptoms of lactose intolerance within 7 days of screening, the subject was given the option to participate in a 7 day cleanse free of the therapy or product to be re-screened for eligibility. Second, if the subject was deemed eligible from the phone screening, an in-person screening was conducted based on the criteria. Lastly, if this criteria is met, the subject proceeded to the lactose intervention. The lactose intervention was a double-blinded, randomized crossover trial that was conducted in 28 verified lactose-intolerant subjects, feeding four types of milk after an overnight fast. Hydrogen concentration in the breath was measured, and intolerance symptoms were recorded for 6 hours following the treatment. Subjects participated in four separate feedings based on current criteria of being a maldigester of lactose. The current inclusion criteria includes participants who fall into one of the following categories: maldigester without a Qualifying Symptom Score, maldigester with a Qualifying Symptom Score, or digester with a Qualifying Symptom Score. Results: From the 853 potential participants who volunteered and self-identified as having lactose intolerant symptoms, approximately only 28 of the participants met the current criteria as a lactose maldigester. From the initial phone screening, 49 participants were excluded due to lack of milk avoidance, 74 participants were excluded due to other means. 10 Participants used therapy(ies) or other produced like laxatives, Pepto Bismol, or Lactaid Dietary Supplements) used for symptoms of lactose intolerance within 7 days of screening and 5 participants participated in a 7 day cleanse to be re-screened for eligibility. This means that in every 10 self-perceived lactose intolerant study participants, only 1 is actually a maldigester of lactose. Based on these results, it raises the question of whether lactose intolerance is really as common as we think? Understanding this question will allow those that are self-perceived lactose intolerant to obtain the necessary dietary requirements of calcium from dairy to improve bone health.

Mentor(s):

Dennis Savaiano, College of Health & Human Sciences, Nutrition Science

Tracy Eaton, Purdue University

Monica Ramakrishnan, Purdue University

Poster Presentation Abstract Number: 156 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Building semantic networks through play

Author(s):

Candace Jarzombek, College of Health & Human Sciences, Honors College

Caitlin Jelensky, College of Health & Human Sciences

Salsabila Lane, College of Health & Human Sciences

Abstract:

Prior empirical studies have shown that building dense semantic networks in early vocabulary can boost word comprehension and learning skills. We expand on this research by asking how children build these semantic connections between words through everyday learning contexts, such as play with their caregivers. When children were 24 months, 55 toddler-parent dyads were recorded while playing with a set of toys including some objects that were related in meaning, such as farm animals and vehicles, and some unrelated objects, such as a Jacob's ladder and slinky. We developed a specific set of coding guidelines to reliably measure whether and to what extent participants touched related or unrelated sequences of toys. Now, we are comparing the amount of time dyads play with related vs. unrelated toys in relation to toddlers' concurrent and future vocabulary and language skills between 24 and 36 months of age. While it is possible that interacting with semantically related toys simultaneously could create confusion for the child in distinguishing between objects, we hypothesize that we will find positive correlations between language skills and the tendency to play with related toys, thereby extending recent findings that children tend to learn novel words that share semantic relations with other known objects. This project will contribute to the literature on parent-child interaction in play, could influence recommendations for how parents encourage interaction with toys in play, and assist in identifying early markers of language disorders and delays.

Mentor(s):

Arielle Borovsky, College of Health & Human Sciences, Speech, Language, & Hearing Sciences

Poster Presentation Abstract Number: 157 :: Life Sciences

College of Health and Human Sciences

The effects of environmental copper exposure on the behavior and morphology of developing zebrafish

Author(s):

Christina Kaucic, College of Health & Human Sciences

Abstract:

Copper is an essential metal that is key in many metabolic functions and is a cofactor in many enzymes. Excess copper exposure has been associated with fatigue, weakness, and neurologic dysfunction in humans. The zebrafish has a high degree of genome sequence homology to humans and were used as the animal model for copper toxicity studies. Survival and then behavioral and morphological changes at sub-lethal concentrations were assessed in developing zebrafish with exposure spanning 1 to 120 hours post fertilization (hpf). Exposure concentrations included 0, 13, 130, and 1300 ppb to span the current US EPA regulatory level in drinking water for the survival analyses and revised to sub-lethal concentrations of 0, 13, and 130 ppb for the behavior and morphology assessments. It was hypothesized that zebrafish exposed to higher concentrations of copper during embryogenesis would show signs of increased physiological and behavioral stress as well as abnormalities in morphology. Copper caused mortality at 1300 ppb and was excluded from further studies. Behavioral studies using the visual motor response test revealed decreased total distance moved, velocity, and time spent moving at 130 ppb in light phases ($p<0.05$). In addition, larvae exhibited significantly decreased head width, head length, total length, brain length, and eye diameter in the 130 ppb treatment ($p<0.05$). Developmental exposure to copper produces dysfunctional locomotor behavior and morphological abnormalities in zebrafish at concentrations lower than the regulatory concentration in US drinking water indicating species sensitivity. Future studies are focused on molecular mechanisms with a specific interest in myelination.

Mentor(s):

Jennifer Freeman, College of Health & Human Sciences, Health Sciences

Keturah Kiper, Purdue University

Poster Presentation Abstract Number: 158 :: Life Sciences

College of Health and Human Sciences

Withdrawn

Poster Presentation Abstract Number: 159 :: Life Sciences

College of Health and Human Sciences

Behavioral alterations following exposure to a lead and atrazine mixture during early development in the zebrafish model system

Author(s):

Anusha Kotapalli, College of Health & Human Sciences

Abstract:

Lead (Pb) and atrazine (ATZ) are hazardous toxicants where the main route of environmental exposure in the United States is through ingestion of contaminated drinking water. Pb is a toxic heavy metal where exposure results in adverse health effects. Pb primarily contaminates household water systems, leaching from older plumbing systems in homes built prior to 1986. ATZ, on the other hand, is an endocrine disrupting chemical known to target the neuroendocrine system. ATZ frequently contaminates drinking water sources in agricultural regions where this herbicide is applied to crop fields. This study tested the central hypothesis that an early developmental exposure to Pb and ATZ mixtures results in a greater than additive mixture toxicity response. The zebrafish model system was applied to test the central hypothesis with exposures to 3 ppb (µg/L) ATZ, 30 ppb ATZ, 100 ppb Pb, or mixtures of 3 ppb ATZ with 100 ppb Pb or 30 ppb ATZ with 100 ppb Pb beginning at 1 hour post fertilization (hpf) and continuing through 120 hpf. Following the exposure, behavioral alterations were assessed in larvae using the Noldus DanioVision white light routine. Locomotor data was analyzed with a repeated measures analysis of variance (ANOVA) to investigate the ten-minute increments of alternating dark and light phases ($\alpha=0.05$). Behavior data showed significant differences for total distance moved, mean velocity, and time spent moving in dark and light phases ($p < 0.05$). The most significant impacts were observed in the mixture treatment groups supporting a mixture reaction that warrants further investigation.

Mentor(s):

Jennifer Freeman, College of Health & Human Sciences, Health Sciences

Janiel Ahkin Chin Tai, Health Sciences

Keturah Kiper, Health Sciences

Poster Presentation Abstract Number: 160 :: Life Sciences

College of Health and Human Sciences

Neurotoxicity of Per- and Polyfluoroalkyl Substances (PFAS): Examination of recent studies in humans and animals

Author(s):

Aditya Kotapalli, College of Health & Human Sciences

Abstract:

Man-made chemicals used in commercial products have certain chemical properties that make the products marketable. Unfortunately, some of these chemical properties, like in the case of per- and polyfluoroalkyl substances (PFAS), result in presence of and bioaccumulation in the environment, which raises concerns due to potential adverse health outcomes following exposure. Increasing reports are indicating neurotoxic effects for PFAS. The recent research literature was examined for studies evaluating neurological outcomes in humans and animals to understand the neurotoxic impacts of various PFAS. Studies included evaluation of PFAS behavioral effects in children, developmental neurotoxicity and behavioral effects in zebrafish, cytotoxicity and autophagy in rats, and neurotransmitter analysis in frogs and polar bears. These studies report decreased executive function as measured by an increase in metacognition score at 8 years old in children with increased PFAS serum levels at 3 years of age and that PFAS was able to pass through the blood brain barrier as seen when comparing serum PFAS to PFAS in cerebrospinal fluid. Developmental neurotoxicity was also seen in zebrafish with survival and morphological changes as well as locomotor abnormalities observed in behavioral studies. Autophagy and cytotoxicity was observed when rat-derived astrocytes were exposed to PFAS. In addition, positive and negative correlations between PFAS concentration and steroid and neurotransmitter concentration were found in frogs and polar bears. Overall, these studies provide support for PFAS neurotoxicity warranting further analysis into the specific mechanisms of action for evaluation of health risk.

Mentor(s):

Jennifer Freeman, College of Health & Human Sciences, Health Sciences

Ola Wasel, Purdue University

Poster Presentation Abstract Number: 161 :: Life Sciences

College of Health and Human Sciences

Examining Demographic Characteristics with the Number of Brownfield and Superfund Sites in Indiana at the Census Tract Level

Author(s):

Sharon Kulali, College of Health & Human Sciences, Honors College

Abstract:

Brownfields and superfund sites are areas known to have substantial contamination with hazardous substances, such as lead and arsenic. This can pose a health hazard to individuals living nearby. Previous work by our group found that there was a significant correlation between the presence of minorities and the number of hazardous waste sites in Indiana counties. As a follow-up project, the goal of this analysis is to determine the correlation of the occurrence of brownfield sites and superfund sites with demographic characteristics at the census tract level. The census tracts, subdivisions of a county split into six-digit codes based on the size of the population in the area, provide a more precise analysis of the population compared to county-level comparisons. We obtained publicly-available data from 2010 on hazardous sites and demographics from the Environmental Protection Agency (EPA) website as well as the U.S. Census website. The U.S. Census Geocoder and the Federal Financial Institutions Examination Council (FFIEC) Geocoding/Mapping System were used to identify the census tract of each known brownfield and superfund sites. Demographic data included age, income, unemployment rate, race, and ethnicity. We identified 4,114 census tracts, 2,513 brownfield sites, and 2,891 superfund sites in Indiana. The mean number of brownfields per census tract was 2.0 (standard deviation (SD) = 2.1); the maximum number of brownfields in a census tract is 20. Mean superfund sites per census tract was 1.5 (SD = 1.2), and the maximum was 17. These results contribute to our understanding of environmental justice.

Mentor(s):

Ellen Wells, College of Health & Human Sciences, Health Sciences

Poster Presentation Abstract Number: 162 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Gender Differences in How Parents Support Early Math Learning

Author(s):

Annabelle Kwon, College of Health & Human Sciences

Abstract:

Previous studies have indicated that young girls have a weaker identification with math when compared to their male peers. The gender discrepancies found in children’s math self-concept may be a combined result of cultural stereotypes, gender roles, and intrapersonal cognitive factors (Cvencek et al., 2011). Recently, it has been shown that girls whose parents are from countries with greater gender equality surpass their male counterparts in math (Rodríguez-Planas & Nollenberger 2018). The purpose of the current study will be to examine the roles parents play in children’s socialization of math learning, investigating whether there is a significant difference in parents' engagement and attitude towards math depending on their child’s gender. Parents of 3- to 5-year-olds (current N = 80, target N = 100) will complete an online survey asking about their engagement in different types of home learning activities, frequency of these activities, and their personal beliefs on learning opportunities at home. To evaluate the possible differences in parents’ overall math engagement and specific activities depending on their child’s gender, I will conduct a two-tailed t-test. This will determine if the frequency and type of activities parents engage in differ based on the gender of their child. The findings will indicate whether parents’ early math practices may contribute to children’s socialization of gender stereotypes surrounding math and it will identify ways to encourage parents to engage in more equitable math activities.

Mentor(s):

Sarah Eason, College of Health & Human Sciences, Human Development & Family Studies

Poster Presentation Abstract Number: 163 :: Life Sciences

College of Health and Human Sciences

Evaluation of Cerebral Volume in a Mini-Pig Model of Radiation-Induced Brain Injury

Author(s):

Anna Lehman, College of Health & Human Sciences

Abstract:

While radiotherapy is critical for the treatment of intracranial tumors, it can lead to a range of radiation-induced brain injuries (RIBI) that ultimately decrease the quality of life for survivors. Loss of cerebral volume, a notable aspect of RIBI, occurs at least 6 months post-treatment and has been shown to relate to cognitive impairment in this population. Our goal was to evaluate whether a mini-pig model of RIBI can reproduce this cerebral volume loss. Two adolescent mini-pigs were irradiated in a manner consistent with pediatric brain tumor patients. A single-fraction 15 Gy dose was given to the left hemisphere the right hemisphere was left unirradiated as an internal control. MRI scans were then acquired at 1 week, 3 months, and 6 months post-irradiation. Using ITK-SNAP, the MRI scans were evaluated for temporal changes in hemispheric and total brain volume for each mini-pig. Our results show that the irradiated hemisphere is smaller than the unirradiated hemisphere across all time points, which is consistent with what is seen in brain cancer survivors. Evaluation of total brain volume at six months post-irradiation shows that it is larger than the total brain volume at baseline, which is a product of increased rate of growth as the mini-pigs mature into adulthood. Future investigations will confirm these findings as well as determine the dose-response relationship of the mini-pig brain with regards to cerebral volume loss.

Mentor(s):

Carlos Perez-Torres, College of Health & Human Sciences, Health Sciences

Whitney Perez, Purdue University

Poster Presentation Abstract Number: 164 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

The Relationship Between Social Participation and Vocabulary Development in Children

Author(s):

Grace Lovell, College of Health & Human Sciences

Bethany Schuster, College of Health & Human Sciences

Abstract:

Early language learning happens in social contexts between caregivers and their children. While prior studies have found positive relations between social play skills and preschool children's leadership qualities, IQ scores, and group involvement, less is understood regarding whether or how this connection also supports language development. Our study aims to determine how social participation with caregivers correlates with language acquisition in 24-month-old children. We recorded 55 participants and their primary caregivers for 15-minute play sessions, in which structured toy categories were provided in a research setting. Evidence of engagement in five types of play with varying degrees of social involvement (solitary, spectator, reactive, reciprocal, and other) were documented in 15-second increments, with the occurrence of a type of social participation coded as a "1" and the absence as a "0." We will then explore how engagement in each social play category relates to the participants' productive vocabulary. We hypothesize that children who participate in play involving higher degrees of social coordination (reactive and reciprocal play) at a greater frequency will also exhibit stronger vocabulary skills. Our findings will enrich the current body of knowledge about the importance of social play to early development and the ways in which parents can foster more interactive play with their children.

Mentor(s):

Arielle Borovsky, College of Health & Human Sciences, Speech, Language, & Hearing Sciences

Poster Presentation Abstract Number: 165 :: Life Sciences

College of Health and Human Sciences

Comparing EDA baseline data from two conditions between autistic and non-autistic children

Author(s):

Suhail Mujibur Rahman, College of Health & Human Sciences

Abstract:

Background: Electrodermal activity (EDA) is based on the change in skin conductance level due to sympathetic nervous activity. Thus, EDA can be used to detect any abnormalities in sympathetic nervous function (Dawson et al, 2007). Autistic individuals often have abnormal reactions to tasks that elicit sympathetic responses (Panju et al, 2015). Baseline EDA is collected as a measure of sympathetic activity in homeostasis.

Objective: To analyze differences in EDA baseline between children with and without autism under two conditions – watching a video or eating a snack.

Method: There were 49 participants among two groups – 27 children with autism (mean age = 4.8, SD = 1.27) and 22 typical developing children (mean age = 4.2, SD = 1.16). Baseline EDA data for the two conditions – watching a video clip of Mr. Roger's Neighborhood or eating snacks was obtained using a Biopac ® from the foot. The data was processed in 10-second segments using MindWare software to generate averages of Mean Skin Conductance Level (SCL) and a number of skin conductance responses (SCRs).

Analytical plan: Differences in baseline measures of EDA will be assessed within a mixed ANOVA with groups (autism, typically developing) as the between-subjects factor and condition (video, snack) as the within-subjects factor.

Implications: Significant differences in baseline between the two conditions would inform variability in findings across studies examining sympathetic regulation in children with and without autism. In that case, any subsequent EDA data collected needs to be processed with factoring in the specific baseline condition.

Citations

Dawson ME, Schell AM and Filion DL (2007) The electrodermal system. In: Cacioppo JT, Tassinary LG and Berntson G (eds) Handbook of Psychophysiology. New York, NY: Cambridge University Press, pp. 159–181.

Panju, S., Brian, J., Dupuis, A. et al. Atypical sympathetic arousal in children with autism spectrum disorder and its association with anxiety symptomatology. Molecular Autism 6, 64 (2015). https://doi.org/10.1186/s13229-015-0057-5

Mentor(s):

Carloyn McCormick, College of Health & Human Sciences, Human Development & Family Studies

Poster Presentation Abstract Number: 166 :: Life Sciences

College of Health and Human Sciences

The Effect of the Level of Parent Engagement on Early Vocabulary Development

Author(s):

Sarah Nicolas Cruz, College of Health & Human Sciences, Honors College

Rita Deitz, College of Health & Human Sciences

Abstract:

Research on parent engagement with young children has linked positive interactions such as high maternal sensitivity towards the child to positive correlations in cognitive development. Similarly, negative parent-child interactions such as intrusive actions by the parent are linked to adverse effects on children’s development. Our research aims to look at both positive and negative parent behaviors in the same study to find out what aspects of parent engagement are specifically correlated with a child’s vocabulary development. Parent engagements were recorded during play sessions between 55 parents and their 24-month-old toddlers with a standard toy set. These videos were coded for specific parent engagement behaviors in six categories as determined and defined by the Child-Parent Interaction Rating Scales for the Three-Bag Assessment 24-Month Wave (Brady-Smith et al., 1999). Categories included parent’s sensitivity, intrusiveness, cognitive development, positive regard, negative regard, and detachment which were rated on a 1-7 Likert scale to be compared to the children’s vocabulary skills at their current age. Our findings will enrich our understanding of how positive and negative interactions affect a child’s language development, and also determine more precisely how parent engagement during play may support early vocabulary development. The data will contribute to evidence supporting recommendations for how parents, clinicians, and educators may support their child’s language and cognitive development through play.

Mentor(s):

Arielle Borovsky, College of Health & Human Sciences, Speech, Language, & Hearing Sciences

Poster Presentation Abstract Number: 167 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Analysis of Parent Perspectives on Priorities for Autism Research Initiatives

Author(s):

Aparajita Reddy Pesaladinne, School of Management

Abstract:

Background: Autism is a neurodevelopmental disorder that has lifelong impacts. Prior studies have identified stakeholders' research priorities such as physical and mental health, accessibility of services, and skill development across the lifespan (Roche, 2021). The causal pathway for autism has both genetic and environmental factors (Masini, 2020) and to date, there has been little research reporting research priorities across populations with different autism likelihood profiles.

Objectives: The goal of this project was to analyse parent perceptions on the focus of future autism research initiatives and motivation for participating in research. Priorities and motivations will also be compared across parents with children in genetic and environmental risk groups.

Methods: Six parents of children with autism completed a 90-minute semi-structured interview. NVivo software was used to code themes of research goals and motivations using a grounded-theory approach.

Results: Parents of children with autism emphasized that the focus of future research should include causal mechanisms of autism, early diagnosis, genetics, and interventions. Motivations for research participation included contributing to science and receiving information about their child. Further analyses will report priorities and motivations of parents with children at a higher genetic/environmental risk for autism.

Discussion: Parents in this study indicated causal mechanism of autism as a major stakeholder research priority. In addition, parents expressed that early diagnosis using genetic and environmental risk factors should be at the core of research initiatives. As a final note, more awareness needs to be created to tackle misinformation and publish relevant findings in an easily accessible way.

Mentor(s):

Carolyn McCormick, College of Health & Human Sciences, Human Development & Family Studies

Poster Presentation Abstract Number: 168 :: Life Sciences

College of Health and Human Sciences

Investigating Cellular Manganese Uptake Using Manganese Selective Small Molecules

Author(s):

Caroline Puch, College of Health & Human Sciences

Frankie Yanko, College of Health & Human Sciences

Abstract:

Manganese (Mn) is an essential metal in the human body implicated in numerous biological processes including normal brain and nerve function, insulin signaling, and bone health. Mn is required to stay within a regulated level as too much can cause neurotoxic effects known as Manganism. The disorder is characterized by Parkinsonian-like effects such as impaired voluntary motor function, muscle spasms and tremors. This similarity to Parkinson's is due to Mn selectively accumulating in dopaminergic neurons of the basal ganglia, the same area affected in Parkinson's. Despite the importance of Mn regulation, the mechanisms through which it is regulated in the brain are not well understood. Previously our group identified 4 small molecules that selectively increase intracellular Mn levels. It is not yet clear whether these small molecules alter Mn levels at low concentrations. To answer this question, murine striatal cells, STHdhQ7/Q7, were exposed to Mn, zinc, copper, cobalt, or nickel at 5, 10, and 25 μM concentrations for three hours. Intracellular levels were assessed using a modified version of the cellular fura-2 manganese extraction assay (CFMEA). In the future, we will evaluate the effects of these small molecules on human induced pluripotent stem cells (HiPSCs) differentiated down a cortical lineage.

Mentor(s):

Aaron Bowman, College of Health & Human Sciences, Health Sciences

Morgan Thomas, Purdue University

Poster Presentation Abstract Number: 169 :: Physical Sciences

College of Health and Human Sciences

Development of a Nuclear Research Reactor Risk Model that Assesses Safety and Security Risk

Author(s):

Emma Rekeweg, College of Health & Human Sciences

Abstract:

Following recent historical events such as the 9/11 terrorist attacks and the Fukushima nuclear disaster of 2011, vulnerabilities of nuclear reactors have become apparent. Nuclear reactors have the potential to become the target of intentional terrorism acts and natural disasters can lead to a release of nuclear radiation into the environment, for example. Without addressing these vulnerabilities, the safety of everyday citizens is put at risk. In previous literature, the safety risk and security risk of a research reactor have been studied as separate concerns. However, there is a lack of research concerning the simultaneous evaluation of safety and security risks. One theme of this study is to develop a more-robust model that identifies combined safety and security risk for research reactor facilities. The PUR-1 research reactor will be used in developing the model. The model will integrate existing security evaluation strategies with modified safety analysis data including contributing factors such as crime and weather data. A risk index score will then be calculated for a particular reactor based on these weighted factors. Ultimately, the model will be applied to other operating research reactors in the US and will be used to optimize the balance of safety and security risks. In addition to protecting the safety of citizens in the surrounding area of a reactor, knowing how to optimize and achieve the lowest risk score can also prove to be beneficial in the planning phase of a reactor in order to identify weaknesses before they occur.

Mentor(s):

Emily Bragers, College of Health & Human Sciences, Health Sciences

Dr. Jason Harris, Purdue University

Poster Presentation Abstract Number: 170 :: Life Sciences

College of Health and Human Sciences

Tracking The Progress of Radiation-Induced Lung Fibrosis in A Mouse Model

Author(s):

Elizabeth Roach, College of Health & Human Sciences

Abstract:

Radiation therapy utilizes X-rays in order to destroy tumors that would otherwise be difficult to remove surgically. Typically, the goal of radiation therapy is to deliver doses in a precise manner to the tumor in order to prevent damage of healthy surrounding tissue. While radiation is proven to be wildly successful in the destruction of tumors, the side effects and injury to adjacent tissue can lead to reduction in quality of life for cancer survivors. Specifically in the lungs, radiation damage first presents as pneumonitis which eventually leads to the scarring and formation of fibrotic regions. The purpose of this project was to observe and characterize pathology in order to create an accurate mouse model representing lung fibrosis due to radiation. This study utilized around 100 C57BL6 male mice which were irradiated with 20Gy in a single fraction to the entire thoracic cavity. The mice were then imaged biweekly until noticeable changes were visible. The imaging techniques utilized included MRI and CT. Images were subsequently analyzed in the software program ITKsnap in order to differentiate healthy tissue from fibrosis, and to track the progress of scarring in the lungs. After analyzing around two hundred images, it was observed that as time continued, more fibrosis appeared. This project allowed us to successfully track the process of lung damage due to radiation utilizing a mouse model. Future directions include quantifying and comparing histology slides to CT images.

Mentor(s):

Carlos Perez-Torres, College of Health & Human Sciences, Health Sciences

Daniel McIlrath,

Poster Presentation Abstract Number: 171 :: Life Sciences

College of Health and Human Sciences

Investigating age differences in temporal swallowing measures in adults: A secondary data analysis

Author(s):

Caroline Sarbieski, College of Health & Human Sciences

Abstract:

Swallowing is critical to survival and complex involving many muscles and nerves in the head/neck. These structures enable swallowing to be completed efficiently and safely, but can be impacted by aging. Documenting changes in typically aging populations is important in order to provide ranges of performance that can be used to compare disordered populations. In addition to changes, variation can be seen in swallowing event sequencing. Our first aim was to determine the order of swallowing events in young and old healthy adults in order to reinforce or supplement previously researched data. Our second aim was to examine duration and reaction time differences in the swallow of these two groups in an attempt to replicate prior, well-designed studies. Participants included eight older (R age= 65-79 years) and eight younger adults (R age= 19-23), who underwent a videofluoroscopic (VFSS, real-time x-ray) assessment to evaluate swallowing of two boluses: sips of thin liquid (10 mL) and bites of pudding (5cc). Blinded analysis for swallowing event sequencing included a series of identifying gestures and bolus location measurements. Swallowing timing variables included Oral Transit Time, Pharyngeal Transit Time (PTT), Pharyngeal Response Time, and Laryngeal Vestibule Closure Reaction Time. Percent comparision was used to compare four previously established ordered sequences with found patterns. An independent t-test was used to compare timing measurements between age groups. Patterns of Laryngeal Elevation (LE) before upper esophageal sphincter (UES) opening and UES opening before hyolaryngeal approximation were found to be robust, aligning with previous research. LE before or with Bolus Past Mandible (BPM) was found less often in older adults. PTT for thin liquids was significantly longer in older adults. Increased PTT and decreased LE before BPM in older adults may be indicative of reduced sensorimotor responses and reduced airway protection.

Mentor(s):

Georgia Malandraki, College of Health & Human Sciences, Speech, Language, & Hearing Sciences

Rachel Hahn Arkenberg, College of Health & Human Sciences, Speech, Language, & Hearing Sciences

Poster Presentation Abstract Number: 172 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Relationship of Microcephaly Severity with Behavioral and Heart-Rate Defined Sustained Attention in Children with Congenital Zika Syndrome

Author(s):

Kate Schrader, College of Health & Human Sciences

Gabby Butler,

Vadant Desai, College of Health & Human Sciences

Kelly Mathis, College of Health & Human Sciences

Ramya Tummala, College of Health & Human Sciences

Sherry Zhang, College of Health & Human Sciences

Abstract:

Congenital Zika syndrome (CZS) is characterized by severe microcephaly that negatively impacts cognitive development. Yet, little is known about the relationship between microcephaly severity and sustained attention, a key component of cognitive abilities. Sustained attention can be measured behaviorally and physiologically, with heart rate-defined sustained attention (HRDSA) generally converging with behaviorally-defined sustained attention (BDSA; i.e., looking). We predicted that BDSA and HRDSA would be positively correlated in CZS while microcephaly severity would be negatively associated with sustained attention. Forty-two Brazilian children with CZS (40% male; age: 38–46 months) and varying degrees of microcephaly at birth (1.59–7.50 standard deviations below norms) watched an animated video while wearing a HR monitor. We assessed whether children were looking at the video (0: not looking; 1: looking); BDSA was quantified as the proportion of time spent looking at the video. To quantify HRDSA, we determined the proportion of time children's HR was consistently decelerated from baseline HR of individual looking episodes. Participants varied substantially in BDSA ($M = .53$, $SD = .32$, range: .00–.99) and HRDSA ($M = .18$, $SD = .22$, range: .00–.97). As expected, BDSA was positively related to HRDSA ($r = .71$, $p <.001$). Contrary to predictions, microcephaly severity was neither associated with BDSA ($r = -.01$, $p = .961$) nor HRDSA ($r = .07$, $p = .657$). These findings suggest that HRDSA is a robust index of sustained attention in CZS regardless of microcephaly severity at birth, offering a complementary and efficient means for measuring and monitoring development of sustained attention beyond behavioral assessments.

Mentor(s):

Wei Siong Neo, College of Health & Human Sciences, Psychological Sciences

Bridgette Kelleher, Purdue University

Poster Presentation Abstract Number: 173 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

The Association Between Social Support and Change in Stress in Caregivers of Children with Disabilities During the COVID-19 Pandemic

Author(s):

Delta Smith, College of Health & Human Sciences

Sophia Wetteroff, College of Health & Human Sciences

Abby Jutt, College of Health & Human Sciences, Honors College

Cameron Dartis, College of Health & Human Sciences

Riley Frye, College of Health & Human Sciences

Abstract:

In the midst of the COVID-19 pandemic, many necessary resources for children with neurogenetic syndromes (NGS) and their caregivers have been temporarily restricted, such as access to childcare and other support systems. These drastic changes have increased the stress levels of caregivers (Brown, et. al, 2020; Dhiman, 2020); however, less is known about the predictors and moderators of caregiver stress. Ongoing research indicates that higher degrees of social isolation during COVID-19 predicted higher levels of stress, depression, and anxiety in caregivers (Kelleher, et. al, 2020). To expand upon this, our research aims to examine how caregivers' social support during COVID-19 relates to changes in stress levels as measured prior to and during the COVID-19 pandemic. Data was obtained through two ongoing studies, the Purdue Early Phenotype Study (PEPS) and the COVID-19 Ecological Momentary Assessment (EMA) Study. Participants were caregivers of children with NGS (AS=13, DS=9, FXS=3, PWS=9, WS=14) ages 25.9-49.7. Their responses were measured using the Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) questionnaire to analyze the change in stress before and during COVID-19. Perceived social support was measured using the Duke Social Support and Stress Scale (DUSOCS; "Duke Health Measures", 1986) during COVID-19. Our analysis will examine our hypothesized association between increased stress and decreased social support levels, controlling for baseline stress. Our findings from this study could have widespread implications for mitigating factors surrounding stress in caregivers of children with neurodevelopmental conditions in times of upheaval.

Sources:

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Psychology Foundation.

Mentor(s):

Taylor Halligan, College of Health & Human Sciences, Psychological Sciences

Bridgette Kelleher, Purdue University

Poster Presentation Abstract Number: 174 :: Life Sciences

College of Health and Human Sciences

Correlating individual differences in suppressing fear behavior with neuronal activity

Author(s):

Elizabeth Sowinski, College of Health & Human Sciences, Honors College

Majd Al Yahya, College of Health & Human Sciences

Abstract:

Disorders such as Post-Traumatic Stress Disorder and panic disorder occur when an individual is unable to suppress fear, even in a safe situation. This maladaptive fear response leads to a decrease in the quality of an individual's lifestyle. Women are diagnosed with fear-related disorders far more often than men. In line with this, previous research has shown that female rats learn to suppress fear at a slower rate than males. This project examined individual differences and sex differences in inhibition of fear and how these differences in learning correlated with neural activity in certain brain regions. We studied male and female Long Evans rats by first running them through a unique behavioral paradigm, where they were exposed to auditory and visual cues representing reward, fear, or safety. With this data, we then separated the rats into “good learners” and “poor learners.” Brains were sectioned and stained against c-Fos, allowing us to quantify the number of active cells within the central lateral amygdala and correlate the ability to learn inhibition of fear with neural activity. In addition to c-Fos, brain sections were stained against PKC-δ, an enzyme found in the amygdala which may be associated with suppression of fear. We hypothesize the proportion of PKC-δ positive cells that are tagged by c-Fos will positively correlate with an individual’s ability to suppress fear behavior in the presence of a safety cue. Our results are expected to advance our understanding of the molecular mechanisms of fear suppression.

Mentor(s):

Susan Sangha, College of Health & Human Sciences, Psychological Sciences; Purdue Institute for Integrative Neuroscience

Jamie Krueger, Department of Psychological Sciences; Purdue Institute for Integrative Neuroscience

Poster Presentation Abstract Number: 175 :: Life Sciences

College of Health and Human Sciences

Latent and Persistent Effects of Methylmercury on Healthy Aging Pathways

Author(s):

Kaitlin Stone, College of Health & Human Sciences

Kiara Smith, College of Health & Human Sciences

Abstract:

Methylmercury is an environmental neurotoxin that can bioaccumulate within aquatic systems, contaminating marine life and risking human exposure through ingestion. This notably results in damage to the neurons and non-neuronal cells of the central nervous system, and the toxicological impacts are known to exhibit latent and persistent effects. Single-cell RNA sequencing by the Bowman Laboratory has connected four metabolic pathways, mTOR, IIS, SIRTs, and eIF2, to methylmercury toxicity and suggested a self-perpetuating alteration of long-term homeostatic states. All pathways play a role in healthy aging, therefore damage may result in the delayed nature of the effects. This project aims to replicate previous studies performed on hiPSCs in neuronal cell lines and investigate the impacts of MeHg exposure on the four pathways. A murine wild-type striatal cell line was exposed to varying concentrations of MeHg, 0, 0.1, and 0.5 μM, 24 hours after plating. The exposure was subsequently removed, and the cells were collected at 24-, 72-, and 120-hours post-exposure. The samples were then analyzed through western blotting, allowing us to evaluate changes in expression and activation of specific proteins associated with these pathways at each time point. While previous data has demonstrated that these pathways are activated in response to exposure, results from the western blots and analysis are forthcoming. However, gross changes have not been observed. Although the project is preliminary, it may provide a new model for studying MeHg exposure and enable insight into the elusive, persistent mechanisms of the neurotoxin.

Mentor(s):

Aaron Bowman, College of Health & Human Sciences, Health Sciences

Lisa Prince, Purdue University

Morgan Thomas, Purdue University

Poster Presentation Abstract Number: 176 :: Life Sciences

Withdrawn.

Poster Presentation Abstract Number: 177 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Examining Socioeconomic and Racial Diversity on Parent Outcomes for Parent-Mediated Interventions in Children with Autism

Author(s):

Jacqueline Talbot, College of Health & Human Sciences

Abstract:

Background. Research suggests that parent-mediated intervention (PMI) may improve various aspects of communication and ASD symptoms (Althoff, C.E, et al., 2019). Systematic reviews suggest that the inclusion of diverse samples would improve research for this treatment (Trembath, D., et al., 2019). Therefore, the purpose of this review is to investigate how diversity-related factors may influence parent stress and child outcomes in parent-mediated intervention.

Methods. Inclusion criteria for the review were: studies implementing a parent medicated intervention with children 0-5 years of age, at least one child with a diagnosis of autism, inclusion of measure of parent wellbeing or stress, randomized control trial study design, and statistics reported for either child or parent outcomes.

Results: Twenty-five articles were identified according to screening criteria. The majority of studies were conducted within the US. 15% of studies reported race/ethnicity and 30% reported income. Most included studies used different intervention models but the majority of interventions targeted language/communication or adaptive behavior child outcomes.

Implications: The small number of included studies that even reported race/ethnicity and socioeconomic status within their samples highlights the need for further evaluation of parent-mediated intervention with attention to diversity. Future studies are warranted to understand unique challenges that underrepresented populations may face when implementing this type of autism treatment. Next steps will be to conduct a meta-analysis to analyze relationships between diversity, stress, parent fidelity and child outcomes.

Mentor(s):

Carolyn McCormick, College of Health & Human Sciences, Human Development & Family Studies

Mehreen Hassan, Purdue University

Poster Presentation Abstract Number: 178 :: Life Sciences

College of Health and Human Sciences

Investigating Eating Efficiency in Normal Development

Author(s):

Mackenzie Zorn, College of Health & Human Sciences

Abstract:

Feeding and swallowing are essential functions that impact quality of life. One way of assessing feeding skills is mealtime duration, which evaluates eating efficiency through analysis of the duration of bites and sips. Past studies investigated mealtime duration in children with neurological diagnoses but did not study typically developing populations, leaving researchers without a baseline for comparison. Therefore, this study aimed to quantify eating efficiency in typically developing children. Children ages 7-8 and 11-12 years consumed five bites/sips of solid, semi-solid, and liquid materials. Out of 21 children screened, data from 12 children has been collected and analyzed; due to COVID-19, data collection is projected to restart in Spring 2021. Thus far, the average mealtime duration for older children ($M = 9.79$ minutes; $SD = 1.88$ min) is slightly longer than younger children ($M = 9.44$ minutes; $SD = 2.48$ min). Despite this, there was not a statistically significant difference between the two groups for average mealtime duration ($p < 0.61$), total mealtime duration ($p < 0.08$), average solid bite duration ($p < 0.90$), average sip duration ($p < 0.23$), or average semi-solid bite duration ($p < 0.90$). This is likely influenced by a small sample size, which will be addressed by ongoing data collection. Though results are preliminary, we anticipate that future data may reveal the emerging differences we see in swallowing efficiency between younger and older typically developing children. These results will have significant implications for treatment of pediatric swallowing disorders by providing baseline values for eating efficiency.

Mentor(s):

Georgia Malandraki, College of Health & Human Sciences, Speech, Language, & Hearing Sciences

Rachel Hahn-Arkenberg, Purdue University

Poster Presentation Abstract Number: 179 :: Social Sciences/Humanities/Education

College of Liberal Arts

Enabled and Constrained: Locally Led Movements' Relationship with Transnational Advocacy Networks

Author(s):

Anna Adamsson, College of Liberal Arts, Honors College

Abstract:

Transnational advocacy networks have been studied in depth for the past thirty years in regard to their effectiveness in reaching their goals. However, their goals do not always align with the goals of the local communities that they ally with. The movement building work begins long before any international attention is paid to an issue. My research aims to fill this gap and center the work of locally led movements in their relationship with transnational advocacy networks. Thus, this study centers on how the transnational advocacy networks both enable and constrain the locally led movements for which they work with. I focus on the U'wa indigenous people of Colombia who have been fighting environmental injustice and oil development on or near their lands for the past thirty years. This case study illustrates the various stages of interaction with transnational advocacy networks.

To accomplish this study, I reviewed the media paid at the international, national, and regional level to the U'wa indigenous people from the years 2005 to August 2020. The categorization of these media outlets and attention helped characterize the amount and spread of attention and the success the locally led movements received. Then, the attention the movement received was compared to the involvement and number of resources given by transnational advocacy networks. This discussion hopefully provides the foundation to inform how and who is leading future discussions on what international media, attention, and resources are deployed in allyship with locally led movements.

Mentor(s):

Stacey Connaughton, College of Liberal Arts, Communications

Poster Presentation Abstract Number: 180 :: Social Sciences/Humanities/Education

College of Liberal Arts

Fort Ouiatenon Archival Management and Digitization

Author(s):

Samuel Bakeis, College of Liberal Arts, Honors College

Mary Phelan, College of Liberal Arts

Jennylee Torres, College of Liberal Arts

Quincy Chanda, College of Liberal Arts

Abstract:

Fort Ouiatenon was built by the French on the Wabash river in the year 1717 to secure fur trading interests in the area and as an outpost to sell to local native groups. It was eventually burned down by American forces in 1791 and later converted to farmland until it was rediscovered in the 1960s. Major excavations in the 1970s and 1980s by Michigan State University generated a wealth of data, e.g., paper records, unit forms, photographic slides, and physical artifacts, but relatively little analysis has been performed on this material. This collection belongs to the Tippecanoe County Historical Association and is stored in Lafayette, IN. The purpose of this project is to manage archived materials to ensure that objects do not deteriorate and are accessible by researchers. Many artifacts have been crammed into uncoordinated shelves that are now being reorganized, meanwhile digitization of slides and card catalogs are assisting in archiving and preservation. Materials in the TCHA Fort Ouiatenon collection were identified by accession number and repacked in archival quality materials. Text and photo materials were processed with Epson Scanners utilizing Adobe Acrobat and Microsoft Excel software for digital storage with the Tippecanoe Country Historical Association. This work will be invaluable for future researchers and will help guide future research on the site and Native American and French relations during the fur trade.

Mentor(s):

Harold Cooper, College of Liberal Arts, Anthropology

Poster Presentation Abstract Number: 181 :: Social Sciences/Humanities/Education

College of Liberal Arts

Trends in chimpanzee behavior research and the biological sex bias

Author(s):

Kamryn Dehn, College of Agriculture, Honors College

Diana Quintero-Bisono, College of Liberal Arts

Abstract:

Trends in primate behavior studies reflect scientific paradigms, and possibly biological canon. To decanonize primatology, it is important to identify what types of data are collected and which individuals are sampled in behavior research. If there are disparities in representation between biological male and female non-human primate study subjects, then this bias could be attributed to a sociobiology canon with research topics that favor male representation, such as hunting and aggression. What is learned by studying primates, specifically our closest living relatives such as the chimpanzee (Pan troglodytes), informs our thinking about the origins of similar behaviors in the human lineage. If certain demographics are systematically excluded from research, we may be missing key information in the collective knowledge that creates and maintains research biases. To address this problem, we extracted metadata from the published literature on wild chimpanzee behavior. Previously, we found that males were disproportionately more represented than females in studies of chimpanzee social behavior (Quintero-Bisono et al. 2020). Here, we evaluated a larger database representing six long-term field sites and 309 studies to describe trends in the behavior research from 1970-2019. We organized these studies into ten categories, including cognition (N= 24), communication (N= 39), conservation (N= 8), endocrinology (N= 7), feeding (N= 65), locomotion (N= 6), methods (N= 1), reproduction (N= 28), social (N= 127), and other (N= 4). Social behavior was the most common research category, comprising of 41.1% of the sample. Collectively, our results show that the largest domain of knowledge on chimpanzee behavior is centered on the social behavior of adult males.

Mentor(s):

Stacy Lindshield, College of Liberal Arts, Anthropology

Nicholas Johnson, Purdue University

Poster Presentation Abstract Number: 182 :: Life Sciences

College of Liberal Arts

The changing global distribution of hemorrhagic septicemia in livestock 1996-2019

Author(s):

Alyssa Eaton, College of Liberal Arts

Abstract:

Outbreaks of hemorrhagic septicemia (HS), caused by certain serotypes of the bacteria Pasteurella multocida, and associated with high mortality in domestic livestock and wildlife were reported in scientific literature in the last decade in countries e.g. Germany and Hungary, where disease was not previously reported to the World Organization for Animal Health (OIE) for several decades, indicating concern over its spread and containment. This paper describes the change in the global distribution of HS in domestic livestock during 1996 to 2019. Data were aggregated from the OIE into 5-year time periods (except for the period 2001-2004). Countries were classified by number of reported confirmed cases of HS (<1 = disease not reported; >=1 = disease reported).

This data will be mapped to provide a visual representation of HS's global distribution. Six countries reported positive cases for period 2015-2019 after having no cases for period 2010-2014 (Gambia, Georgia, Israel, Kazakhstan, Lesotho, Serbia). Eight countries reported absences of cases from 2015-2019 after positives in 2010-2014. 15 countries that experienced recent shifts from positive to negative and vice versa were in equatorial regions of South America and Africa, with the 16 other countries following this pattern being found predominantly in the Iberian Peninsula, Eastern Europe, and the Middle East, indicating continuously changing disease landscapes. Notably, the OIE data does not include outbreaks that were described in peer-reviewed scientific literature. We therefore plan to conduct a systematic review of scientific literature and ProMed disease reports to address data gaps.

Mentor:

Wendy Beauvais, College of Veterinary Medicine, Comparative Pathobiology

Poster Presentation Abstract Number: 183 :: Social Sciences/Humanities/Education

College of Liberal Arts

Vernacular Culture and Health Crises

Author(s):

Chyna Ferguson, College of Liberal Arts, Honors College

Abstract:

Consistently we hear the call to trust science when it comes to matters of public health. Yet, the unfolding story of the coronavirus is not simply a narrative of clinical trials and official closures, but a patchwork of amateurs practicing resourcefulness in a time of acute crisis. From homemade masks and hand sanitizers to car-bound protests and religious gatherings, the headlines are filled with stories of non-specialists: some developing novel means of virus evasion, others continuing time-honored rituals in defiance of expert opinion. This project seeks to use the framework of vernacular culture to document how different communities respond to the virus. We hear a lot about statistics and expert opinions in the media related to coronavirus, but less so about the individual and personal experiences during this pandemic. The aim here is not to judge or even comprehensively understand instances of everyday planning, but rather to contextualize, and ultimately create empathy for the non-expert. The mode of engagement for this project will be a singular podcast documentary essay, in which I will interview subjects to uncover how the non-expert responds to the virus and discuss the invisible, everyday losses felt in vernacular culture, as evoked by the pandemic. This podcast will ultimately propose questions to help discover what effects Covid-19 has had on vernacular culture.

Mentor(s):

J. Peter Moore, Honors College

Poster Presentation Abstract Number: 184 :: Social Sciences/Humanities/Education

College of Liberal Arts

Technologies Role in the Education and Expression of Marginalized Music Creators

Author(s):

Abby Francis, College of Engineering

Abstract:

This research project focuses on marginalized music creators and performers. We aim to identify and explore trends related to online communities, communities specifically related to their marginality, and other influences such as familial, role model, and institutional entities. These trends manifest themselves into the expression of these creators on their online platforms, namely YouTube, and play a role in the way they educate both themselves and their audiences. Online communities in the ever-changing technological era allow increasingly evolving relationships between creator and consumer. Both negative and positive feedback can contribute to a creator's relationship with their work and their community, and often play a crucial role in developing an identity that is tied to their marginality. By analyzing these trends through blog posts, YouTube videos, other content our subjects release, and personal interviews, we are able to get a clearer picture of how technology may be affecting marginality and fostering expression or antagonism for these individuals. Subsequently, we may be able to develop tangible strategies or ideas that will allow developing creators to make the most of these tools.

Mentor(s):

Christopher Cayari, College of Liberal Arts, Rueff School of Design, Art, and Perform

Poster Presentation Abstract Number: 185 :: Social Sciences/Humanities/Education

College of Liberal Arts

Censorship Against Editorial Cartoonists: A Comparison of Legal Regimes in India and the United States

Author(s):

Catherine Gallant, College of Liberal Arts, Honors College

Abstract:

The purpose of this project is to compare and contrast types of censorship under the legal regimes in India and the United States regarding editorial cartoonists. These comparisons aim to discover similarities and differences in the legal actions taken against editorial cartoonists in India and the United States. The methods for conducting research on this topic include analyzing legal cases from both India and the United States, collecting data on the type of legal actions used, the scenarios the actions were used in, the purpose of the actions, and the overall effectiveness of the legal action. Sources such as news outlet articles and other literature will be used to help develop an understanding of the context surrounding the cases. The results of this project are significant because while the legal regimes of India and the United States have been previously compared, these comparisons did not focus on the treatment of editorial cartoonists specifically. Legal actions taken against editorial cartoonists with the intent to punish or silence may highlight issues regarding freedom of speech and censorship. This is important because India and the United States are the two largest democracies in the world.

Mentor(s):

Dwaine Jengelley, Honors College

Anish Vanaik, Purdue University

Poster Presentation Abstract Number: 186 :: Social Sciences/Humanities/Education

College of Liberal Arts

Facebook and U.S. Elections

Author(s):

Matthew Heagerty, College of Liberal Arts, Honors College

Abstract:

In 2004, Facebook started in a Harvard dormitory. Now it is an internet juggernaut valued at over 720 billion dollars. However, increasingly the social media company has come under pressure for a multitude of scandals, from election engineering to anti-trust violations. How did Facebook react to “fake news” in the 2020 U.S. presidential election compared to 2016? To answer this question, this research draws from the Facebook Incidents Database, which uses news data (2004-2020) to track 4,097 Facebook incidents and over 800 Facebook-related regulatory scrutiny and lawsuits. The database is the first scholarly effort to organize Facebook’s global incidents in issues ranging from speech, privacy, monopoly, fake news, and radicalization to place scandals like Cambridge Analytica into wider context. The database also relies on human coders to track Facebook’s response and any resulting legislation as well as determine Facebook’s responsibility for and political importance of each incident. For this research, I will use the database to study misinformation between the 2016 and 2020 election cycles. Specifically, I compare analysis news coverage of election-related misinformation three months before and after each election. This analysis will track the changes in number and type of Facebook-related scandals between the two elections, scandal importance, as well as Facebook’s response to see what, if any, differences are between them.

Mentor(s):

Swati Srivastava, College of Liberal Arts, Political Science

Poster Presentation Abstract Number: 187 :: Social Sciences/Humanities/Education

College of Liberal Arts

Newspapers in the Era of the Internet: How Analytics and the Business of News Influence Reporting in English Language Newspapers Around the World

Author(s):

Elijah Heindricks, College of Liberal Arts, Honors College

Abstract:

Do journalists report the news differently either when the newspapers they work at are under financial stress or when the impact of their work is measured using social media analytics, such as the number of times an article gets shared? Quantitative research in political science suggests that the business of selling the news can change the way reporters report about world events. The implication is that the information news audiences get about the world not only reflects the quality of the events that get covered, but also the economic pressures on news organizations. The trouble is that the quantitative work in this area is not usually able to get at the day-to-day experience of being a journalist. In addition, studies of the relationship between the economics of news and the reporting of news tends to focus just on the news industry in the United States. We address this question about the relationship between economic pressures on reporting by conducting interviews with journalists who work at English language newspapers around the world.

Mentor(s):

Dwaine Jengelley, Honors College

Poster Presentation Abstract Number: 188 :: Social Sciences/Humanities/Education

College of Liberal Arts

Drink Environment Modeling

Author(s):

Gabriel Leonard, School of Management, Honors College

Alex Peterson, College of Science, Honors College

Abstract:

Abstract redacted.

Mentor(s):

Torsten Reimer, College of Liberal Arts, Communications

Kirstin Dolick, Purdue University

Poster Presentation Abstract Number: 189 :: Social Sciences/Humanities/Education

College of Liberal Arts

Understanding Stress is the High School Setting

Author(s):

Cassandra Marquez, College of Liberal Arts

Abstract:

The purpose of this study was to gather information on students that pertained to their stress levels over the course of the Spring 2021 semester. Three sections of 10th grade honors classes from a Lafayette school provided ample information in order to analyze the trends in high school stress and how it related to both their private and academic life. Using various warmups and monthly check-ins, students provided first hand accounts about their stress and reflected on these issues. They also offered feedback during a unit and described what made it the most and least stressful. Due to that reflection and my hope to limit the stress coming from my classroom, we made teaching adjustments such as adding a new unit to the curriculum instead of jumping into a longer work of literature, introducing coping mechanisms to deal with stress, and also spent time working on time management skills. By the end of the study, the information gathered showed that learning coping skills, creating engaging lessons, and providing autonomy in the classroom helped to limit the stress on students.

Mentor(s):

Benjamin Lathrop, College of Education, Curriculum & Instruction

Poster Presentation Abstract Number: 190 :: Social Sciences/Humanities/Education

College of Liberal Arts

Meditative Spaces: An Analysis of Black Counter Spaces Amidst COVID-19

Author(s):

Isabella Matthews,

Abstract:

The impact of COVID-19 has illuminated pre-existing racial disparities that greatly affect the Black population within America today. Social media's portrayal of COVID-19, specifically to the Black community, plays a negative role in how individuals within said community respond to the virus. Historically, there has been a justified lack of trust of the white-dominated healthcare system. This, compounded with the increase of trauma due to the disproportionate numbers of Black people who have succumbed to the disease are just some of the institutional shortfalls taking place. Furthermore, these issues have yet to be fully discussed in the context of social media. Because this lack of institutional aid and understanding of social media exists, there has been an emergence of counter meditative spaces made by and for Black and Brown communities on digital platforms such as Instagram, Facebook and Twitter that provide COVID-19 resources. This collective action to provide accurate information is not unlike other historical spaces such as the Black church in providing the Black community the space to create change. For this reason, the purpose of this paper will be to understand how specific Black communities address trauma and develop meditative spaces within social media amidst COVID-19. Further, this project will look at current media spaces and compare them to the way historical spaces such as the Black church also served as a meditative space of support for Black communities.

Mentor(s):

Kim Gallon, College of Liberal Arts, History

Poster Presentation Abstract Number: 191 :: Social Sciences/Humanities/Education

College of Liberal Arts

The Effect of Climate Change and Human Predation on the Niche Space of North American Proboscideans.

Author(s):

Alejandra May, College of Liberal Arts, Honors College

Abstract:

Approximately 13,000 years ago, 37 genera of North American megafauna went extinct. Proboscideans, mammoths, and mastodons, specifically, were among the megafauna affected. Today, researchers continue to debate between three hypotheses to explain these North American Pleistocene mass extinctions: (1) human over-hunting, (2) climate change leading to a reduced niche, or (3) a combination of both. Our previous research suggests that the effects of the warming, drying, and more seasonal climate at the end of the Pleistocene likely caused a competitive environment between mammoth and mastodon seen in a drastic shift in both species' niche space. While ecological theory predicts that competition can drive species to extinction, our original sample was not complete. We expanded our previous work by increasing our database, including new site location data and radiocarbon dates, and completing reconstructions of key paleoenvironmental variables. Our objective is to model the effects of climate change and human hunting on the niche space of North American proboscideans within Bayesian hierarchical and structural equation causal inference frameworks. This study will enhance our understanding of the changing environments in which this megafauna lived and may have implications for studying modern extinction events.

Mentor(s):

Erik Otárola-Castillo, College of Liberal Arts, Anthropology

Lauren Christopher, Purdue University

Poster Presentation Abstract Number: 192 :: Social Sciences/Humanities/Education

College of Liberal Arts

Russian Lexicon through Structure and Meaning

Author(s):

Joshua Owen, College of Liberal Arts

Abstract:

The purpose of this project is to work towards developing a new method of teaching Russian vocabulary through roots and morphology. Vocabulary is a cornerstone to language learning, as well as one of the most time-consuming portions of the process. Often vocabulary is taught in the forms of lists, with memorization being the expectation. Russian language learning is no different. Russian vocabulary is heavily built upon sets of productive roots, prefixes, and suffixes, and various combinations of them. For example, the word преродаватель (pronounced pre-po-da-VA-tyel), meaning “teacher”, a word which is taught in the first year of Russian study is made of two prefixes, a root, and a suffix. A form of teaching Russian vocabulary focused on teaching these building blocks of roots, prefixes, and suffixes could then give students the ability to construct new words, or deconstruct the meaning of newly encountered words, as opposed to the traditional lists and memorization. This project builds on the work of other students from last year, expanding the number of frequent roots as well as other affixes such as prefixes and suffixes.

Mentor(s):

Olga Lyanda-Geller, College of Liberal Arts, Language & Culture

Poster Presentation Abstract Number: 193 :: Social Sciences/Humanities/Education

College of Liberal Arts

Analyzing Covid-19 Misinformation on Facebook

Author(s):

Zhuoran Qiu, College of Liberal Arts

Abstract:

Social media platforms have been noted as an incubator for fake news. Facebook owns the most frequently-used online social media and social networking services, including Facebook, Instagram, and WhatsApp. Bringing connections and convenience into users' life, however, Facebook's important role in today's world and its scale of manipulation have made the company a target of criticism in terms of user privacy, monopolistic issues, and fake news. How did Facebook handle Covid-19 misinformation on its platform? To answer this question, this research draws from the Facebook Incidents Database, which uses news data (2004-2020) to track 4,097 Facebook incidents and over 800 Facebook-related regulatory scrutiny and lawsuits. The database is the first scholarly effort to organize Facebook's global incidents in issues ranging from speech, privacy, monopoly, fake news, and radicalization to place scandals like Cambridge Analytica into wider context. The database also relies on human coders to track Facebook's response and any resulting legislation as well as determine Facebook's responsibility for and political importance of each incident. For this research, I will use the database to study news coverage about COVID-19 misinformation — such as origins and severity of the virus, so-called remedies for healing the symptoms, and vaccine skepticism — from January 2020 till January 2021. Covid-19 misinformation has the potential to cause physical harm to a number of people. Thus, this research intends to further the discussion on Facebook's News Feed feature in today's pandemic, how coronavirus misinformation has been spreading on Facebook, and Facebook's response to Covid-19 misinformation.

Mentor(s):

Swati Srivastava, College of Liberal Arts, Political Science

Poster Presentation Abstract Number: 194 :: Social Sciences/Humanities/Education

College of Liberal Arts

Anatomy of the Kôkôjagoti Media Center

Author(s):

Diana Quintero, College of Liberal Arts

Abstract:

The Kôkôjagõti Media Collective is based in A'Ukre, a Mebêngôkre-Kayapó (Kayapó), Kayapó Indigenous Lands, Pará, Brazil and consists of a group of Indigenous filmmakers who engage with filmmaking to illustrate daily life and Kayapo values. By adopting filmmaking, Kôkôjagõti filmmakers participate in decolonizing digital media by presenting their own narrative to diverse audiences. The relatively recent construction of the Kôkôjagõti Media center and the collective has allowed filmmakers to develop their films and professional filmmaking practices in conversation with broader issues that impact the sustainability of filmmaking over time. The Kôkôjagõti Collective is part of a broader political and cultural conversation focused on environmental justice, land rights, and Indigenous rights in Brazil. For example, the physical structure and components of the media center demands attention to the lifecycle of the materials and equipment used. The community also considers their authority as professional filmmakers and the way in which this has impacted film dissemination and screening. EULA (End User License Agreements), IPR issues (Intellectual Property Rights), and other legal and regulatory are important considerations for the filmmakers when distributing and sharing their films in digital and extra-local contexts. By analyzing the filmmaking process and “anatomy” (structures, institutions, materials) of the media center we can better draw attention to the impact and significance cultivating sustainable and self-determined media work.

Mentor(s):

Laura Zanotti, College of Liberal Arts, Anthropology

Poster Presentation Abstract Number: 195 :: Social Sciences/Humanities/Education

College of Liberal Arts

The "Businessmen in Politics" Movement: Origins and Contemporary Public Opinion

Author(s):

Calvin Robinson, School of Management, Honors College

Abstract:

Since 1995, America has seen a sharp increase in the number of businesspeople in Congress, outpacing other occupational backgrounds. This trend is significant, as political science research suggests that Congress members' occupational history prior to entering political service has a significant effect on their voting behaviors while in office.

This report seeks to explain the origins of America’s 'businessmen in politics' movement using secondary historical research. Additionally, this report provides a data-driven analysis of how Americans have come to view businesspeople as politicians by analyzing several datasets of public opinion polling.

Mentor(s):

Peter Watkins, College of Liberal Arts, Political Science

Poster Presentation Abstract Number: 196 :: Social Sciences/Humanities/Education

College of Liberal Arts

Conspiracy and Cooperation: A Cross-Country Study of Globalism in Coronavirus Cartoons

Author(s):

Claire Stites, College of Liberal Arts

Abstract:

In the last year, the entire globe has been joined together under the common threat of COVID-19. The virus has infected citizens of every country world-wide and taken the lives of millions. This tragedy has raised many new questions about globalism, the world-wide political climate, and public opinion as countries attempt to navigate the social, political, and economic impacts of a pandemic. Global coordination is more needed than ever before, and globe-spanning conspiracy theories have emerged as part of political discussions everywhere. Political cartoons from various countries and their content are snapshots of the way COVID-19 may have shaped global perceptions throughout the pandemic. Analyzing political cartoons from various countries during such an inherently global event is a unique opportunity to see how the global community responded to tragedy through humor. I collected an original dataset of cartoons from several French, Indian, and American cartoonists. The cartoons are in both English and French. From this unique dataset, I observe trends in globalism over the course of the pandemic and seek to understand how political cartoons in these countries have viewed global aspects of the pandemic. I track themes of blame, globalism, success, fear, sympathy and their presence in the cartoons over time and across countries. Identifying the changes in global response over the course of the pandemic and the trends in its themes allows us to understand the connection of political discourse and current events, as well as the impact of the Coronavirus on globalism.

Mentor(s):

Dwaine Jengelley, Honors College

Anish Vanaik, Purdue University

Poster Presentation Abstract Number: 197 :: Social Sciences/Humanities/Education

College of Liberal Arts

Archiving Amazonia: A Digital Photography Database for Biocultural Diversity

Author(s):

Clara Villalon, College of Liberal Arts

Abstract:

The project Archiving Amazonia: A Digital Photography Database for Biocultural Diversity aims to create a visual and digital database of photographs for biocultural diversity as part of an engagement project. To accomplish this goal, in an organized manner, each image is categorized and metadata is added to them. Some of the tasks associated with this project include researching terms that are culturally relevant for the Mebêngokre Kayapó Peoples, and deciding which metadata might be appropriate in each case. Metadata refers to the data used to describe an image. Although general metadata, such as date and place, may apply in the research, it is important to realize that not all standardized metadata is appropriate in each case. Standardized metadata are guidelines established to label images which assumes they are applicable for each group; this type of metadata may be seen as inclined towards a particular group rather than universal, or patronizing towards other groups. The use of terms and keywords in the Mebêngokre Kayapó language help to accurately represent the community and eliminate possible biases or inaccuracies that may arise with the use of standardized metadata. The images in the digital database are the result of several years of students and study abroad programs. It is a collection of images that represents past students' generations and their created bonds with the community. The digital database is meant to be turned in to the Pykôre Association, an indigenous nonprofit led by the Mebêngokre-Kayapó community for their own use.

Mentor(s):

Laura Zanotti, College of Liberal Arts, Anthropology

Poster Presentation Abstract Number: 198 :: Social Sciences/Humanities/Education

College of Liberal Arts

The Impacts of COVID-19 on College Students' Mental Health and Accessibility of Mental Health Resources

Author(s):

Yifan Zhang, School of Management

Abstract:

With stunning speed and severe sweep, COVID-19 spread throughout the globe, leaving no country or group unaffected, university students included. Universities were forced to shut down in-person classes and switch to online classes, inevitably resulting in greater pressures on and greater threats to the mental health of college students, whose hopes and expectations for college were necessarily altered and frequently crushed. Given the significant repercussions, one goal of this project is to get a nearly real-time picture of how the severity of the following concerns are negatively impacting the mental health of college students: fear of infection, social isolation, and concern for academic progress and career prospects. A second goal of this project is to analyze the corresponding barriers to and lack of mental health resources for college students during COVID-19. Finally, using current data to portray the urgency of this crisis, this project aims to provide meaningful analyses so that universities can be more acutely aware of the state and extent of students' mental problems caused by COVID-19 and the very real and urgent need for providing more mental health resources and promotions at universities. These timely captures of data, coupled with comparisons to pre-COVID-19 data, should be insightful to assist universities in their efforts to be proactive and responsive to the mental health needs of their communities.

Mentor(s):

Melissa DeFrench, College of Liberal Arts, English

Poster Presentation Abstract Number: 199 :: Social Sciences/Humanities/Education

College of Pharmacy

Incorporating Cultural Considerations to Care During an Interprofessional Simulation Activity

Author(s):

Jennifer Garson, College of Pharmacy

Abstract:

Purpose: Incorporating cultural considerations to care is an important component of providing optimal patient care, with research showing a gap in the inclusion of cultural considerations in the education of future healthcare professionals. This study evaluated pharmacy, nutrition science, and nursing students' assessment of their own cultural competence before and after completing activities structured around caring for patients with cultural considerations impacting their care.

Methods: Students worked in interprofessional teams to complete a simulated encounter with standardized patients that focused on the consideration of how their cultural, ethnic, and/or religious beliefs or background might impact their treatment and interactions. Students completed a Cultural Continua assessment adapted from Hofstede's Cultural Dimensions and the AAC&U Intercultural Knowledge and Competence Assessment (IKCA). Anonymized data from both assessments was collected from all three disciplines across a two-year span, then analyzed to identify trends and differences.

Results: Between 2019 and 2020, 496 students completed the Cultural Continua assessment and 491 students completed the AAC&U IKCA. Results show strong similarities across all disciplines in students' self-assessment of their cultural competencies and attitudes.

Conclusion: Despite there being a gap in the inclusion of cultural consideration activities within healthcare education, participation in a culturally-focused activity showed similar cultural attitudes and competencies among interprofessional health science learners. Healthcare education programs should continue to provide culturally-based activities and allow students to assess their own competencies as they learn to care for diverse patients.

Mentor(s):

Zachary Weber, College of Pharmacy, Pharmacy Practice

Monica Miller, Purdue University - College of Pharmacy

Poster Presentation Abstract Number: 200 :: Social Sciences/Humanities/Education

College of Pharmacy

Perceived Impact of a Counseling Practice Session on Pharmacy Student Comfort Level and Ability in Counseling on Sexual Health Products

Author(s):

Margaret Tharp, College of Pharmacy

Abstract:

Objective: To determine the impact of a simulated counseling session on pharmacy students' perceived ability and level of comfort in counseling patients on men's and women's health products.

Methods: Pharmacy students attended a laboratory focused on men's and women's health products. The laboratory included two small group discussions about products and a 10-minute

counseling session with a mock patient. Students (N=133) completed pre and post surveys to assess their perceived comfort level and ability to counsel on products. The survey was 45 items and based on the theory of planned behavior. Items focused on: (1) perceived comfort level and ability to counsel to cis- or transgender patients, (2) 11 health product types, and (3) their future intent to counsel or prescribe. A 7-point Likert scale (strongly disagree to strongly agree) was utilized. Wilcoxon Signed-Rank tests were conducted to determine statistical significance ($p < 0.05$) for the primary objective.

Results: Statistically significant positive changes were identified for all survey items ($p < 0.000$) assessing perceived comfort level and ability to counsel, though only 5 products were incorporated into mock counseling scenarios. Students also indicated they intended to provide counseling ($p < 0.015$) and prescribe products in the future ($p < 0.010$) after completing the laboratory.

Discussion: Pharmacy students' perceived comfort level and ability to counsel improved regardless of whether students had the opportunity to practice counseling with a mock patient on that specified product. These results may support small group discussion as an effective method to increase students' confidence in counseling on men's and women's products.

Mentor(s):

Rachel Rogers, College of Pharmacy, Pharmacy Practice

Kim Illingworth Plake, Purdue University College of Pharmacy

Poster Presentation Abstract Number: 201 :: Life Sciences

College of Science

Recombinant Expression of the Full-Length Tulane Virus Nonstructural Polyprotein

Author(s):

Angela Agnew, College of Science, Honors College

Abstract:

Abstract redacted.

Mentor(s):

Wen Jiang, College of Science, Biological Sciences

Xueyong Xu, Purdue University

Poster Presentation Abstract Number: 202 :: Life Sciences

College of Science

Investigation of the Oncogenic Properties of Phosphatase Regenerating Liver-3 Enzyme

Author(s):

Jinan Ayub, College of Science

Abstract:

Phosphatase regenerating liver (PRL) is an enzymatic phosphatase whose oncogenic properties warrant its investigation as a therapeutic drug target. Specifically, it is well understood that PRL3 overexpression can be directly linked to cancer, as the phosphatase can activate PI3K/AKT pathways and downregulate PTEN levels, promoting metastasis and epithelial-mesenchymal transition (EMT). The purpose of this project was to further investigate mutated PRL3 proteins in order to assess whether or not mutations, rather than overexpression, of PRL3 can lead to cancer. Furthermore, whether these mutations specifically caused a gain-of-function or loss-of-function in PRL3 activity was examined. This study began by investigating common point mutations associated with PRL3 using the cBioPortal for Cancer Genomics database, through which R138 was identified as the most commonly mutated site. The four most frequent PRL3 mutations were created using QuikChange® site-directed mutagenesis. After sequencing the DNA to confirm mutagenesis, the recombinant proteins were purified to investigate their biochemical properties in vitro, such as their trimerization ability and phosphatase activity. Results indicated the most common mutation, R138C, had similar trimerization ability compared to wild-type PRL3, however, the other three mutants had lower trimerization ability. Interestingly, all four oncogenic mutants showed decreased kinetic activity and lower binding affinity for the pNPP substrate. Although these results imply that these oncogenic mutations are indeed loss-of-function, further in vivo experimentation should be conducted to confirm the applicability of these results in transfected human cell lines.

Mentor(s):

Ovini Amarasinghe, College of Science, Chemistry

Zhong-Yin Zhang, Purdue University, Department of MCMP and Institute for Drug Discovery

Poster Presentation Abstract Number: 203 :: Physical Sciences

College of Science

SUSY Exclusion Using Machine Learning

Author(s):

Abhijeet Balaji, College of Engineering

Ashwin Kidambi, College of Engineering

Gustavo Andres Saez Cruz, College of Science

Noah Fleming, College of Science

Abstract:

It has long been known that the Standard Model of particle physics is incomplete, there are many phenomena where the model breaks down. One such case arises when physicists try to calculate the mass of the Higgs boson through the model alone. Since the Higgs Boson is strongly coupled to the top quark, its calculated mass is affected by the top quark. The top quark can have any momentum from zero to infinity, which would force the Higgs boson to have a mass close to the planck scale (1019 GeV); when the LHC discovered the Higgs boson, however, it was discovered to have a mass of roughly 125 GeV. This became one of the hierarchy problems found in the Standard Model, and there are many proposed solutions to it. One such solution involves the stop squark, the supersymmetric (SUSY) counterpart to the top quark; the existence of a light stop squark may lead the mass of the Higgs to converge at the value observed at the LHC. Using data from the Compact Muon Solenoid detector at the LHC and simulated SUSY data, a DNN can process various kinematic variables to generate a discriminant that allows for the classification of Standard Model or SUSY processes. The accuracy of this classifier is verified using statistical tests for uncertainty.

Mentor(s):

Amandeep Bakshi, College of Science, Physics & Astronomy

Andreas Jung, Purdue University

Poster Presentation Abstract Number: 204 :: Physical Sciences

College of Science

Searching for Familons in Lifetime Measurements of Muonic Germanium and Free Muons

Author(s):

Faith Bergin, College of Science, Honors College

Abstract:

Our group is carrying out the search for a possible pseudo-Goldstone boson known as a famlion produced by the neutrinoless muon decay μ→e^+ + X using a High Purity Germanium (HPGe) detector. We obtain information about muons from cosmic rays as they are able to interact with the detectors observed as events. We measure the fluorescence produced by positive and negative muons stopped inside the detector volume and obtain information on their decay lifetime. Thus, by comparing lifetimes, we are able to prove we are observing two distinctly charged muons. As the next stage of this analysis, a LaBr detector will be used to measure the energy of the positive muon Michel decay positrons, from which we can determine information about the familon and prove its existence in order to search for new physics outside of the standard model. In the case that there is no evidence for a familon signal, the research will still improve the existing sensitivity limit on the search for μ→e^+ + X decay.

Mentor(s):

Jijun Chen, ,

Shihua Huang, Purdue University Department of Physics and Astronomy

David Koltick, Purdue University Department of Physics and Astronomy

Poster Presentation Abstract Number: 205 :: Physical Sciences

College of Science

Polarimetric Analysis of the 19 May 2013 Norman-Shawnee, Oklahoma Tornadic Supercell

Author(s):

Jacob Bruss, College of Science

Abstract:

Within the last decade, the National Weather Service has upgraded their existing network of WSR-88D radars with dual polarization capabilities. As a result of these upgrades, the ability to infer dynamical features became possible through variables such as differential reflectivity (ZDR). We focused on the ZDR column, which can be used as a proxy for thunderstorm updrafts. Using polarimetric radar observations of the Norman-Shawnee tornadic storm from 2230 UTC 19 May 2013 to 0000 UTC 20 May 2013- (which produced an EF-4 tornado around 2300 UTC) we analyzed ZDR columnar volume, surface area, and height above the melting level. ZDR column volumes from the Norman-Shawnee storm were found to lie within observed distribution from a large sample of storms. Analysis could not be performed within 20 minutes of the tornado report due to limited vertical sampling of the storm in radar's cone of silence. Despite this limitation enough time series data were available to compare the evolution of ZDR columns before and after tornadogenesis. Another tornadic supercell analyzed by Tanamachi et. al. (2015), observed by the same radar 11 days later, exhibited similar ZDR column behavior prior to tornadogenesis. Specifically, multiple ZDR columns merged, and hail altered the low-level ZDR patterns in the forward flank of both storms. We plan to further analyze this storm using lightning data as a potential way to strengthen our speculations about the ZDR column behavior prior to tornadogenesis.

Mentor(s):

Milind Sharma, College of Science, Earth, Atmospheric, & Planetary Sciences

Robin Tanamachi, Purdue University

Poster Presentation Abstract Number: 206 :: Life Sciences

College of Science

Evaluating the impact of extracellular vesicles in driving cellular transformation

Author(s):

Anjali Byappanahalli, College of Science, Honors College

Abstract:

Extracellular vesicles (EVs) are cell-derived vesicles that are implicated in cell-to-cell communication and transmission of disease states. They play a part in the redistribution of proteins, lipids, and nucleic acids (mRNA, miRNA, and DNA), as well as mediate the development of several disease states, such as cancer. Recent evidence has shown that cancer-derived EVs contribute to the recruitment and reprogramming of cells in the tumor-microenvironment by carrying various oncogenic factors to transform non-cancerous cells into cells with cancerous phenotypes. These factors can result in changes such as increased invasion and proliferation, among other cancerous hallmarks. Therefore, understanding the biology behind the EV-mediated communication is key to uncover mechanisms and developed targeted therapeutics against cancer EVs driven tumorigenesis. Our study aims to explore how transformed-cell-derived EVs contribute to the recruitment and reprogramming of cells in the microenvironment through epithelial to mesenchymal transition (EMT). EMT is a biologic process through which a cell assumes a mesenchymal phenotype, with enhanced migratory capacity, invasiveness, elevated resistance to apoptosis, and increased production of ECM contents. Another phenotype we are assessing is the induction of anchorage-independence. Anchorage-independent growth is the ability of transformed and cancer-derived cells to survive and grow in the absence of anchorage to the extracellular matrix (ECM). This property of cancer cells enables them to form tumors.In this study, we evaluate the capacity of EVs derived from transformed lung bronchial epithelial cells (HBEC-KPC) to drive cellular transformation in non-transformed lung bronchial epithelial cells (HBEC, HBEC-KRAS and HBEC-KP). Specifically, we evaluate its potential to promote epithelial to mesenchymal transition (EMT) and anchorage-independent growth in non-transformed cells.

Mentor(s):

Andrea Kasinski, College of Science, Biological Sciences

Zulaida Soto-Vargas, College of Science, Biological Sciences

Poster Presentation Abstract Number: 207 :: Life Sciences

College of Science

TRAP2-Tomato Immunostaining of Highly Activated Neurons in Mice Fed a Large Meal

Author(s):

Steven Carlson, College of Science

Abstract:

Vagal afferents from the stomach and small intestine send signals to different areas of the brain which control factors such as satiation (the ending of a meal) and the control of meal size. The mechanism by which these signals are sent to the brain likely affects the development of eating disorders, obesity, and other health-related problems. This project studies neuronal activation in the Nucleus Tractus Solitarius (NTS) due to vagal afferents from the stomach and small intestine in mice fed a large meal. The aim of the project is two-fold. Firstly, the project aims to test the efficacy of the novel TRAP2-Tomato immunohistochemical staining procedure for viewing activated neurons in the brain. Secondly, the project seeks to study whether there is a difference in the number of activated neurons in the NTS of mice fed a large meal in the daytime vs nighttime. Mice that are bred to contain the TRAP2 and Tomato genes, which are crucial to the immunostaining process, are divided into two groups: daytime feeding and nighttime feeding. The mice are fed a large meal, their brains are sectioned and undergo the immunohistochemical procedure, and the number of highly activated neurons in the NTS are quantified. At the time of this writing the data has not yet been analyzed so results and conclusions are not available. However, a Student’s T test will be used to compare the mean number of highly active neurons in the daytime and nighttime groups.

Mentor(s):

Edward Fox, College of Health & Human Sciences, Psychological Sciences

Hannah Serlin, Purdue University

Poster Presentation Abstract Number: 208 :: Life Sciences

College of Science

Interleukin-1beta promotes IL-2-independent Th9 cell differentiation

Author(s):

Maia Clare, College of Science

Abstract:

CD4+ T helper (Th) cells play an important role in adaptive immunity by regulating inflammation through their production of cytokines. IL-9-producing T helper cells (Th9) promote allergic inflammation and immune cell differentiate in response to TGF-β and IL-4. Additionally, in vitro studies have found IL-2 to be critical for Th9 differentiation. However, in vivo-derived Th9 cells often co-develop with IL-17-producing Th17 cells that are repressed by IL-2. These data suggest that other inflammation-specific signals may promote IL-9 production when IL-2 is limiting. Previous work has demonstrated that nuclear factor kB (NF-kB) signaling is enhanced in inflammatory disease and promotes both Th9 and Th17 differentiation in vitro. We therefore asked if NF-kB activating cytokines/cell surface receptors could rescue IL-9 production in the absence of IL-2. Upon IL-2 blockade in culture, Th9 cells upregulated several TNF receptor family members, including the receptor for the NF-kB-signaling cytokine IL-1□. Further, treatment of IL-2-deprived Th9 cells with IL-1□ rescued Th9 cell differentiation in culture. In working out the mechanism of this novel form of Th9 cell differentiation, I demonstrated that the Th9-associated transcription factor, BATF was induced by IL-1 signaling and that IL-1-mediated rescue of IL-9 production in limiting IL-2 conditions was dependent on BATF. Together, these data implicate an IL-1/NF-kB/BATF-dependent pathway that enhances IL-9 production when IL-2 is limiting and that this pathway may be targeted therapeutically to limit allergic airway disease.

Mentor(s):

Matthew Olson, College of Science, Biological Sciences

Daniel Alejandro, dcanaria@purdue.edu

Poster Presentation Abstract Number: 209 :: Physical Sciences

College of Science

Cosmic-Ray Exposure Chronology of Martian Meteorites

Author(s):

Henry Dawson, College of Science, Honors College

Abstract:

In this study, the concentrations of the radioisotopes 10Be, 26Al, 21Ne, and 22Ne were used to investigate the exposure history for a number of Martian meteors of the Shergottite class. By using pre-existing models of the production rates for these isotopes, the expected concentrations could be determined for each meteor, which could then be compared to the experimental data. In almost all cases analyzed, the level of 21Ne was much higher than was predicted by the model, observed by looking at ratios of 21Ne/10Be and 21Ne/26Al. 26Al is produced readily by solar cosmic rays, which meteors are primarily exposed to while in space, after ejection from the parent body. The elevated concentration of 21Ne therefore requires another production method to account for the additional amount observed. One possibility is that the 21Ne was produced on the surface of Mars. Should this be the case, it would have an application to impact ejecta modeling. Previous models have primarily had ejected materials coming from deep underground before the impact. However, for there to have been surface exposure, the ejected rocks would have needed to be only shallowly buried, meaning that the models would need to be revised.

Mentor(s):

Marc Caffee, College of Science, Physics & Astronomy

Poster Presentation Abstract Number: 210 :: Life Sciences

College of Science

Computer Vision and Machine Learning for Forest Inventory

Author(s):

Garrett Martin, College of Engineering

Nick Eliopoulos, College of Engineering

Ganesh Viswanathan, College of Engineering

Yezhi Shen, College of Engineering

David Jarufe, College of Engineering

Zeren Li, College of Engineering

Justin Hsiung, College of Engineering

Yiting Gan, College of Science

Sohan Pramanik, College of Engineering

Isabella Capuano, College of Engineering

Abstract:

Forest inventory analysis relies on manual data collection to assess the conditions and trends of forest development. Its applications are significant but its process is labor and time-intensive. Recent advances in remote sensing and computer vision have made it possible to automate data collection with consumer-grade cameras and analysis techniques that leverage machine learning. Enhancements to our algorithm have improved published methods using stereoscopic photogrammetry to calculate diameter at breast height, taper, and first branch height of tree stems in real-time. Our algorithm also generates an annotated virtual model of measured trees by integrating GPS data with video. The algorithm takes input in the form of a .BAG file and exports a map with a point for each detected tree in the plot. In order to aid tree trunk detection and analysis, we have developed a segmentation neural network to identify parts of a tree within RGB images captured by a stereo camera.. Accurate stand maps will ensure that measures estimated from video, such as diameter at breast height or taper, are accurate and are ascribed to the correct tree. This advancement will improve the team's ability to use the system for real-time, real world data collection, which will transform forest inventory analysis process.

Mentor(s):

Shao Guofan, College of Agriculture, Forestry & Natural Resources

Keith Woeste, Purdue University, USDA

James Warren, Purdue University

Poster Presentation Abstract Number: 211 :: Physical Sciences

College of Science

Gravitational Direct Detection of Dark Matter

Author(s):

Bahaa Elshimy, College of Science

Abstract:

The techniques utilized so far in Dark Matter (DM) direct detection have been centered around WIMP-motivated experimental efforts. However, given the lack of direct detection, a novel discovery method has been introduced by the Windchime Project. Exposure would be via gravitational couplings (the necessary DM interaction method) and sensitivity would range over multiple DM models including ultralight and Planck Mass DM. The long-term goal of this project is to construct a large-scale, 3-dimensional detector with an array of ~10^9 quantum-limited, optomechanically-enhanced impulse sensors capable of gravitationally identifying the track of a crossing DM particle by collectively probing the noise floor via a sqrt(N)-enhancement analysis.

This provided the motivation for the two primary areas of my work. The first was based on the necessity for a virtual proof of concept of the detector by means of developing a simulation framework. This was achieved through the application of Newtonian dynamics, signals analysis, and DM galactic models. Besides serving as the basis for further analyses, the acceleration results of this virtual detector also validated the theoretical stipulation of a necessary non-trivial optimal filtering analysis technique for track identification. Accordingly, the second focus of my work centered around this analysis framework. Inspired by LIGO’s gravitational wave detection method, we implemented a Template Matching model that optimally compared the impulse data to the signatures of all possible detector tracks and then resulted in Signal-to-Noise Ratios for all six track parameter spaces. This foundation therefore paves the way for Windchime’s continuing analyses and future physical detectors.

Mentor(s):

Rafael Lang, College of Science, Physics & Astronomy

Juehang Qin, Purdue University

Poster Presentation Abstract Number: 212 :: Life Sciences

College of Science

Natural Variation in Drought Tolerance of Arabidopsis thaliana

Author(s):

Christina Gallick, College of Science

Abstract:

Drought frequency and severity is expected to increase regionally due to climate change, which will have negative consequences for natural plant populations. Arabidopsis thaliana is a widespread winter annual adapted to seasonal droughts coincident with the onset of flowering. Most research on drought tolerance in this species has not imposed drought treatments during flowering, the relevant life cycle stage. We quantified natural variation in late-stage drought tolerance in A. thaliana ecotypes and examined how well the origin climate predicted drought tolerance. We imposed drought treatments of different severities on late-stage plants of ecotypes from Sweden, Italy, and Spain and measured survival, flowering time, fruit production, seed production, and germination. All plants survived the drought treatments, but there were strong and significant differences in the effects of drought on fruit production among the ecotypes that were dependent on treatment. All ecotypes experienced similar reductions in fitness in one drought treatment, but reductions in fitness ranged from 10-97% in another. There was evidence of selection for earlier flowering in response to drought stress, suggesting that natural variation in drought tolerance in A. thaliana may be mediated by changes in both physiology and phenology. Surprisingly, drought tolerance was not significantly related to the origin climate variables like mean precipitation. However, we could not examine temporal variation in climate variables, which is likely important for differential adaptation to drought. By understanding how ecotypes respond to different drought treatments, we can better predict how different A. thaliana populations will be affected by climate change.

Mentor(s):

Christopher Oakley, College of Agriculture, Botany & Plant Patholgy

Josh Kraft, Purdue University

Poster Presentation Abstract Number: 213 :: Physical Sciences

College of Science

Data Mining the Zwicky Transient Facility Alert Stream to Improve Strategy Engine Performance and Extraction of Supernova Explosion Parameters

Author(s):

Braden Garretson, College of Science

Xiaoyu Liu, College of Science

Ankita Mishra, College of Science

Zhuofan Li, Polytechnic Institute

Abstract:

The Vera Rubin observatory will allow us to detect more supernovae than ever before, and with it estimated to discover thousands of supernovae and 10 million alerts per night, it requires new methods of real-time filtration, interpretation, and prioritization of survey alert streams to identify candidates for follow up. A solution for this problem is by using the Recommender Engine For Intelligent Transient Tracking (REFITT) which uses live alerts in order to predict the future behavior of transients thereby allowing it to recommend which alerts are worth following up on. However, one significant challenge with REFITT is supernova classification, due to spectroscopic methods being scarce and time consuming, and photometric methods being poorly exploited. To fix this we will create a template light curve library of photometrically classified supernovae, which will allow REFITT to more accurately make follow up recommendations. To achieve this goal, we are developing an algorithm that can classify light curves as either a supernova or not a supernova by using a wavelet transform on gaussian processed regression. By using this model to classify a large number of light curves, we will create a more robust template library for REFITT to perform on ZTF like events, and ultimately allow us to maximize scientific return of all sky survey data, including characterizing the physical explosion parameters of transients at rates that are orders of magnitude greater than presently possible.

Mentor(s):

Danny Milisavljevic, Physics & Astronomy

Jack Reynolds, Purdue University

Poster Presentation Abstract Number: 214 :: Social Sciences/Humanities/Education

College of Science

Identifying the Impact of a Research Data Management Educational Intervention

Author(s):

Shaurya Gaur, College of Science

Abstract:

Association of College and Research Libraries (ACRL) Research Data Management (RDM) Road Shows are professional development interventions intended for Liaison/Subject librarians to help develop skills needed to provide data management services in academic libraries. Additional objectives include discovering disciplinary need for data management and the application of disciplinary knowledge and skills to create a data interview. To understand and address these objectives in a more comprehensive manner, instructors collected three surveys categorized as: Pre-survey, 1-month post-survey and 6-month post survey. These surveys were developed to gain insight into liaison knowledge, behavior and attitudes as well as the impact of the Road Shows. The datasets being analyzed comprise a total of 8 events and 352 attendees. In the pre-survey, 1-month post-survey and 6-month post-survey, we are analyzing the responses of 202, 46 and 30 attendees. The specific questions that we are targeting through the series of online surveys are the following:

- Do Liaisons have the skills and knowledge for RDM activities?
- Are Liaisons prepared to talk to faculty and researchers about RDM?
- Did the ACRL RDM show affect their preparedness?

In order to address the following questions, we developed R software code (using the likert R package) to generate plots showing the percentage of responses to each question as a metric of agreement and influence respectively. The plots depict the variability of responses observed to each of the questions from the collected surveys.

Mentor(s):

Megan Sapp Nelson, Libraries

Abigail Goben, University of Illinois at Chicago

Poster Presentation Abstract Number: 215 :: Life Sciences

College of Science

A High-Throughput Screen for Activators and Inhibitors of HYPE-mediated AMPylation

Author(s):

Alyssa George, College of Science

Evan Hebner, College of Science

Anika Mahmood, College of Science

Abstract:

Aggregation of the pre-synaptic protein α-synuclein into formations called Lewy bodies is one of the major hallmarks of Parkinson's disease. We previously showed that the sole human Fic protein, HYPE, can attach an AMP moiety to α-synuclein through the process of adenylylation (AMPylation), which leads to a decrease in many of the neurotoxic phenotypes associated with Parkinson's Disease. HYPE is intrinsically inhibited in vivo and upregulated only under stress of misfolded proteins, so the ability to manipulate HYPE's activity is of significant therapeutic relevance. The purpose of this study is to identify small molecule activators and inhibitors of HYPE, which can cross the blood-brain barrier and facilitate drug development. To this end, we developed a fluorescence polarization-based dual high-throughput screen, which uses the fluorescent ATP analog FL-ATP to measure HYPE's AMPylation activity as a readout. Results from our pilot assay identified several small-molecule activators and inhibitors of HYPE, however, these molecules were not optimized for the central nervous system (CNS) or drug development. These are the first small-molecule modulators of HYPE AMPylation that have been identified. Our current assay screens larger, more diverse chemical libraries (DIVERSet™ ChemBridge and CNS-Set™ ChemBridge) whose compounds have a higher probability of blood-brain barrier penetration and are more applicable to the CNS. Any druggable activators we identify in this screen will undergo in vivo testing and be developed into therapeutic treatments for Parkinson's disease.

Mentor(s):

Seema Mattoo, College of Science, Biological Sciences

Ali Camara, Purdue University

Poster Presentation Abstract Number: 216 :: Innovative Technology/Entrepreneurship/Design

College of Science

PanCan Diagnosed (a miRNA Approach): Using Feature Selection, Ensemble Algorithms, and Interpretability for the Early Diagnosis and Personalized Treatment of Pancreatic Cancer

Author(s):

Siya Goel, Temporary

Abstract:

miRNAs have shown to be significant in the development of cancer tumors. Currently, pancreatic cancer's (PC's) early diagnostic rate is just 9% as screening methods are unattainable, making it the fourth leading cause of cancer death. Many studies have achieved low accuracy (70-75%) as they use methods that do not take into account the 33% misdiagnosis rate of PC with other cancers. As a result, feature selection, ensemble algorithms, and interpretability techniques were used to find significant miRNAs in order to construct an early diagnostic tool for PC. In the first phase, recursive feature elimination algorithms were used to find 200 differentially expressed miRNAs in PC and no PC samples as well as early and late PC samples. In the second phase, an ensemble algorithm was constructed out of K-Nearest Neighbor, Naive Bayes, Neural Network, and Logistic Regression models in order to diagnose PC and distinguish between early and late stages. In the third stage, XGBoost, SHAP, and Skater interpretability methods were used to find which miRNAs were significant in model predictions. In the fourth stage, a user interface, PanCan Diagnosis, was designed to test if a person had no, early, or late stage PC and also displayed the patient's most differentially expressed miRNAs. This novel tool is the first in literature to receive a diagnostic accuracy of above 90%, seek miRNAs that can lead to personalized treatment of early and late stage PC samples, offers a ten-fold improvement in monetary costs, and is two times faster than current methods.

Mentor(s):

Clark Gedney, College of Science, Biological Sciences

Poster Presentation Abstract Number: 217 :: Physical Sciences

College of Science

Determining the lineshape of the 1S-2S transition of antihydrogen in the ALPHA Experiment

Author(s):

Robert Gustafson, College of Science, Honors College

Abstract:

In particle physics, every fundamental particle has a corresponding antiparticle which is nearly identical except for having the opposite charge. Research is being performed to search for asymmetries between particles and antiparticles. The Antihydrogen Laser Physics Apparatus (ALPHA) Experiment is determining the energy spectrum of antihydrogen and comparing it to that of hydrogen. The experiment shines a laser on trapped antihydrogen and observes the rate of 1S-2S transitions as a function of laser frequency. To find the expected result, computationally heavy simulations are used. In our work, we attempt numerical integrations and analytic expressions that would replicate the results of the simulations. This would drastically decrease the required computational time. In a simplified model of the antihydrogen trap, we show that simulation and numerical integration arrive at the same result, while the analytic expression can reproduce the general structure of the transition rate vs frequency.

Mentor(s):

Francis Robicheaux, College of Science, Physics & Astronomy

Poster Presentation Abstract Number: 218 :: Life Sciences

College of Science

Discovery of small molecules that target MYC G-quadruplex for MYC Inhibition

Author(s):

Jarin Harrell, College of Science, Honors College

Mercedes DeMoss, College of Science, Honors College

Abstract:

The MYC oncogene is a promising drug target for cancer research due to its overexpression in a majority of cancers. However, the MYC protein is considered undruggable because of its short half-life and lack of binding pocket. Stabilizing the MYC promoter G-quadruplex with small molecules decreases MYC protein levels in cancer cells causing cell death. Indenoisoquinoline compounds have been shown to induce and stabilize the MYC promoter G-quadruplex and inhibit MYC expression. A few of them have also begun to be tested in clinical trials and could possibly be used to treat cancer patients who are unresponsive to other treatment methods. Currently, there is no commercially available DNA-targeted small molecule compound library. At the beginning of this study, a DNA-targeted molecule compound library with over 2000 indenoisoquinoline compounds and analogs was created. In vitro studies identified those compounds that bind to the MYC promoter G-quadruplex. In vivo assays with two different Burkitt’s lymphoma cell lines (CA46 and RAJI) were used to determine the potency of the compounds. These results narrowed the drug library to 270 hit compounds. The identified hit compounds are being used in single-dosage and IC50 cell assays with the same Burkitt’s lymphoma cell lines to assess each compound’s ability to inhibit MYC and relative potency. The goal of these experiments is to fine-tune the compound library and develop a more in-depth structure-activity relationship for indenoisoquinoline compounds at this promising cancer target.

Mentor(s):

Danzhou Yang, College of Pharmacy, Medicinal Chemistry & Molecular Pharmacology

Yichen Han, Purdue University

Luying Chen, Purdue University

Poster Presentation Abstract Number: 219 :: Mathematical/Computation Sciences

College of Science

Stock Price Prediction Using LSTM

Author(s):

Tim Houston, College of Science, Honors College

Abstract:

The purpose of this project is to create a machine learning model to predict stock prices using past stock data. The data is obtained from the Tiingo API and read into a Jupyter notebook using Python. A variety of stocks are chosen from different industries and levels of volatility in order to minimize the effect of similar stocks moving together. Next, this data is divided by date into two disjoint sets for training and testing. The recurring method used on the training data relies primarily on long short-term memory (LSTM), which takes into account sequences of data points, such the closing price of stocks over time. Then, the accuracy of the resulting model is evaluated using the testing data as input. Additionally, the model continues to improve as the testing data is appended to the larger training dataset on a daily basis. The model is evaluated by comparing the greatest expected change, whether it be an increase or decrease, in stock price each day to the actual change of that stock's price. This use of extreme changes attempts to assess the overall ability to make profitable investing decisions.

Mentor(s):

Kiseop Lee, College of Science, Statistics

Poster Presentation Abstract Number: 220 :: Life Sciences

College of Science

Folate-Targeted Imaging and Therapy with Accelerated Kidney Clearance

Author(s):

Roxanne Huff, College of Science

Abstract:

Abstract redacted.

Mentor(s):

Philip Low, College of Science, Chemistry

Spencer Lindeman, Purdue University

Poster Presentation Abstract Number: 221 :: Physical Sciences

Withdrawn.

Poster Presentation Abstract Number: 222 :: Physical Sciences

College of Science

Inorganic Chemistry Experiment: Formation and Properties of Metal-Ligand Complexes

Author(s):

Allyson Imfeld, College of Science

Abstract:

Metal ions commonly exist in the form of coordination complexes. These complexes consist of a metal ion bound to ligands, which can be anything from nonmetal ions, small molecules such as H2O, NH3, or large organic molecules. The properties of such complexes include different colors, photo-physical characteristics, magnetics, reactivity, biological activity, and catalytic properties. We have developed an inorganic chemistry lab experiment that introduces students to the coordination chemistry of three different metals (Fe, Cu, and Ni) by allowing them to relate complex formation to color changes and solubility. The objectives of the experiments presented are as follows: i) Correctly calculate and prepare solutions of known concentrations. ii) Observe and understand the chemistry of transition metal complexes. iii) Observe and explain changes in color and solubility in terms of metal-ligand interactions. iv) Analyze results in regards to metal-ligand formation. This lab experiment provides students with a multi-faceted look at different chemical principles including formation of coordination complexes, solubility, redox chemistry and the chemistry of transition metals. In addition to the in person version of this lab, an online version is also in development.

Mentor(s):

Gudrun Schmidt, College of Science, Chemistry

Poster Presentation Abstract Number: 223 :: Life Sciences

College of Science

Protecting Internet Users with Epilepsy or Chronic Migraine from Graphic-Based Attacks

Author(s):

Sean Joo, College of Science

Abstract:

Flagging graphics interchangeable formats (GIFs) on personal devices are essential to protect users with epilepsy or chronic migraine. The research broke GIFs into frames and compared consecutive frames in pairs with three conditions: the ratio of average intensity, percentage of dangerous pixels, and hertz value. First, the average intensity of each frame is calculated using the formula: 0.299 * red + 0.587 * green + 0.114 * blue (Sedgewick & Wayne, 2017), for each pixel in the frame. Next, to obtain the percentage of dangerous pixels, each pixel of the same location from the two frames is compared. The absolute value of the difference between intensities of the pixels is found. A value less than 128.0 (Sedgewick & Wayne, 2017) is incompatible. Then, the ratio of incompatible and different pixels is obtained, which is multiplied by the ratio of different and total pixels. Finally, if the hertz value, inverse of the duration of each frame divided by 1000, falls within 3 to 30 (Wirrell & Hernandez), the GIF can be potentially dangerous. Thus, three threat levels, risky, dangerous, and extreme, have been established if one, two, or three conditions are met, respectively. After taking these results, viewers can be notified so that they can be protected from potential graphic-based attacks.

Sources:

Sedgewick, R., & Wayne, K. (2017). Object-Oriented Programming. *Computer science an interdisciplinary approach*. Addison-Wesley Professional. (pp. 330-381). Boston: Addision-Wesley.

Wirrell, E., & Hernandez, A. (Eds.). (2019). Photosensitivity and Seizures. *Epilepsy*. https://www.epilepsy.com/learn/triggers-seizures/photosensitivity-and-seizure

Mentor(s):

Rua Williams, Polytechnic Institute, Computer Graphics Technology

Poster Presentation Abstract Number: 224 :: Life Sciences

College of Science

Toxicity Associated with Exposures to Nanoparticle Mixtures

Author(s):

Emily Jung, College of Science

Abstract:

Welding involves production of fumes when joining metals together, and these fumes contain nano-sized particulate matter which contribute to pulmonary disease via inhalation. The objective for this study is to examine how exposure to nanoparticle mixtures influence toxicity. We expected that nanoparticle composition of metal fumes results in differential toxicological consequences. We characterized iron and manganese nanoparticles and used them in varying exposure proportions to assess toxicity. Lung epithelial cells and macrophages were exposed to collect endpoints of cytotoxicity, inflammation, and oxidative stress. Results overall indicated that different nanoparticle mixtures result in different responses compared to individual nanoparticles alone. Cytotoxicity assays suggested concentration dependent cytotoxicity and that Mn has a greater cytotoxicity when combined with Fe. Transferrin and ferritin heavy chain gene expression results suggested a preference for Fe nanoparticles. Heme oxygenase-1 gene expression results indicated that greater amounts of Mn induce increased oxidative stress. Manganese nanoparticles are also responsible for eliciting inflammatory responses as evidenced by TNF-aplha, interleukin-6, C-C motif chemokine ligand-2, and C-X-C motif chemokine ligand-2 gene expression. Welding fumes composed of nanoparticle mixtures have significant toxicological effects that demonstrate a need for improved particulate matter inhalation prevention protocols to reduce risk of development of pulmonary conditions.

Mentor(s):

Jonathan Shannahan, College of Health & Human Sciences, Health Sciences

Saeed Alqahtani, Purdue University

Li Xia, Purdue University

Poster Presentation Abstract Number: 225 :: Physical Sciences

College of Science

Custom Filters and Control Hardware for Superconducting Quantum Circuits

Author(s):

Sean Khomphengchan, College of Engineering

Maaz Ahmed, College of Science

Abstract:

With advancements in modern technology, applications of quantum information sciences are now more within reach than they ever have been before. This is especially true for superconducting circuits which have emerged as a leading platform for quantum computing, quantum simulation, and quantum enhanced sensing. In this project, we investigate custom low pass filters using Eccosorb material for efficiently shielding noise from the circuit devices. We will also build custom low noise programmable voltage sources for controlling superconducting devices. We present the design, fabrication or setup, and characterization of these devices, and discuss potential future improvements to the designs. These filters and voltage sources, as outcomes of the project, will be integrated into a comprehensive control and measurement system for the exploration of quantum dynamics in superconducting circuits.

Mentor(s):

Ruichao Ma, College of Science, Physics & Astronomy

Jeremy Cadiente, Purdue University

Ramya Suresh, Purdue University

Botao Du, Purdue University

Poster Presentation Abstract Number: 226 :: Mathematical/Computation Sciences

College of Science

Data and VR Modeling for Historical Projects

Author(s):

Rahul Kolli, College of Science

Abstract:

Big data enforces companies and organizations to assess data through analysis, prediction, modeling. The idea of improving data analysis is important in an ever-changing technological climate, where computer modeling aids in simulation and artificial intelligence. This research focuses on integrating historical events, data science, and computer programming to collect information on reconstructing historical battles. The computer program targets a variety of divisional and non-divisional units, their respective losses, and placement on the battlefield across the latter half of the 20th century. In efforts to effectively identify various army positions, dataset correlations through the usage of k-means clustering were used - this type of data analysis is important in filling in a lack of information. Utilizing python libraries also allows for a better user-interface through graphics and easy-to-read conclusions. The research was conducted by utilizing new domain analysis to effectively display results, different software systems to improve productiveness, and consulting a historian to promote accuracy. The biggest challenge faced was graphically representing data with non-existing values that were not recorded at the time and had to be estimated according to correlation. Data will be documented through multiple platforms to investigate the different parameters that were analyzed in the initial stages of data collection. This type of virtual reality python modeling will aid in a deeper understanding of different historical events.

Mentor(s):

Sorin Matei, College of Liberal Arts

Robert Kirchubel, Purdue University

Poster Presentation Abstract Number: 227 :: Life Sciences

College of Science

Operant Conditioning Paradigm for Illusory Perception Testing in Mice

Author(s):

Claudia Li, College of Science, Honors College

Abstract:

Studying illusory processing can reveal why the animal visual system is so robust to perturbations. In particular, the mechanism by which animal visual systems produce optical illusions to fill in information gaps has yet to be explained. Kanizsa figures, composed of Pac-man inducers, evoke the perception of illusory shapes. Despite the absence of any physical edges and subsequent lack of receptive field activation, the illusory contours have been shown to elicit neural responses in lower visual areas. In order to show that mice can perceive optical illusions, a paradigm was devised to train mice to discriminate between simultaneously presented Kanizsa illusory contours of opposite orientations. Through a series of increasingly complex training stages, they learned the correct orientation, reaching average performances of 75% or higher. During a transfer testing stage, the mice succeeded in choosing the correct orientation when real contours were displayed in place of their illusory counterparts, demonstrating their use of global visual cues over local cues. Using optogenetics, inhibition of the lateromedial (LM) area was shown to hinder performance. As a result of developing this training paradigm, the ability to perceive illusory contours can be further explored in different disease models. Impaired perception of Kanizsa figures has been observed in patients with Williams syndrome and autism, and elucidating the underlying mechanisms would improve our understanding of how these disorders disrupt illusory processing.

Mentor(s):

David Williams, Not a Purdue West Lafayette Employee

Alexander Chubykin, College of Science, Biological Sciences

Alexandr Pak, Purdue University

Poster Presentation Abstract Number: 228 :: Life Sciences

College of Science

Plant Leachates Impact Infection Dynamics in an Amphibian Fungal Pathogen

Author(s):

Emily Martin, College of Science

Abstract:

Changes to the natural world, including the anthropogenic spread of foreign species to vulnerable areas, are increasingly concerning, especially within aquatic ecosystems. The movement of plant species introduces invasive leaf litter into freshwater habitats which can alter water conditions, directly impacting ecological interactions. While leaf litter is known to affect aquatic organisms by releasing chemical compounds into the water (i.e., creating “leachate”), disease outcomes remain relatively unexplored. Within aquatic systems, the emergence of Batrachochytrium dendrobatidis (Bd), a fungal pathogen, has contributed to global amphibian declines and extinctions. We tested if leaf litter leachates will affect Bd disease outcomes due to their effects on Bd growth and tadpole hosts. We predicted that leachates would diminish Bd infectivity and host susceptibility, with more pronounced effects by invasive plant species’ leachates compared to those of native species. Bullfrog tadpoles were individually infected with Bd in one of six leachates (3 native, 3 invasive) for 7 days. We quantified infection status and load and measured tadpole mortality, growth, and development across the exposure period. Our results may demonstrate that leachates could serve as a mitigation buffer, lessening the hold of the Bd crisis and offering a new perspective on environmental Bd infection dynamics.

Mentor(s):

Catherine Searle, College of Science, Biological Sciences

Spencer Siddons, Purdue University

Paradyse Blackwood, Purdue University

Poster Presentation Abstract Number: 229 :: Life Sciences

College of Science

Application of Polygenic Risk Scores to Understand Disease Risk and Phenotypic Associations

Author(s):

Melanie Martinez, College of Science, Honors College

Abstract:

Polygenic risk scores (PRS) have been increasingly used to quantitatively measure an individual's inherited susceptibility to certain diseases and can be used in conjunction with other study designs to measure additional associations: this study analyzes and compares the average PRS of autoimmune disorders to determine which populations are at a higher risk for the given complex disorder. In addition, correlations between average PRS and prevalences of different populations are calculated. The scores are estimated with PRSice-2 using disease-specific summary statistics from published genome-wide association studies (GWAS). Country prevalence data is acquired from the Global Burden Disease Study 2019 and correlations are calculated in R. In parallel with this analysis, a cross-disorder phenome-wide association study (pheWAS) is performed to reveal associations between PRS of autoimmune disorders and various phenotypes relating to socioeconomic status, lifestyle factors, and physical and mental health. The PHESANT software package is used to test association of the PRS with phenotypes in the UK Biobank dataset. The results from the first analysis determine populations at a higher risk for certain disorders and thus could help in aggressive testing and planning control measures for those disorders, while the second analysis identifies potential factors associated with genetic liability for autoimmune disorders.

Mentor(s):

Peristera Paschou, College of Science, Biological Sciences

Apostolia Topaloudi, Purdue University

Pritesh Jain, Purdue University

Poster Presentation Abstract Number: 230 :: Physical Sciences

College of Science

XENON1T Double Photoelectron Emission Range Observation

Author(s):

Matthew McLaren, College of Science

Rishabh Midha, College of Engineering

Zain Khurshid, College of Science

Caden Glenn, College of Science

Abstract:

Our purpose in conducting this research is to determine the double photoelectron emission range of each PMT within the XENON1T detector. The XENON1T detector is comprised of a cylindric tank containing mostly xenon liquid and some xenon gas with photo multiplier tubes (PMTs) at the top and bottom of the tank underneath the Gran Sasso mountain located in Italy. This was done within one academic semester with one day of data from the XENON1T detector. The detector itself holds 248 PMTs which detect scintillation light from both particle interactions and electrons that are extracted from the liquid by an electric field. From this, we can determine the double photoelectron emission range observed and record the results from each PMT. This important because we want to lower the energy level to be able to observe solar neutrinos.

Mentor(s):

Rafael Lang, College of Science, Physics & Astronomy

Juehang Qin, Purdue University

Poster Presentation Abstract Number: 231 :: Life Sciences

College of Science

Downstream Effects: Impact of Antibiotic Pollution on Aquatic Host-Parasite Interactions

Author(s):

Hannah Melchiorre, College of Science

Abstract:

The global increase in antibiotic use has led to contamination of freshwater environments occupied by parasites and their hosts. Despite the identified impacts of antibiotics on humans and wildlife, the effect of antibiotics on host-parasite life cycles is relatively unexplored. We utilize the trematode parasite Schistosoma mansoni, and its snail intermediate host Biomphalaria glabrata to explore the influence of an ecologically relevant antibiotic concentrations on the life history characteristics of both parasite and host. Our results demonstrate that antibiotics not only accelerate parasite development and have a positive effect on parasite reproduction, but also increase the likelihood of host egg laying, and delay parasite-induced host castration. Using a mathematical model, we suggest that these life history alterations associated with antibiotics are likely to increase parasite transmission and disease burden.

Mentor(s):

Dennis Minchella, College of Science, Biological Sciences

Grace Schumacher, Purdue University

Poster Presentation Abstract Number: 232 :: Physical Sciences

College of Science

Biodegradable Adhesive Strength in Ocean Water

Author(s):

Logan Miles, College of Science

Kylie Smith, College of Science

Abstract:

Water resistance is a property that needs to be tailored for adhesive applications. Food packaging and wood products are examples where bonding must persist when water is present. By contrast, water resistance should be lower for cosmetic applications where binders need to wash off easily. Some medical applications also require degradable glues with a limited degree of water resistance. For example, wound healing bandages are designed with reversible bonding in mind because it may be desirable to use water for their pain free removal. Plant-based adhesives are nontoxic, degradable, and tunable regarding their water-resistant properties. They are good candidates for applications that require some water resistance. Here we present results that show how the adhesive performance of corn protein glue changes over time when water is present. Corn protein readily dissolves in ethanol and water mixtures but not in water alone. The dissolution properties of this protein and the potential for cross-linking allow for improving water resistance. We observe changes in adhesion strength in both tap water and ocean water. Lap-shear testing experiments were performed on wood substrates to determine the adhesive strength of various formulations using clay fillers such as limestone and the phosphoprotein, casein. We are comparing the change in adhesion within one hour under the tap and ocean water, where most change has been observed. Although our initial studies are qualitative in nature, they show potential for future applications.

Mentor(s):

Gudrun Schmidt, College of Science, Chemistry

Poster Presentation Abstract Number: 233 :: Life Sciences

College of Science

Determining the Synergistic Effect of Lippia and Cisplatin on the Viability of MDA-MB-231 Cells

Author(s):

Chyna Davis, College of Science

Alexis Musleh, College of Science

Abstract:

Triple-negative breast cancer (TNBC) is a subtype of breast cancer characterized by a lack of estrogen, progesterone, and human-epidermal-growth-factor 2 receptors. Compared to other subtypes of cancer, TNBC has poor survival rates and is described as aggressive, invasive, and lymph node-positive. In an attempt towards developing novel therapeutic options for TNBC, we sought to determine the synergetic effects of the chemotherapy drug Cisplatin (Csp) and an extract of the plant Lippia Origanoides. Csp is a useful anticancer agent and can suppress TNBC growth by interlinking between DNA bases, causing double-stranded breaks, and inducing cell apoptosis. Previous studies demonstrate Lippia Origanoides has pro-apoptotic and anti-proliferative effects on various cancer cell lines. Our recent work reveals Lippia Origanoides extract (LOE) treatment leads to decreased proliferation of MDA-MB-231 TNBC cells by inducing cell cycle arrest and apoptosis. Overall, the purpose of our current experiment is to determine the ability of LOE to enhance the efficacy of Csp in TNBC cells. This will be tested by measuring the effects of LOE and Csp combination treatment on MDA-MB-231 cell viability and metabolism through MTT and Glucose Glo Assays. Ultimately, these studies could support LOE as a valuable source of bioactive compounds that have the potential to enhance the actions of Csp based chemotherapy agents in TNBC.

Mentor(s):

Ignacio Camarillo, College of Science, Biological Sciences

Rajeswari Sundararajan, School of Engineering Technology, Purdue University

Poster Presentation Abstract Number: 234 :: Physical Sciences

College of Science

Geochemistry at Springs in Furnace Creek and Ash Meadows: Implications for Regional Interbasin Flow

Author(s):

Sneha Nachimuthu, College of Science

Abstract:

There is an ongoing debate over the existence of a hydrogeologic connection between the springs discharging in Ash Meadows National Wildlife Refuge (AM-NWR) and springs discharging in Furnace Creek, Death Valley National Park. (FC-DVNP). These desert springs provide critical habitat for endangered aquatic species. Ash Meadows is thought to be a part of a regional groundwater flow system present in the southern Great Basin (CA and NV). One group, Belcher et al. (2009) and Hershey et al. (2010,) propose a conceptual model where FC-DVNP springs are supported by regional, interbasin groundwater flow between AM-NWR and FC-DVNP. Another group, Mayo and Nelson (2014), propose a conceptual model where discharge at FC-DVNP is supported by local mountain-front and mountain-block recharge with additional recharge from intermittent streams. In this study, spring waters in both AM-NWR and FC-DVNP were analyzed for isotopes not used in the previous studies. Spring water samples were analyzed for ^{2}H, ^{18}O, ^{3}H, $^{36}Cl/Cl$ ratios, Cl^{-}/Br^{-} ratios, Sr^{2+}, and specific conductivity. The data show that ^{2}H and ^{18}O and Sr^{2+} track each other (the composition of FC-DVNP springs changes concurrently with AM-NWR springs), $^{36}Cl/Cl$ ratios decrease slightly while Cl^{-}/Br^{-} ratios and specific conductivity increase slightly from AM-NWR to FC-DVNP indicative of a continuous flow path. Therefore, our data support the presence of a hydrogeologic connection between the FC-DVNP and AM-NWR springs; however, local recharge from rare, high-intensity rain events can potentially provide recharge. This study adds a new wrinkle to the ongoing debate on the origin of the FC-DVNP springs.

Mentor(s):

Marty Frisbee, College of Science, Earth, Atmospheric, & Planetary Sciences

Poster Presentation Abstract Number: 235 :: Physical Sciences

College of Science

Automated Detection of Mesocyclones Including Area and Intensity in X-band Radar Observations

Author(s):

Raychel Nelson, College of Science

Abstract:

At Purdue University, Python software under testing automatically detects and characterizes mesocyclones based upon data from the X-band Teaching and Research RAdar (XTRRA) recently installed near campus. The XTRRA is located in a lower atmospheric observation gap between National Weather Service (NWS) operational radars, and we hypothesize that XTRRA will better detect low-level mesocyclones that those radars may sample poorly. The ultimate goal is to create a campus-wide alert system for multiple classes of impending severe weather. The software is currently being tested against mesocyclone detections made by the nearest NWS NEXRAD radars during past precipitation events on or near campus and verified via manual identification to calculate probability of detection (POD) statistics. One current weakness of the mesocyclone detection algorithm is the relatively small number of mesocyclone observations available, since the XTRRA has only been operating since 2018. The algorithm is first being evaluated using precipitation data from the summer periods (May through August) of 2019 and 2020, which are the typical severe weather maxima for Indiana. As more mesocyclone observations become available, the detections should improve. The completed alert system will aid in preserving life and property on the Purdue University campus. Ideally, this system will supplement NEXRAD data to aid the National Weather Service in issuing warnings with more accuracy and lead time.

Mentor(s):

Robin Tanamachi, College of Science, Earth, Atmospheric, & Planetary Sciences

Poster Presentation Abstract Number: 236 :: Life Sciences

College of Science

Protein Encapsulation to Improve Sample Quality for Cryo-Electron Microscopy

Author(s):

Hannah Pletcher, College of Science, Honors College

Abstract:

Cryo-electron microscopy (cryo-EM) is a method of structure characterization of proteins that does not require crystals. However, complete structure characterization can be prevented by sample heterogeneity and preferred orientations. Sample heterogeneity prevents the achievement of the highest resolution. The air-water interface can denature samples and induce preferred orientations, which inhibits the reconstruction of a complete three-dimensional structure. The hypothesis of this study is that the negative effects of heterogeneity and preferred orientations could be reduced by the encapsulation of the sample in cage-like proteins. This study suggests using the human norovirus virus-like particle (VLP) to encapsulate cargo-proteins to be imaged under cryo-EM. This system is achieved via molecular cloning into vectors and expression in insect cell lines. The use of the human norovirus viral capsid protein for the encapsulation of the protein target could allow for improved reconstruction quality by making the protein target more compact and less flexible, reducing the effects of heterogeneity, and by preventing contact with the air-water interface, inhibiting preferred orientations.

Mentor(s):

Frank Vago, College of Science, Biological Sciences

Wen Jiang, Purdue University

Poster Presentation Abstract Number: 237 :: Mathematical/Computation Sciences

College of Science

Optimizing Clustering on a Quantum Annealer

Author(s):

Ben Pulver, College of Engineering

Ian Reidenbach, College of Science

Alexander Woodruff, College of Science

Abstract:

Clustering algorithms on quantum computers are not yet to the point of usurping their classical counterparts. Clustering, a way to group things based on certain characteristics, can be a valuable tool for particle physics as it may be utilized to determine which tracks in the CMS detector correspond to different proton-proton collisions within a single bunch crossing event. Our goal with this project was to investigate and improve quantum computer clustering. We utilized the framework of mean effective field theory to estimate the ideal anneal offsets to optimize this process. Furthermore, we examined the accuracy of our algorithm and how it changes with the complexity of the problem to give us information on its performance and show the problems it excels at.

Mentor(s):

Andreas Jung, College of Science, Physics & Astronomy

Andrew Wildridge, Purdue University

Poster Presentation Abstract Number: 238 :: Life Sciences

College of Science

Investigating Fic Proteins as Virulence Factors for the Gastric Pathogen, *Helicobacter pylori*

Author(s):

Vandana Reddy, College of Science

Alexandra Stiffler, College of Science

Abstract:

Fic (Filamentation Induced by Cyclic AMP) proteins are catalytic enzymes that regulate cell signaling by covalently adding an AMP or phosphate to target proteins. Fic proteins from bacterial pathogens can translocate into eukaryotic cells, AMPylating host proteins to evade immune cells. While most bacteria encode a single Fic protein, Helicobacter pylori, the causative agent of gastric ulcers and cancer in humans, encodes multiple Fic proteins, some of which are located within its Type IV Secretion System (T4SS) pathogenicity locus. The abundance of Fic proteins could provide clues to how these proteins co-evolved to potentially mediate pathogenesis and fitness.

We successfully cloned, purified, and characterized HpFic1 from H. pylori strain Puno120. Using HpFic1 WT, where the Fic active site is intrinsically blocked, and its SE/AA mutant, where the Fic active site is constitutively open, we assessed HpFic1's adenylyltransferase activity in vitro. HpFic1-SE/AA successfully catalyzed auto-AMPylation, indicating it is a bone fide adenylyltransferase. Further, HpFic1-WT showed de-AMPylation activity, a recently discovered self-regulatory mechanism for some Fics. We also identified bacterial elongation factor TU (EfTu) as an in vitro AMPylation target for HpFic1, an interesting observation as EfTu was earlier shown to be phosphorylated by the Fic homolog, Doc, from the P1 Prophage. Interestingly, in mammalian cell transfection assays, HpFic1 localized to the nucleus, adding complexity to its function. Additionally, we solved the crystal structure of HpFic1 to 2.0 Å. Crystals belonged to the C2221 space group, with one asymmetric unit containing two molecules. This structural information provides insights for ATP and possible target docking.

Mentor(s):

Seema Mattoo, College of Science, Biological Sciences

Poster Presentation Abstract Number: 239 :: Life Sciences

College of Science

Mechanism Characterization of bacterial ubiquitin E3 ligase lpg0634 using experimental docking

Author(s):

Hannah Rondon, College of Science

Abstract:

Legionella pneumophila is a gram-negative pathogenic bacterium that causes Legionnaires' disease, which is a severe form of pneumonia. During its infectious cycle, L. pneumophila secretes virulence protein effectors into the host cytoplasm to interfere with host cellular activities. One of these host pathways is the ubiquitin system, which is involved in host immune response and protein degradation. L. pneumophila secretes a ubiquitin E3 ligase, lpg0634, which function is unknown. While the structure of lpg0634 has been characterized, its catalytic mechanism is poorly understood for bacterial ubiquitin E3 ligase lpg0634. To investigate lpg0634's catalytic function, we use computational approaches to characterize how lpg0634 catalyzes ubiquitin ligation and the interaction between E2~ubiquitin complex and E3 ligase. Our analysis of structure suggests that lpg0634 is unlikely to catalyze ligation through an E3~ubiquitin thioester complex that canonical E3 ligases use. We also identify residues that are likely involved in the interaction between lpg0634 and the E2~ubiquitin complex. Our findings help elucidate the catalytic mechanism of lpg0634 and, how L. pneumophila hijacks the host ubiquitination pathways. Understanding the strategies L. pneumophila uses to propagate can identify novel targets for therapeutics in Legionnaires' disease.

Mentor(s):

Zhengrui Zhang, College of Science, Chemistry

Poster Presentation Abstract Number: 240 :: Life Sciences

College of Science

Identifying tradeoffs in responses of Daphnia genotypes to a pathogen and abiotic stress

Author(s):

Meredith Scherer, College of Science

Abstract:

Organisms in natural systems are subjected to many types of stress, including abiotic conditions and pathogens. For example, runoff due to road salts is increasing the salinity levels in many freshwater environments. At the same time, there are also pathogens present in these environments. Due to the presence of multiple stressors, we need to understand how organisms are responding to each stressor individually and combined.

We studied the response of a freshwater crustacean, Daphnia dentifera, to salinity and then the response to a fungal pathogen. To examine the tradeoffs between the responses to salinity and a fungal pathogen, we used 12 different genotypes of Daphnia dentifera as the host and Metschnikowia bicuspidata as the fungal pathogen. Initially we tested the effect of salinity, and then tested the effect of M. bicuspidata on the mortality rate of the 12 different genotypes of Daphnia. For each trial, we found differential success among the 12 genotypes of Daphnia. However, the correlation between percent survival from the salinity trial and proportion infected from the Metschnikowia trial was not statistically significant. In conclusion, the ability to withstand the pathogen or abiotic condition does not confer an advantage over the other in the 12 genotypes of Daphnia that we tested. Understanding the tradeoffs between the responses to salinity and a fungal pathogen will have ramifications in the control of road salt runoff and population dynamics in Daphnia.

Mentor(s):

Catherine Searle, College of Science, Biological Sciences

Kacie Jonasen, Purdue University

Poster Presentation Abstract Number: 241 :: Physical Sciences

College of Science

Quantum and transport lifetimes in tunable InAs/InP two-dimensional electron gases with differently graded buffer layers

Author(s):

Matthew Schulz, College of Science

Abstract:

In this study, the quantum and transport lifetimes are analyzed between InAs/InP two-dimensional electron gases (2DEGs) in heterostructures with differently graded buffer layers. Four stacks are being tested in this study: three grown at 320 degC, 390 degC, and 460 degC with linearly graded buffers and another one grown at 390 degC with an exponentially graded buffer. In order to find the two lifetimes, the magnetotransport of each sample was taken for different densities (varying the density with an applied gate voltage) at 300 mK. The Shubnikov-de Haas (SdH) oscillations were then analyzed using dingle plots in order to extract the quantum lifetimes. Overall, it was found that quantum lifetime was not a strong function of density in any of the structures, whereas the transport lifetimes varied strongly with density. However, it was also found that the quantum lifetime was substantially higher in the exponentially graded buffer.

Mentor(s):

Michael Manfra, College of Science, Physics & Astronomy

Sara Metti, Purdue University Physics and Astronomy

James Nakamura, Purdue University Physics and Astronomy

Poster Presentation Abstract Number: 242 :: Life Sciences

College of Science

Role of Mutant KRAS and Suppression of PP2A-B56α in the Transformation of Pancreatic Epithelial Cells and the Progression of Pancreatic Cancer

Author(s):

Rebecca Shelley, College of Science

Abstract:

Pancreatic cancer is the fourth leading cause of cancer-related deaths in the United States. Most pancreatic ductal adenocarcinoma (PDAC) patients have an oncogenic, gain-of-function mutation in KRAS (KRASG12D), which is considered “undruggable.” It’s important to understand how oncogenic KRAS contributes to PDAC to develop alternative therapeutic strategies. Protein phosphatase 2A (PP2A) is a regulator of many of the downstream effectors of KRAS, and the tumor suppressive activity of PP2A is downregulated in PDAC cell lines. There are many different B-subunits of the PP2A complex that control substrate recognition, but low expression of the B56α subunit correlates with poor prognosis in PDAC patients. Together, these studies suggest that PP2A-B56α suppression may significantly contribute to PDAC progression. The goal of our research is to (1) determine if the expression of cellular PP2A inhibitors increases in early PDAC lesion formation, (2) identify how oncogenic KRAS leads to suppression of PP2A-B56α activity, and (3) determine if the loss of PP2A-B56α accelerates lesion formation. To investigate this, we will use KRASG12D mutation and PP2A-B56α knockdown approaches in vitro to identify how oncogenic KRAS and loss of PP2A-B56α cooperate to transform normal pancreatic cells by looking at cell identity and signaling changes. Mouse models with pancreas-specific oncogenic KRAS and PP2A-B56α loss will be used for in vivo studies to measure tumor characteristics and PDAC progression. Discovering the mechanisms of PP2A-B56α in relation to the oncogenic KRAS pathway will support the use of therapeutic activators of PP2A for PDAC patients and possibly other cancers with oncogenic KRAS.

Mentor(s):

Brittany Allen-Petersen, College of Science, Biological Sciences

Samantha Tinsley, Purdue University

Poster Presentation Abstract Number: 243 :: Mathematical/Computation Sciences

College of Science

Characterizing Students’ Engineering Design Strategies Using Energy3D

Author(s):

Jasmine Singh, College of Science

Abstract:

The goals of this study are to characterize design actions that students performed when solving a design challenge, and to create a machine learning model to help future students make better engineering design choices. We analyze data from an introductory engineering course where students used Energy3D, an open source computer-aided design software, to design a zero-energy home (i.e. a home that consumes no net energy over a period of a year). Student design actions within the software were recorded into text files. Using a sample of over 300 students, we first identify patterns in the data to assess how students in the course approached the design task and what paths they followed to complete the project. Using students’ early actions within the software, we use the scikit-learn machine learning library to train a model that can predict if a particular student will successfully design a zero-energy home. Such a model can help future students since future versions of the software can have built-in helpful pop-up notices for students who may struggle with the design task.

Mentor(s):

Alejandra Magana, Polytechnic Institute, Computer and Information Technology

Brittany Newell, Purdue University

Viranga Perera, Purdue University

Poster Presentation Abstract Number: 244 :: Life Sciences

College of Science

Characterization of Drug Candidates as Lowe Syndrome Therapeutics

Author(s):

Lisette Skiba, College of Science

Abstract:

Abstract redacted.

Mentor(s):

R. Claudio Aguilar, College of Science, Biological Sciences

Jennifer Lee, Purdue University

Poster Presentation Abstract Number: 245 :: Physical Sciences

Withdrawn.

Poster Presentation Abstract Number: 246 :: Life Sciences

College of Science

Comparing induced pluripotent stem cells and cancer: The NuMA Protein

Author(s):

Rachel Stucky, College of Science

Abstract:

The hopes of regenerative medicine through induced pluripotent stem cells (iPSCs) have caught the attention of researchers and clinicians. Although future goals include repairing spinal cords, forming new heart tissue, and creating high quality models for disease research, the reality is that the ability to obtain and culture stem cells currently yields poor results. Additionally, the likelihood of cancer formation after stem cell implantation poses a major health risk that must be addressed before stem cells can be used in clinical settings. To help solve these problems, we are focusing on the organization of the cell nucleus, which is essential for the homeostasis of stem cells. We have previously demonstrated that the Nuclear Mitotic Apparatus (NuMA) protein is an essential organizer of higher order chromatin necessary for proper cell fate determination. Here, we are hypothesizing that NuMA plays a role in iPSC dedifferentiation and reprogramming stability. Chromatin-immunoprecipitation with NuMA from differentiated epithelial cells revealed binding to DNA regions corresponding to five genes associated with the dedifferentiation necessary to produce iPSCs. Through western blot, we have shown that cancer cells with low level of stemness lack the expression of dedifferentiation genes and stem cell co-transcription factor LEDGF compared to iPSCs. Spontaneous differentiation of iPSCs in culture was accompanied by the loss of expression of these markers. However, in contrast to differentiated cells, both iPSCs and cancer cells presented a similar unique pattern of NuMA expression, warranting further analysis of NuMA function at the interface of normal and cancerous behaviors.

Mentor(s):

Sophie Lelievre, College of Veterinary Medicine, Basic Medical Sciences

Yunfeng Bai, Purdue University

Poster Presentation Abstract Number: 247 :: Physical Sciences

College of Science

Heat Waves and Role in the Food, Energy, Water Nexus

Author(s):

Suyash Uppal, College of Science, Honors College

Gozde Iloglu, College of Science

Abstract:

Heat stress is caused by exposure to intense heat and humidity for long periods of time. It can cause serious health conditions that can lead to death. There are several factors affecting the intensity of such conditions such as the time being exposed to the said conditions or access to resources like water, shade, air conditioning, etcetera. While the effect of heat stress on human health is a crucial problem to consider, we need to look beyond the effects of heat stress on individuals and consider its effect on society. On a larger scale, added contributions of heat stress can present complications on the labor capacity of future generations. This can have huge ramifications on the economy as entire populations will be forced to relocate due to rising temperatures in primarily the mid-latitude regions. There is current scientific literature on the adverse effects of rising temperatures that details methods to quantify and hedge against the risk of these effects in the form of insurance and derivatives. In this paper however, we are analyzing the heat stress as measured by Wet-Bulb Globe Temperature (WBGT), a metric that combines the effects of temperature and humidity. By combining an appropriate probability model with a cost function that quantifies the effects of WBGT, we can develop a framework for pricing derivatives as a function of conditional expectations. This framework is useful in helping us better understand the future costs of climate change, hedging practices, and mitigation strategies.

Mentor(s):

Matthew Huber, College of Science, Earth, Atmospheric, & Planetary Sciences

Qinqin Kong, Purdue University

Poster Presentation Abstract Number: 248 :: Physical Sciences

College of Science

Molecular characterization of iron-organic complexes using brown carbon proxies

Author(s):

Matthew Varas, College of Science

Alison Reed, College of Science

Abstract:

Atmospheric aerosols are known to influence the Earth's radiative balance by scattering or absorbing light, resulting in a cooling or warming effect, respectively. Moreover, the secondary organic aerosols (SOA) produced by biomass burning are known to have a significant impact on global and regional air quality, public health, and climate. One group of compounds present in biomass burning-related SOA is brown carbon (BrC), a class of moderately and strongly absorbing molecular components. Of these, nitroaromatic compounds (NAC) are known to contribute substantially to the overall light absorption. Although the formation and physicochemical properties of NAC have previously been investigated, the subsequent multiphase reactions of these species are not fully understood. Recently, it has become more apparent that metal-organic complexation plays an integral role in atmospheric multiphase reactions from sources such as biomass burning. In this work, we investigate the interactions between NAC commonly found in BrC, i.e., 4-nitrocatechol, and transition metals (i.e. Fe^{3+}) through aqueous phase dark reactions. We employ UV-vis spectroscopy for bulk investigations and state-of-the-art HPLC-PDA-ESI/high-resolution mass spectrometry to systematically separate and identify individual absorbing species and to quantify their contribution to total light absorption. This study provides insight into the fate of BrC chromophores composed of nitrated organics commonly observed in anthropogenic emissions.

Mentor(s):

Ana Morales, College of Science, Chemistry

Christoper Wester, College of Science, Chemistry

Alexander Laskin, College of Science, Chemistry

Poster Presentation Abstract Number: 249 :: Life Sciences

College of Science

Developing an Assay to Detect Arbovirus from Mosquito Saliva

Author(s):

Holly Weilbaker, College of Science

Abstract:

An estimated one-sixth of the world’s disability and illness every year is caused by vector-borne diseases. The Aedes aegypti mosquito used in this study is a vector for arboviruses that cause yellow fever, Zika, chikungunya and Dengue in humans. The ability to transmit virus is indicated by the presence of viral particles in mosquito saliva. High-throughput (HTP) assays to collect mosquito saliva and detect viruses are lacking. The goal of this project is to develop a HTP assay to rapidly test saliva from individual mosquitoes for the presence of viral RNA. For this study, the Liverpool strain of A. aegypti mosquitoes were cultured under standard conditions. Mosquitoes were placed into 2 mL tubes, starved for 24 hours, and then permitted to feed on a 5% sucrose solution + blue food dye delivered via filter paper or cotton ball in a dark, humidified chamber for 3 hours. Feeding was confirmed by assessment of mosquito abdomen and detection of blue excreta on filter paper cones placed in the tubes. Results will determine the efficiency of mosquitoes feeding via filter paper and will be used for the development of HTP assays. Future work will examine the effectiveness of this method for detecting (a) mosquito saliva and (b) viral RNA from the saliva of Dengue-infected mosquitoes. Mechanisms to adapt this assay for HTP viral detection are under consideration and would facilitate improved diagnostics, disease surveillance, and discovery of small molecule drugs that disrupt viral transmission by the mosquito.

Mentor(s):

Catherine Hill, College of Agriculture, Entomology

Maria Murgia, Purdue University

Poster Presentation Abstract Number: 250 :: Life Sciences

College of Science

Strucutal Determination of BamD in Pseudomonas aeruginosa

Author(s):

James Wellnitz, College of Science

Abstract:

The β barrel assembly machine (Bam) is a protein complex generally made up of five subunits and found in the outer membrane of gram-negative bacteria. The complex has been shown to be essential to bacterial survival, and thus is a possible target for novel antibiotics. The focus of this work is on solving the structure of the BamD subunit of Pseudomonas aeruginosa via X-ray crystallography. One of the major bottlenecks in this approach is the expression of the target protein in host cells. There is no predetermined rule that defines how well a protein will express in a certain approach or environment and determining ideal conditions often requires many empirical observations. Parameters like the type of cell or temperature of expression can be altered until an acceptable approach is identified, and the bottleneck is overcome. This project outlines the various conditions and approaches taken to find a condition suitable for expressing P. aeruginosa BamD in a line of E. coli cells. Experimentation has shown the protein is soluble when expressed at 37 °C and was previously successfully expressed in C41-DE3 pLysis cells. However, these results are not consistently repeatable so a better method must still be determined.

Mentor(s):

Nicholas Noinaj, College of Science, Biological Sciences

Poster Presentation Abstract Number: 251 :: Life Sciences

College of Science

Distribution predicts global patterns of extinction risk in toads

Author(s):

Desi Wilson, College of Science

Abstract:

Among vertebrates, amphibians are the most vulnerable group to extinction as novel selective agents, like disease and habitat degradation, have resulted in increased mortality. Despite the worldwide population decline of amphibians, there is substantial variation between species in their extinction risk. Given that the main threats to frogs and toads vary predictably with latitude and altitude across the world, anuran species are expected to differ in extinction risk along those geographic axes. Here, we examine this prediction in toads (Bufonidae), a large anuran family with a worldwide distribution in which species vary widely in extinction risk. We used distribution and conservation status data for 458 species of toads from the International Union for Conservation of Nature Red List assessment. Using a geographic information system, we characterized the latitudinal and altitudinal distribution for each species and determined toad species richness along those geographic axes. Using phylogenetic ANOVAs, we evaluated how distribution affects extinction risk in toads worldwide. We found that species' distribution is a strong predictor of their extinction risk. Overall, species that occur at low latitudes and high altitudes are more likely to have a higher risk of extinction. These findings suggest that distribution plays an important factor in predicting toads' risk of extinction. Our results also revealed that low latitudes hold the highest toad diversity and high altitudes have a high proportion of endemic species. Ultimately, these findings contribute to characterize the extinction risk predictors which offer insight for the development of conservation strategies given limited species assessment information.

Mentor(s):

Ximena Bernal, College of Science, Biological Sciences

Ana Larrea, Purdue University

Nigel Anderson, Brown University

Poster Presentation Abstract Number: 252 :: Life Sciences

College of Science

Structural Analysis of BamA, a therapeutic target for bacterial infections of F. nucleatum

Author(s):

Lindsey Wilson, College of Science

Abstract:

Fusobacterium nucleatum is an oral commensal that is known to cause opportunistic infections and is linked to many diseases including colorectal cancers. They are Gram-negative, meaning they have double membranes and thus a need for a β-barrel Assembly Machinery (BAM) complex. The BAM complex is responsible for the folding and insertion of proteins into the outer membranes, and its essentiality to proper functioning of Gram-negative bacteria make it an excellent target for drug therapeutics. While the BAM complex in E. coli is well studied, the structure of the analogous complex in F. nucleatum has yet to be solved. The goal of this ongoing investigation is to characterize the structure of the four Polypeptide-Transport Associated (POTRA) domains of the BamA subunit in F. nucleatum using X-ray crystallography. This is a subset of a larger project that aims to characterize the entire F. nucleatum BAM complex in order to advance drug design of antibiotics against this species. We predict the Fusobacterium BAM to be very similar in structure to the E. coli BAM and hope to find that existing antibiotics for E. coli can easily be adjusted for treating Fusobacteria. A successful purification procedure for the POTRAs includes metal affinity chromatography, anion-exchange chromatography, and size-exclusion chromatography procedures. At this time, no crystal structure has been solved, but a model of the molecular envelop has been created using data from Small-Angle X-ray Scattering (SAXS).

Mentor(s):

Nicholas Noinaj, College of Science, Biological Sciences

Claire Overly, Purdue University

Poster Presentation Abstract Number: 253 :: Innovative Technology/Entrepreneurship/Design

College of Science

VIP Disinfecting Robot - Sneeze Detector

Author(s):

Ricardo Xie, College of Engineering

Cindy Ding, College of Science

Abstract:

Under the circumstances of global pandemic, a research team was formed to design disinfecting robots that can help staff members and custodians in cleaning rooms, as well as protect those in the room from pathogens. This sub-team specifically focuses on designing the sneeze detector equipped on the robot using deep learning to localize and identify sneezes from other noises. The team plans to process audio using deep learning toolboxes from MathWorks' world-famous programming platform MATLAB®, and are working on the integration of the sneeze detector and the disinfecting robot. Simulations of sneezes and background noises are made with available resources at home and online as team members are working remotely this semester. Through developing a sneeze detector that localizes sneezes in a room, it helps aid disinfecting robots to clean deeper at specific areas of the room. This decreases the exposure to pathogens on staff, custodians, and others in the room, thereby lowers the risk of people getting sick.

Mentor(s):

Richard Voyles, Polytechnic Institute, Engineering Technology

Poster Presentation Abstract Number: 254 :: Life Sciences

College of Science

Opportunity or Catastrophe? Effect of Salinity on Host-Parasite Interactions of Schistosomiasis

Author(s):

Ao Yu, College of Science

Abstract:

Seawater intrusion caused by anthropogenic climate change may affect freshwater species and their parasites. While brackish water certainly impacts freshwater systems, its impact on disease transmission is largely unknown. This experiment examined the effect of salinity on host and parasite interactions using a freshwater snail host, Biomphalaria alexandrina, and the human trematode parasite Schistosoma mansoni. Four components were analyzed to evaluate the impact of salinity on disease transmission: snail survival, snail reproduction, infection prevalence, and the survival of the parasite infective stage (cercariae). We found a decrease in snail survival, snail egg mass production, and snail infection prevalence as salinity increases. However, cercarial survival peaked at an intermediate salinity value. Our results suggest that seawater intrusion into freshwaters could decrease schistosome transmission to humans. However, the effect of seawater intrusion on the entire food web and species interactions will need to be explored in order to draw well-rounded conclusions.

Mentor(s):

Jonathan Vannatta, College of Science, Biological Sciences

Stephanie O. Gutierrez, Purdue University

Dennis J. Minchella, Purdue University

Poster Presentation Abstract Number: 255 :: Physical Sciences

College of Science

Nonblind Analysis of XENON1T Data Using Double Photoelectron Emission Signals

Author(s):

Yinchen Zhou, College of Science

Moses Hamm, College of Engineering

Robin Carpenter, College of Science

Xieyuan Guo, College of Science

Abstract:

The XENON1T experiment is a direct-detection experiment looking for evidence of dark matter interacting with regular matter. The purpose of this project is to conduct a non-blind analysis on a small portion of the XENON1T dataset to look for any possible WIMP or solar Boron-8 neutrino events, while using double photoelectron emission to lower the energy threshold. Due to the low event energy of the search region, fine-tuning and improvement of existing background cuts needs to be performed. Therefore, a significant part of this study will be focused on modulating and refining existing background cut parameters and searching for possible events in the target low energy region. Simple data cuts were made with physical and statistical reasonings provided in order to limit over-fitting and researcher bias. Even if null results are obtained, this study will help future researchers refine the search for significant events within the XENON data.

Mentor(s):

Rafael Lang, College of Science, Physics & Astronomy

Juehang Qin, Purdue University

Poster Presentation Abstract Number: 256 :: Social Sciences/Humanities/Education

Honors College

Evaluating the Informed Learning curriculum of HSCI 131 and student usage of the suggested study methods to achieve success

Author(s):

Natalie Myers, College of Science

Abstract:

Abstract redacted.

Mentor(s):

Lisa Hilliard, College of Health & Human Sciences, Health Sciences

Poster Presentation Abstract Number: 257 :: Social Sciences/Humanities/Education

Krannert School of Management

Economic Effectiveness of COVID-19 Government Relief in Indiana

Author(s):

John Lawicki, School of Management

Abstract:

Abstract redacted.

Mentor(s):

Kelly Blanchard, School of Management, Economics

Poster Presentation Abstract Number: 258 :: Mathematical/Computation Sciences

Krannert School of Management

A Novel Approach to Align Forecasts to Competing Operational Business Outcomes

Author(s):

Jiacen Liu, School of Management

Hui Zeng, School of Management

Abstract:

We research and develop an approach and tool that quantities credit union branch cash-on-hand forecasts and identifies the set of predictions among a set of competing models that balances competing KPIs among the Chief Membership Engagement Officer and Chief Financial Officer. This research project extends the 2021 Crossroads Classic Analytics Challenge among Butler University, Indiana University, University of Notre Dame, and Purdue University where the student authors won first place in the undergraduate division. We show 1) how our ensembled forecast algins to a couple custom and changeable business KPIs agreed upon among the CMEO and CFO, 2) how any model forecast could be evaluated from these business perspective metrics prior to deployment, and 3) we develop a tool that the credit union's Business Intelligence team can use in practice.

Mentor(s):

Matthew Lanham, School of Management, Quantitative Methods

Poster Presentation Abstract Number: 259 :: Mathematical/Computation Sciences

Krannert School of Management

Purdue Basketball Turnover and Dribble Data Analysis

Author(s):

Zac Matheny, School of Management

Abstract:

For my project I worked with the Purdue Men's Basketball Data Analyst to observe trends related to the weaknesses in the team. By using excel we were able to provide suggestions to the coaching staff to solve these problems and help the team perform better. The analysis mainly focused on the who, what, when, where, and why with turnovers and dribbles.

Mentor(s):

Gary Evans, School of Management, Quantitative Methods

Poster Presentation Abstract Number: 260 :: Social Sciences/Humanities/Education

Krannert School of Management

Dynamic Gender & Leadership: A Role Congruency Approach

Author(s):

Olaoluwakitan Smith, School of Management

Abstract:

Past research has identified that stereotypes of men are relatively stable, while stereotypes of women are dynamic (Diekman & Goodfriend, 2006). More specifically, over time, people expect women to increase in masculinity, while not changing in femininity. Simultaneously, perceptions of leadership have changed to include higher levels of emotional intelligence and feminine characteristics. The purpose of this research was to examine how these changing views of women affected perceptions of them as leaders. Across two studies participants were asked to indicate the average woman, man, and leader on both masculine and feminine characteristics across a 100-year period (past - 1970, present - 2020, and future - 2070). Study 1 treated year as a between-subjects variable and gender as a within-subject variable, while Study 2 treated gender as within-subjects and year as within. Results in both studies revealed that across time and gender, men and leaders consistently looked more similar, while women looked different. More specifically, even with changing perceptions of women and leaders, men and leaders are consistently more similar in the past, present, and future, than women and leaders. The most prominent implication of these studies' results is that even though stereotypes for women are changing to include more agentic and successful traits (Diekman & Goodfriend, 2006), the expectation is that women's roles will never be congruent with leaders. It seems the think-manager-think-male phenomenon (Schein, 1973) is far from changing.

Mentor(s):

Meara Habashi, School of Management, Organizational Behavior & Human Resources

Poster Presentation Abstract Number: 261 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

Investigation on Barriers to Lean Manufacturing Implementation

Author(s):

Keita Arakawa, Polytechnic Institute, Honors College

Abstract:

Lean manufacturing, a methodology introduced by the Toyota Production system, focuses on minimizing waste while simultaneously increasing company value. Many barriers exist which prevent effective implementation of the lean methodology, including ineffective management, poor company culture, lack of incentives, limited employee training, and inefficient technology. This poster aims to summarize findings from an Indiana-specific lean survey (sample size = 126), quantifying the influence of barriers on organizational decision making towards implementation. The survey required participants to rank-order to what extent barriers prevent lean implementation. Secondary data was also used to block companies to revenue generated and quantity of employees. The data analysis utilizes the Kruskal-Wallis test to compare ranked values according to the blocked demographics. The test shows that larger companies (≥20 employees) are more affected by a culture barrier in implementing lean manufacturing than smaller companies (≤20 employees). The poster concludes with providing recommendations for overcoming lean implementation barriers.

Mentor(s):

Lisa Bosman, Polytechnic Institute, Technology Leadership & Innovation

Poster Presentation Abstract Number: 262 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

Digital Portal for the Data Visualization Process

Author(s):

Nicole Dwenger, Polytechnic Institute

Abstract:

Data visualization is an important, multi-stage process in finding insight through data synthesis and analysis. The data visualization community understands that it’s valuable to teach the process, but there is no consensus on how. One approach is to use activity worksheets to guide students through the data visualization process. Previous worksheet designs involved transferring paper-based worksheets into digital surveys. These surveys were populated by users online and saved as data for analysis. However, this approach lacked a portal to house the worksheets. The absence of digital storage makes analysis of students’ perceptions and the effectiveness of the worksheets difficult to assess. In this work, I will design and develop an interactive web-based platform that guides a user through the steps of the data visualization process using embedded Qualtrics surveys. User testing will be conducted on a prototype through Google Sites to determine the usability and impact of the platform. The user group that will test the platform are undergraduates and graduates who have learned the data visualization process previously. After testing and gathering feedback, I will iterate on the design of the prototype using the intended technology. The final platform will use GatsbyJS, MDX, and GitHub Pages to easily develop, update, and deploy the digital portal. The digital portal is designed to simplify the process for beginners and serve as a teaching tool for teachers introducing the data visualization process. The digital portal will serve as a prototype for desktop applications that can be modeled for multi-institutional use.

Mentor(s):

Vetria Byrd, Polytechnic Institute, Computer Graphics Technology

Poster Presentation Abstract Number: 263 :: Social Sciences/Humanities/Education

Purdue Polytechnic Institute

Minecraft modders and their ownership of mods

Author(s):

Robert Hastict, Polytechnic Institute

Abstract:

Video game communities, especially who's game of choice is a PC or Computer game, have a prolific modding scene. Modders, creators of downloadable addons or modifications to the video game, have come to dominate a part of how gamers consume gaming content. Yet very little research has been conducted into how the Modders feel about their mods, or more specifically, who owns the mod as a piece of intellectual property. It is not unheard-of mod teams becoming video game developers, working for the video game company that created or owns the video game that the mod was made for, or working on an independent project using the mod as a design basis. The objective of the study will be asking Minecraft Modders, who have a mod with over 100,000 downloads on the website Curse Forge and have a mod currently available for the current version of Minecraft, version 1.16, to fill out a questionnaire related to their experience with Modding, their feelings about their mods, and who they feel owns the mods they create. The hypothesis is that Modders will feel that they own the mods they created. Minecraft's community was chosen due the game being one of the best-selling video game titles of all time, along with having an active modding community across numerous forum sites. The website Forge Curse was chosen due to easy of access to data and contacting Modders. The questionnaire has not been created, data about the Modders has yet to be collected.

Mentor(s):

Kathryn Seigfried-Spellar, Polytechnic Institute, Computer Information

Poster Presentation Abstract Number: 264 :: Mathematical/Computation Sciences

Purdue Polytechnic Institute

Creating a Prototype Visualization Tool for Analyzing Pre-pubescent Lupus Data

Author(s):

Nathan Kanter, Polytechnic Institute

Abstract:

Systemic Lupus Erythematosus (SLE), commonly known as Lupus, is a chronic autoimmune disease, that can target any organ in the body. The disease has been reported to be most dangerous for adolescents in the first year after diagnosis. The aim of this research is to develop a prototype visualization tool for analyzing pre-pubescent Lupus data. This research utilizes data visualization techniques and visual analytics to examine a variety of variables that track Lupus symptoms and puberty progression. This will enable incremental refinement of the interface and assess functionality of the tool. The current results show the earlier an adolescent is in puberty, the worse the Lupus symptom flares are. Theoretically, this could be due to the intense surge of hormones into the body, primarily leptin. The results suggest if the correct hormone can be identified as the catalyst for the flares, the hormone could be suppressed to slow down the progression of puberty to provide improved quality of life for SLE adolescents. Continued work will include adding statistical elements to the backend to provide summary information about the data to help users better understand the data. To enable this functionality, the following features will be integrated into the tool: creating a filter for variables, a breakdown menu for each individual patient, and a cross-variable analysis. This work has been partially funded by the Purdue Science and Technology Center (NSF CCF-0939370) and the OUR Scholars Scholarship with IRB approval (IRB #1807020849).

Mentor(s):

Vetria Byrd, Polytechnic Institute, Computer Graphics Technology

Collaborators:

Dr. Kathleen M. O’Neil, Riley Children’s Hospital

Dr. Martha Rodriguez, Riley Children’s Hospital

Poster Presentation Abstract Number: 265 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

Safety Culture In the Purdue Flight Program: Cirrus SR-20 vs. Piper Archer

Author(s):

Elliot Knapp, Polytechnic Institute, Honors College

Abstract:

The purpose of this study is to understand the risk and safety implications of a full plane fleet change at the Purdue University Airport, where a large volume of student flight training is conducted. During the summer of 2020, the Purdue flight program introduced a fleet of 13 Piper Archer aircraft, replacing most of the Cirrus SR-20 aircraft in use. The difference in layout and maneuverability of the two types of aircraft posed a threat to flight instructors and students whom had never flown the Piper Archer. Using operational manuals and interviews with students and flight instructors, this presentation examines the critical differences between the aircraft and how students and instructors have adapted to the drastic change. I review personal experiences the subjects have had while flying, as well as the hazards and obstacles for the common Purdue pilot. The subjects were asked a series of questions involving personal incidents of risk with both aircraft, key differences noticed between the aircraft, and the successfulness of the fleet transition. This review portrays the effectiveness of safety protocols and requirements implemented and how the subjects have responded to an enhanced safety culture in the 2020-2021 school year. This presentation confirms the increased risk associated with a new aircraft and encourages diligence and cooperation from the entire program to follow proper procedure and identify potential safety threats.

Mentor(s):

Stephanie Brown, Polytechnic Institute, Aviation & Transportation Technology

Poster Presentation Abstract Number: 266 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

Measurement of Biological Signals using P-Type Organic Field Effect Transistors

Author(s):

Walter Kruger, Polytechnic Institute

Abstract:

Organic Field-Effect Transistors (OFETs) have been characterized and fabricated in laboratories with increasing success. OFETs have been identified as an emerging technology with great potential within the medical and biotechnology areas of study. This project aims to demonstrate the OFETs' capabilities of passing biological signal by characterizing the response of a P-Type OFET to electrical currents generated by muscles (Electromyography Signal) and heart palpitations (Electrocardiogram Signals). Through the application of simulated bio-signals into the OFET, the corresponding current-voltage output readings are measured to showcase the low voltage signal passthrough of the specified signals. Additionally, output characteristics and transfer curves for the OFETs are analyzed to evaluate the performance of the OFET and provide insight on its current-voltage capabilities. This data is gathered with the goal of providing future researchers with the methodologies and techniques used to measure common bio-signal and achieve signal amplification using single OFET networks.

Mentor(s):

Mohammad Javad Mirshojaeian Hosseini, Polytechnic Institute, Engineering Technology

Robert Nawrocki, Purdue University

Poster Presentation Abstract Number: 267 :: Physical Sciences

Purdue Polytechnic Institute

Design of a compliant variable-stiffness elbow exoskeleton for human arm rehabilitation

Author(s):

Jiayu Luo, Polytechnic Institute

Abstract:

This research presents an in-process design of a novel passive variable-stiffness joint (pVSJ) device that is aimed to be used in rehabilitation purpose. Several concepts are explored in this research and one optimal design is selected. The goal of this research is to develop a device capable of changing stiffness as desired, as it will be adapted to human joint rehabilitation process. A prototype was made to test the concept, corresponding CAD models and FEA are developed to further verify the design. Current rehabilitation process requires a lot of man-power and specialized environment with corresponding equipment, for example, gyms and dumbbells. Current exoskeleton designs are also mostly active actuated, thus required external power source and complex actuators. Thus, our ultimate goal is to have this process can be done anywhere, anytime, with no specific equipment and power source restrains. The result of this research would be a compact pVSJ that could be easily attached to light weighted exoskeleton frames without active power input. This work has quite a broad potential even besides rehabilitation, such as outer space exercise devices or haptic VR applications.

Mentor(s):

Dongming Gan, Polytechnic Institute, Engineering Technology

Poster Presentation Abstract Number: 268 :: Mathematical/Computation Sciences

Purdue Polytechnic Institute

Building Visualization Tools for Mathematical Structure

Author(s):

Natalie McGuckin, Polytechnic Institute

Abstract:

I am conducting research to design a visualization in the area of game theory. This research team includes faculty and colleagues from five universities. We are analyzing the results of over 100 years of computation on Purdue’s clusters, resulting in more than 100 Petabytes of data. The goal is to understand the underlying structure of the mathematics for a large game theory problem. We have built a tool where we can pick any three points in the parameter’s space of the problem and have our visualization show us the structure of the game in that region. At any (x,y,z)-coordinate, we can use an interactive "hover" feature that reveals the underlying mathematical structure to the user. We are using D3.js, a JavaScript library, to visualize the data. The visualization approach is crucial because the mathematical structure is recursive. We routinely use the visualization tool to zoom into the space, revealing the fine-grain details of the attributes for the space, in a way that would be impossible without this tool. This research is related to a foundational game theory problem that has been open since the 1960s. By conducting this research, we will further the understanding of this foundational game theory problem.

Mentor(s):

Mark Daniel Ward, Vice Provost for Teaching & Learning

Poster Presentation Abstract Number: 269 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

Design of Variable Stiffness Ankle Exoskeleton

Author(s):

Krishna Rao, Polytechnic Institute

Abstract:

Here we present the design of a novel variable stiffness ankle exoskeleton that is lightweight, quiet, efficient, and cheap to manufacture. This ankle exoskeleton does not restrict normal locomotion and provides assistive torque to the ankle allowing for an increased efficiency in walking and running. This work is an extension of previous research done on passive variable stiffness joints (PVSJ) from our previous research. We created a device that utilizes a clutch system with multiple springs in parallel with the calf muscle that will aid daily bipedal locomotion. Our new design highlights the ability to change effective stiffness more rapidly than previous designs, while maintaining the desired stiffness ranges. This concept can be used in a wide variety of applications such as increasing efficiency of movement, helping elderly, and for recreational use.

Mentor(s):

Donming Gan, Polytechnic Institute, Engineering Technology

Poster Presentation Abstract Number: 270 :: Social Sciences/Humanities/Education

Purdue Polytechnic Institute

Children's Perceptions of Manufacturing Careers: Examining the Influence of Industry-Public Education Initiatives

Author(s):

Sydney Serban, Polytechnic Institute

Abstract:

Manufacturing in the United States economy has been a key factor since the start of the industrial revolution, and it continues to influence the nation's economic success. However, by 2028, it is estimated that manufacturing in the United States will face a shortage of over two million workers. Accordingly, recommendations have been made to remedy this issue by investing in long-term industry and public education partnerships. Therefore, this study focused on investigating children's perceptions of manufacturing before and after an industry-led outreach initiative titled Manufacturing Week, developed through a regional commerce group and co-hosted by several large manufacturing companies in one Midwestern town.

Students ranging from grades K through 12 were surveyed before and after the industry-driven outreach event. The survey results were analyzed to determine any significant changes in regard to the participants' career perceptions and open-response questions were coded to provide a qualitative description of their experience during the event. It is important to understand how STEM outreach activities that often involve robotics, coding, and design, align with actual workforce demands. In general, survey results suggest participants seemingly realized that there are other career pathways in manufacturing that do not require a 4-year college degree to enter, felt that creativity and innovation could be encouraged in the related careers, and recognized that manufacturing jobs pay well. This study shows that the activities included in Manufacturing Week may have helped participants to develop a more accurate perception of manufacturing-related careers while also influencing their appreciation of the manufacturing process.

Mentor(s):

Dr. Greg Strimel, Polytechnic Institute, Technology Leadership & Innovation

Liesl Krause, Purdue University

Poster Presentation Abstract Number: 271 :: Social Sciences/Humanities/Education

Purdue Polytechnic Institute

Childrens STEM Literature

Author(s):

Alexia Seymour, Polytechnic Institute

Abstract:

This research project was designed to see what preconceived gender norm ideas that elementary aged students had about STEM. Over the course of 8 weeks a researcher would go into a local elementary school and read to a class of students in each grade (K-5). Students were given a pre-study questionnaire with questions about STEM, such as "I like Math", "Boys are good at Science", "Girls are good at Technology". Students would circle a thumbs up, thumbs down, or a question mark if they did not know. The next 6-weeks were when the researcher would go into the classes and read different books from the NSTA's Top STEM Children's Literature Books. During the final week the students would take the exact same survey. This allowed us to input their responses from the beginning of the time, to the final 8th week into an excel sheet to compare their changes from thumbs down to thumbs up and so on. After all of the data is inputted the data is analyzed.

Mentor(s):

Dr. Greg Strimel, Polytechnic Institute, Technology Leadership & Innovation

Poster Presentation Abstract Number: 272 :: Social Sciences/Humanities/Education

Purdue Polytechnic Institute

Abandoned Sentinels: An analysis of the past, present, and future of former armed forces installations

Author(s):

Jacob Slater, Polytechnic Institute, Honors College

Abstract:

Abandoned Sentinels seeks to draw attention to a relatively unknown set of former military installations located around the San Francisco Bay Area. Following their closure, the sites have seen little in the way of recognized re-use, falling into an inescapable state of ever growing decay. Yet, amidst perceived disuse, the installations continue their history, serving an entirely different mission outside the purview of national defense. Utilizing historical documents, current public records, oral histories, and present-day photographs, sites are presented in both historical and modern contexts. Building on the theoretical framework of "Ruinology", I reconstruct the process by which these places came to be ruins and document the forgotten histories of these neglected landmarks. The resulting analysis details how the previous missions of former installations impact their eventual re-use. Further, insight is provided into the availability of historical documentation, the usefulness of documentation in analyzing abandoned places, and the significance of in-person fieldwork with regards to the analysis of modern ruins. Through the consideration of both the historical and present state of former installations, a better understanding of their present reality can be formed.

Mentor(s):

Jason Parry, Honors College

Poster Presentation Abstract Number: 273 :: Social Sciences/Humanities/Education

Purdue Polytechnic Institute

Needs Assessment of Digital Forensic Examiners

Author(s):

Lucas Wiese, Polytechnic Institute

Abstract:

Digital forensic investigators and examiners experience high rates of negative mental health symptoms frequently leading to cases of PTSD. Therefore, a needs assessment was compiled to assess the gap of the current and desired levels of well-being in this population. Needs assessments of this sort have been used in military populations and other professional industries, however, no survey regarding law-enforcement has yet been completed. The survey was compiled from several established and validated scales which were gathered from past literature, standards, and related studies. Nevertheless, specific adaptations were made to fit our population as we worked to modify scales such as the PTSD Checklist, Perceived Need for Care Questionnaire, Traumatic Event Scale, Life Stressor Events Scale, and more. Additionally, there are measures and scales to catch social & familial support, psychological distress, coping mechanisms, and job satisfaction. Accordingly, a holistic view of the individual's well-being is gathered including their perceived need for care. While the survey is complete and the study approved by the IRB, the data collection is not yet complete where we aim to reach 200 respondents in either the public or private sector. Moving forward, we hope that the results collected will give us a clear picture of the mental health and well-being of these individuals with data about their perceived need for care. People who are responsible for the care and development of these individuals should use our data set to form implementations or procedures for care focused on this population in this stigmatized industry.

Mentor(s):

Kathryn Seigfried-Spellar, Polytechnic Institute, Computer Information

Poster Presentation Abstract Number: 274 :: Social Sciences/Humanities/Education

Honors College

Automated Data Processing: Making Community Indicators Possible for Lafayette, Indiana

Author(s):

Jace Newell, College of Engineering, Honors College

Eli Coltin, School of Management, Honors College

Eric Flaningam, College of Engineering, Honors College

Abstract:

City and regional planners have utilized community indicators for more than 100 years to measure the interdependence of social, environmental, and economic inputs that influence a community's well-being. Collaborators seeking this type of community information, notably in the north-end region of Lafayette, Indiana, United States, cannot develop indicator-based projects because of the prohibitive, manual, and labor-intensive analysis processes. These practices keep not only Lafeyette but cities worldwide from implementing dedicated community indicator systems.

What is the extent to which an automated process will efficiently provide sufficient data for the City of Lafayette to inform neighborhood revitalization, affordable housing, and homelessness intervention initiatives? In what ways can our data processes be quantitatively analyzed using automated, software-aided approaches? These are the questions addressed within this project as we examine specific community indicators to provide adaptive recommendations to the increasingly impoverished, suffering region of Indiana. The plan is to mitigate the current labor-intensive reality by creating an automated system that will result in the city receiving up-to-date data and analysis that will assist them in formulating optimal decisions about existing and future community development initiatives.

Researchers are partnering with the City of Lafayette in developing automated processes to evaluate project performance through scripted, autonomous community indicator reporting. By accessing and statistically analyzing city information databases, researchers are gauging community projects' effectiveness and necessity in Lafayette's north-end region. These results will continuously and positively impact the outcomes of the decisions our partners, the City of Lafayette, commit to concerning the well-being of its members.

Mentor(s):

Jason Ware, Honors College

Poster Presentation Abstract Number: 275 :: Social Sciences/Humanities/Education

College of Liberal Arts

Online Radicalization on Facebook

Author(s):

Brooke Price, College of Liberal Arts

Abstract:

In this modern age of surveillance capitalism, the product that companies such as Facebook and Google sell is users. This is a successful business model for the companies but has detrimental effects on society. Scholars have examined how companies like Facebook have violated peoples' privacy, censored speech, allowed radicalism to spread, and monopolized their industries. How has Facebook treated different threats of radicalization, such as Islamic extremism and white nationalism? To answer this question, this research draws from the Facebook Incidents Database, which uses news data (2004-2020) to track 4,097 Facebook incidents and over 800 Facebook-related regulatory scrutiny and lawsuits. The database is the first scholarly effort to organize Facebook's global incidents in issues ranging from speech, privacy, monopoly, fake news, and radicalization to place scandals like Cambridge Analytica into wider context. The database also relies on human coders to track Facebook's response and any resulting legislation as well as determine Facebook's responsibility for and political importance of each incident. For this research, I use the database to evaluate radicalization incidents and scandals that have occurred on Facebook to see how media attention to the types of radicalization occurring on Facebook have changed over time. I also track Facebook's response and global regulation following these scandals to analyze any differences in their treatment.

Mentor(s):

Swati Srivastava, College of Liberal Arts, Political Science

Poster Presentation Abstract Number: 276 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Purdue Canines for Autism Research Study

Author(s):

Annika Larson, College of Health & Human Sciences, Honors College

Rhea Sparrow, College of Health & Human Sciences

Abstract:

Purdue CARES: A pilot study exploring the effects of service dogs on children with Autism Spectrum Disorder and their families

Despite an increased inclusion of skilled companion animals as a complementary intervention method, there is a lack of empirical research exploring the partnering of service dogs with children with Autism Spectrum Disorder (ASD). Purdue CARES (Canines for Autism Research Study) is a pilot study focused on evaluating the impact of service dogs on child ASD symptomology, stress physiology, and sleep, along with caregiver well-being, and overall family functioning. Study participants, recruited from Canine Companions for Independence (CCI), a national service dog provider, include children with a diagnosis of ASD between 4 to 17 years of age and their caregivers. The treatment group of our study includes 42 families currently with a service dog and the control group includes 36 families currently on the CCI waitlist to receive one. Methods for data collection include a caregiver survey containing several standardized behavior rating scales to assess child functioning (e.g. Social Communication Questionnaire, Aberrant Behavior Checklist, Behavior Assessment System for Children). This survey also contains self-report measures for the caregiver (e.g. Patient Health Questionnaire, Caregiver Strain Questionnaire). Saliva samples are also collected by caregivers over a three-week period to evaluate stress levels through measurement of the salivary cortisol awakening response. Purdue CARES hopes to offer insight into the efficacy of service dogs for children with ASD and their families and to provide an evidence base that allows more families to potentially understand what to expect from this complementary intervention.

Mentor(s):

Marguerite O'Haire, College of Veterinary Medicine, Comparative Pathobiology

Kerri Rodriguez, Colorado State University

Bridgette Kelleher, Purdue University

Mandy Rispoli, Purdue University

Poster Presentation Abstract Number: 277 :: Life Sciences

College of Agriculture

Effect of Rising CO2 Emissions on Tomato Immunity Relationship with Endophyte

Author(s):

Silenze Esquivel Benjamin, College of Agriculture

Abstract:

Concerns with climate change and how it will affect the severity of plant diseases, decrease future crop yields, and threaten future food security in a world of increasing human population is at the forefront of understanding emerging challenges in agriculture. The elevated atmospheric CO2 levels on Earth will impact interactions between plants, their mutualists, and their pathogens. This can have a significant impact on crop yields, thereby stressing the importance to anticipate the developing changes. Plants are known to be key players in the food web to provide energy for other organisms, not only pathogens and herbivores, but a community of commensal and mutualistic microbes as well. Tomatoes are known to support *Trichoderma harzianum*, a fungal endophyte, that in turn aids in the development of ISR (Induced Systemic Resistance) of the tomato plants against other pathogens, such as *Botrytis cinerea*, a foliar fungal pathogen. With the onset of climate change, the ISR may transform with elevated atmospheric CO2 levels. CO2 level increases have the potential to change plant photosynthetic rate, stimulate plant growth, and increase carbon allocation to the roots. The immunity of three different tomato plant varieties were studied with their established mutualist, *Trichoderma harzianum*, against *Botrytis cinerea*, under ambient and elevated atmospheric CO2 concentration conditions. Results from this study will aid in providing a better understanding of a puzzle piece of our future and current agricultural challenges in the face of climate change.

Mentor(s):

Lori Hoagland, College of Agriculture, Horticulture & Landscape Architecture

Amit Jaiswal, Purdue University

Poster Presentation Abstract Number: 278 :: Social Sciences/Humanities/Education

College of Education

Launch the Future

Author(s):

Kayla Neal, College of Education

Abstract:

There is compelling evidence that the racial and class disparities in STEM are caused by systemic barriers that exist before college, primarily due to the lack of exposure and representation in these fields. This lack of exposure has long term implications that restrict not only awareness that lower-income students and students of color have about STEM careers, but also their interest, efficacy, and aspirations for those careers. For example, only 29% of Latinx students and 21.8% of Black students who started college with the intention of majoring in a STEM field graduated with a STEM bachelor's degree after six years in comparison to 52% and 43% of their White and Asian peers, respectively. By working with the Downtown Boxing Gym in Detroit, MI, the Launch the Future Project seeks to provide services and spread awareness for groups who have been historically ignored or mistreated in society, specifically lower-income Black and Latinx students. The study used interviews with students and staff at the Downtown Boxing Gym as well as surveys to take qualitative measures of STEM interests, career expectations, engagement, efficacy, and enjoyment. These interviews and survey results were then coded into categories such as knowledge of STEM interests, perception of personal attainment potential, sources and content of messages concerning STEM, experiences of STEM in school, perceived importance of STEM, and other factors influencing perception and decisions about STEM careers. This data will be used to determine how the Downtown Boxing Gym impacted students' STEM interests, efficacy, and aspirations.

Mentor(s):

Amanda Case, College of Education, Educational Studies

Poster Presentation Abstract Number: 279 :: Social Sciences/Humanities/Education

College of Education

How Different Types of Linguistic Scaffolds Increase Language Comprehension and Interactions for English Learners through Interactive Read Alouds

Author(s):

Kailyn Smith, College of Health & Human Sciences

Abstract:

The purpose of read alouds are to increase comprehension, connect with children's background, and to have children experience a fluent reader. The dynamic nature of a read aloud by a teacher can foster all such criterion with English learners (ELs), who are at varying levels of language proficiency, because it naturally scaffolds their understanding through interaction, gestures, and use of pictures. Recently, audio recorded books have been used instead of teacher read alouds, which may reduce the original read aloud benefits for ELs. Instructional scaffolds used during read alouds foster relationships and allow for a more interactive environment that can improve the understanding of a given text, while simultaneously addressing their English language development. Scaffolds include asking questions (linguistic), acting out movements (kinesthetic), and repeating sections of the book with students (linguistic). In this study, I analyze a transcript drawn from two video captures of separate read alouds in the same kindergarten classroom at the beginning and middle of the school year. An analysis was performed to code the different types of scaffolds teachers employed and describe the number of students' reception of these scaffolds. The main purposes of this study were to observe which scaffolds were being used and students' responses to them. These results will help determine which scaffolds are best for increasing comprehension and language production. The implications from this study suggest that the implementation of linguistic scaffolds can enhance language comprehension and student interactions with teachers.

Mentor(s):

Patricia Morita-Mullaney, College of Education, Curriculum & Instruction

Poster Presentation Abstract Number: 280 :: Life Sciences

College of Engineering

An Analysis of Mycobacteriophage Scoobydoobydoo

Author(s):

Ryan Richard, College of Engineering

Samuel Spence, College of Engineering

Yug Rao, College of Science

Abstract:

Bacteriophages are essentially viruses for bacteria. They attach onto a bacterial cell, and hijack the cellular machinery in order to reproduce. We have been studying these phages and their genomes in order to find out more about what each gene does. In order to annotate the genes of phages correctly a variety of databases and reports are used to determine the start site and function. Phage databases and softwares are able to help confirm the start site and potential function of a gene after it has been auto-annotated in our software. Once the genes are called throughout the genome, several programs were used to further analyze the structure and function of the proteins through a three pronged approach. First, a Python program was used to identify and classify the mutations in the base pair sequence of specific genes, to gain insight about where mutations occur. The evolutionary process of the genome was also traced using phylogeny programs, and the structures of similar proteins were then visualized and analyzed. Bacteriophages are a great source for a ton of genetic information, as there are many different types with different functions. The specific phage we are annotating has only two known close relatives, so the work we are doing is very new, and could provide valuable information on bacteriophage genetics, and add to the current database for bacteriophages.

Mentor(s):

Anthony Hegarty, College of Agriculture, Agricultural & Biological Engineering

Gillian Smith, Purdue University

Poster Presentation Abstract Number: 281 :: Life Sciences

College of Science

Determining the structure of Bam A in Pseudomonas aeruginosa

Author(s):

Michelle Mai, College of Science

Abstract:

Pseudomonas Aeruginosa is a Gram-negative bacterium that causes many diseases in living organisms. In humans, it usually infects those whose immune systems are already weakened by an existing disease, such as cystic fibrosis. The danger of this bacterium derives from its increasing development of antibiotic resistance to multiple drugs. In order to create new antibiotics, it is important to understand the structure and function of Pseudomonas Aeruginosa. P. aeruginosa requires a ß-barrel-assembly machinery (BAM) complex to create ß-barrel outer membrane proteins. These proteins are very important for the function of the Gram-negative bacterium. The BAM complex consists of five components, BamA, BamB, BamC, BamD, and BamE.

In order to determine the structure of BamA in P. aeruginosa, many steps were performed. Bioinformatics was completed to understand different aspects BamA, such as gene sequence and molecular weight. The gene was cloned, expressed, and purified. In the future, structural analysis needs to be completed, such as CD analysis and X-ray crystallography to understand the structure of P. aeruginosa.

Mentor(s):

Matthew Huber, College of Science, EAPS

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Eligibility: No prior research experience
Cross-listed with ILS 180

GS 39501 UNDERSTANDING YOUR UNDERGRADUATE RESEARCH EXPERIENCE II

This second course for Purdue undergraduate researchers focuses on data through collection, analysis, and communication. Each student develops an academic poster to present their research project data and implications and provides/receives peer feedback.

Eligibility: Completed 29501
Cross-listed with ILS 380

GS 29501 UNDERSTANDING YOUR UNDERGRADUATE RESEARCH EXPERIENCE I

This first course for active Purdue undergraduate researchers employs self-reflection to better contextualize what they gain during their research. Students also use their research experience to further develop skills in time management, research communication, using Purdue Libraries' resources, and providing constructive feedback to peer researchers. Students deliver and critique research pitches and abstracts about their projects.

Eligibility: Current undergraduate researcher
Cross-listed with ILS 280

GS 49501 BEYOND UNDERGRADUATE RESEARCH

This course is for Purdue students considering graduate or professional school. Students examine the various phases of program identification, selection, application, and funding. They recognize qualities and skills that make research mentors effective while developing their own skills as mentees and future mentors. Students conduct research to identify potential programs and develop a statement of purpose.

Eligibility: Junior or senior status interested in graduate/professional school
Cross-listed with ILS 480

For more information, contact us!

Hicks Undergraduate Library Suite G937
504 W. State St.
West Lafayette, IN 47907
765-494-6503
UGResearch@purdue.edu
purdue.edu/undergrad-research

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