

2022
SROP

**Purdue University
Summer Research
Opportunities Program**



SROP

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Undergraduate University: New Mexico Tech

Undergraduate Degree: Computer Science

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Mechanical Engineering

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Tahira Reid Smith

Research

An Examination of User Performance in a Quadrotor Landing Task With Dynamic Obstacles

As technology becomes more and more advanced, it can be hard for humans to keep up with. This is why a focus in Human-Machine Interactions becomes so important. Human-Machine Interactions are exactly what they sound like, they are interactions between humans and machines. Attempting to create machines that are more user friendly, or offer some sort of assistance or support to the machines operator can be beneficial both to the learning process for someone to use a machine, or help to contribute to the overall safety of the environment revolving around the machine. This study will focus on the observation and collection of data for research subjects interacting with a 2d quadrotor simulator. In particular, it will focus on the impact of unexpected changes in the simulator environment, and determine how well the subject can respond to such changes. Based on how the subjects react to these tests, we can better assess where assistance technology may be needed in the future, and better understand where human error can come into play.

Marcela Munoz



Undergraduate University: California State University

Undergraduate Degree: Sociology

Undergraduate Graduation Date: June 2023

Graduate Field of Study: Psychological Sciences

Purdue University SROP College: College of Health and Human Sciences

Purdue University SROP Faculty Mentor: Dr. David Rollock

Research

A Preliminary View of Asian Demographic Diversity in the Clinical Science Literature

Marcela Munoz and Dr. David Rollock

Overall there is a growing need to understand South Asians and other underrepresented populations that fall under the umbrella term of Asian. Although there has been a major emphasis on expanding the studies of the Asian population as a whole, little is known about the actual demographic breakdowns that represent and diversify this large community. The purpose of this preliminary study is to understand how well demographical diversity is represented and characterized. In this study I examined and coded six top Clinical Psychological Science scholarly articles, as well as six Cultural Diversity and Ethnic Minority Psychology articles in order to gain a better sense of what social scientists are reporting in their data in terms of race in order to study how well diversity is specifically documented into their methods. As a result of this I discovered that Ethnocultural Specialty journals have a greater amount of articles that go beyond broad levels of broad continent classification (Level 1) compared to CSP, and report higher levels of ethnicity and analyzation (Level 2&3) towards the greater Asian community. Overall, the mainstream Psychological (CSP) journals do not report specific levels of ethnicity due to the fact that they do not deem it to be as 'important' in their area of study. By analyzing these 12 top scholarly articles, I have concluded that the CDEMP has a higher emphasis on race, but overall there is still much growth and representation for Asians and their region of origin. By conducting research on this topic and analyzing top scholarly articles I can conclude that the CDEMP has a higher emphasis on race, but overall there is still much room for growth and representation for the specific populations.

Kojo Benefo



Undergraduate University: University of Maryland

Undergraduate Degree: Mechanical Engineering

Undergraduate Graduation Date: May 2024

Graduate Field of Study: Aeronautics and Astronautics

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Wayne Chen

Research

High-Velocity Flight of Sand Particles for Gas Gun Impact Experiments

Turbines have implemented ceramic composites in the hot zones of turbines due to the microporous structure and heat resistance of ceramic materials. This makes the erosion of jet turbines more unpredictable, and unpredictability can be dangerous. The unpredictability comes from the behavior not being well studied. Erosion from these turbines can come from planes flying over arid areas. Arid areas have an increased number of loose particles in the atmosphere, such as sand, dirt, and other sediments. A single grain of sand, cannot do much, but masses of sand hitting a turbine at high speeds can cause significant damage over time. As a result, the turbine life can decrease or yield unexpectedly due to the brittle nature of ceramic matrix composites. To simulate this phenomenon, high-speed impact particle testing is undertaken. Using different pressures, a sabot is propelled towards the sabot stripper. This method must be used to fire projectiles of small size and irregular shape. A high-speed velocity reader calculates the particles' speed as it exits the barrel, and a high-speed camera captures the particle leaving the sabot stripper. With this, the best methodology for stripping the sabot can be found. An evaluation of the flight path can determine the efficiency of the sabot and sabot stripper. Finally, one can evaluate the impact of the particle on the targets.

Diego Navar



Undergraduate University: University of Washington

Undergraduate Degree: Political Science – International Relations

Undergraduate Graduation Date: May 2024

Graduate Field of Study: Political Science

Purdue University SROP College: College of Liberal Arts

Purdue University SROP Faculty Mentor: Dr. Jay McCann

Research

The Poor People's Campaigns Participation

The Poor People's Campaign (PPC) is a movement led by Reverend William Barber which seeks to empower and organize working class poor people across the Nation. The Poor People's Campaign evolved from the Moral Mondays movement that was based in the mountains of Appalachia, specifically North Carolina. The PPC is an ecumenical movement of all people regardless of class, age, race or creed that represents the poor. Its main goal is to uplift the working-poor by igniting a moral revival in the US through a fusion coalition of all different types of people. This is the main goal of the movement as the messaging of Reverend Barber has been clear and consistent since the inception of the movement. Today the movement is still centered in the Northeast and South but has spread to become nationwide. This study sought to find out the characteristics of the movement's participants as the movement claimed to be composed of people of all ideologies, class, age, race and creed. The results we found was that the movement's participants were overwhelmingly older, educated, Liberal and Christian. These findings indicated that the demographics of the Marchers did not align with the "fusion coalition" the organization claimed to have as a base.

Douglas McGowan



Undergraduate University: Pennsylvania State University

Undergraduate Degree: Mechanical Engineering

Undergraduate Graduation Date: May 2025

Graduate Field of Study: Mechanical Engineering

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Steven Son

Research

Ballistic Property Testing of Solid Propellants Across Various Scales

Solid propellants are a great way to harness chemical energy for various uses, including rocket engines and munitions. They can be produced in numerous different ways, with varying formulations. To reliably use these formulations, knowledge of their ballistic and mechanical properties is required. Two of the most fundamental properties are burn rate and tensile strength. However, learning about these properties requires a large amount of mixing, casting, testing, and data analysis. The goal of this project is to streamline that process by collecting data on several formulations that can be analyzed and used to hone the accuracy of a machine learning project. By comparing results between different formulations and sample sizes, machine learning algorithms can be utilized to predict the behavior of larger scale samples.

Elijah Velasquez



Undergraduate University: Texas Tech University

Undergraduate Degree: Psychology

Undergraduate Graduation Date: December 2022

Graduate Field of Study: Psychological Sciences

Purdue University SROP College: College of Health and Human Sciences

Purdue University SROP Faculty Mentor: Dr. David Rollock

Research

Color-Blind Racial Ideology and Political Orientation: Variations by Gender & Ethnicity

Elijah Velasquez, Adilene Osnaya, and David Rollock, PhD.
Purdue University

Background: Color-Blind Racial Ideology (CBRI) has shown evidence of reinforcing racial prejudices and/or inequalities as an expression of ultramodern notions of racism among White Americans and of internalized racism or the adoption of negative racial stereotypes among people of color (CBRI; Neville et al., 2013). In this study, CBRI was analyzed with political orientation, gender, and ethnicity/race to determine if there was a relationship between the variables as well to examine the mechanisms that may vary the outcomes. Data was collected from the PSYCH 120 Introductory Psychology research pool ($N = 3,564$) at a Midwestern University with a survey via Qualtrics. Using a factorial ANOVA, results revealed significant main effects of gender, political orientation, and ethnicity ($p < .05$). Moreover, results indicated a significant two-way interaction between ethnicity and political orientation such that White participants reported the largest variance in CBRI scores from lowest when liberal and highest when extremely conservative, with Black and Latinx remaining significantly lower than White and Asian participants when not extremely liberal or conservative. Finally, results showed a significant three-way interaction between gender, political orientation, and ethnicity such that males with more conservative ideology from Asian and White ethnicity/racial groups were strong predictors of higher CBRI scores versus the lowest CBRI scores coming from female Black and Latinx liberals.

James Vo



Undergraduate University: Portland State

Undergraduate Degree: Biological Sciences

Undergraduate Graduation Date: June 2023

Graduate Field of Study: Biological Sciences

Purdue University SROP Unit: Purdue Center for Cancer Research

Purdue University SROP Faculty Mentor: Dr. Shijuan Kuang

Research

Regenerative Potential of Skeletal Muscle Stem Cells

The mechanisms of cancer contain nuances and complexities that have yet to be discovered. One of the mechanisms that are currently being studied now is the regenerative properties of muscle stem cells. The anatomy of the muscle tissue is intricate in nature, a membrane called the basal lamina lays on top of the individual bundles of muscles called myofibril. The basal lamina acts as the scaffold that anchors epithelial, muscle, and nerve cells. These membranous layers contain satellite cells (SC's) which lay on the periphery of the muscle fibrils. These satellite cells are responsible for the growth and regeneration of muscle tissue after damage. In this study, the three main transcription factors at play are the Pax7, MyoD, and Myf5. MyoD and Myf5 are classified as myogenic regulatory factors (MRFs) which regulate myogenesis. The regenerative properties of muscle cells are our topic of interest. This research study aims to demonstrate the regenerative potential of the transcription factors by analyzing the morphological composition of injured and uninjured mice. A variety of staining techniques were utilized such as hematoxylin and eosin staining (H&E staining).

Noor Halabi



Undergraduate University: California State Polytechnic University

Undergraduate Degree: Chemical Engineering

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Chemical Engineering

Purdue University SROP Unit: Purdue Center for Cancer Research

Purdue University SROP Faculty Mentor: Dr. Bumsoo Han

Research

Size Distribution Analysis of Hydrophobic Drug Nanoparticles with Metal-Phenolic Network Coatings

Cancer has been identified as the 2nd leading cause of death in the United States. Advancements in nanotechnology have resulted in new cancer therapies involving the synthesis of drug loaded nanoparticles which are biocompatible, stable, and highly specific. To decrease the mortality rate of multiple cancers, efforts are conducted to encapsulate Paclitaxel, a common cancer drug, within nanoparticles to target and prevent the growth of cancer cells. One common obstacle faced when synthesizing nanoparticles is the presence of nonactive excipients (i.e. nanoscale delivery tools) as well as Ostwald ripening. Ostwald ripening is characterized by the agglomeration and growth of functional nanoparticles into deactivated crystals. However, catechol containing compounds are being investigated for their binding strength as well as their enhanced antitumor activity to address the aforementioned problems. Specifically, a polyphenolic-metal network was utilized to encapsulate the drug within the nanocore and offer stability up to several months. Synthesis of the nanoparticles occurred through the use of microfluidic chips. Microfluidic devices have enabled the expansion of nanoparticle synthesis past the batch process in an effort to upscale their production. Efforts to decrease the mixing time required for the formation of nanoparticles included the use of hydrodynamic flow focusing (HFF), where the central flow is compressed by a sheath fluid. HFF has been proven to form a homogenous particle size distribution with little batch to batch variation. This research aims at manipulating flowrate and flow ratio parameters within the microfluidic chip to assess the homogeneity and uniformity in size of synthesized nanoparticles.

Alondra Colón Vega



Undergraduate University: University of Puerto Rico - Ponce

Undergraduate Degree: Biomedical Sciences

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Biomedical Sciences

Purdue University SROP Unit: Purdue Center for Cancer Research

Purdue University SROP Faculty Mentor: Dr. Sulma Mohammed

Research

Response of LCTC and BCTC Breast Cancer Cells to In Vitro Inhibition of T-Cell Immune Checkpoint Receptors CTLA-4 and PD-1

Author: Alondra M. Colón Vega, Xavier E. Ramos Cardona, Sulma Mohammed

The detachment of cells in a breast cancer tumor can spread through the lymphatic system, as lymph circulating tumor cells (LCTC), or through the bloodstream, as blood circulating tumor cells (BCTC). Recent studies of both cell lines indicate a lower survival rate caused by LCTC compared to BCTC. Immunotherapy has become a leading option, where targeting specific immune checkpoints has shown potential treatment options in a variety of cancers. CTLA-4 and PD-1, negative regulating immune checkpoint inhibitor receptors found in the T-Cell, have decreased proliferation and viability once administered inhibitory anti-CTLA-4 and anti-PD-1 in Triple Negative Breast Cancer Cells. In this work, we examine the administration of anti-CTLA-4 and anti-PD-1 in an interaction between a cancer cell and immune cell, specifically lymph circulating tumor cells (LCTC) and blood circulating tumor cells (BCTC). The addition of CTLA-4 and PD-1 inhibitors to LCTC and BCTC co-cultured with PBMC show no significant changes in their LDH cytotoxicity. Unlike LCTC, BCTC expressed lower levels of LDH cytotoxicity in their co-culture with PBMC and immune checkpoint inhibitors. These findings hint further analysis of the features and composition of LCTC and BCTC to understand why no significant changes were expressed.

Ana Cloure



Undergraduate University: University of Miami

Undergraduate Degree: Biomedical Engineering

Undergraduate Graduation Date: December 2022

Graduate Field of Study: Biomedical Engineering

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Jacqueline Linnes

Research

Human Papillomavirus (HPV16) - Rapid Diagnostic Test for Cervical Cancer Screening

Cervical cancer is one of the most common cancers in women worldwide and it is almost always caused by Human Papillomavirus (HPV) infection. Early detection of the cancer-causing types of HPV is a crucial step to preventing disease progression. In-clinic testing is the current screening method, which may not be accessible to all women and sometimes fails to connect patients to follow-up care. We aim to develop a diagnostic tool that will detect HPV from a self-collected sample, making early detection of HPV more accessible and ultimately preventing cervical cancer. Here we assess the Limit of Detection (LoD) of a recombinase polymerase amplification (RPA) DNA amplification reaction to detect HPV 16. The results from the assay demonstrate that the test is able to detect HPV16 at [10-100] copies per 50 μ L reaction. These results are significant since this DNA concentration could be expected of self-collected samples, which suffer from lower DNA concentrations than provider collected samples.

Alana López Cruz



Undergraduate University: University of Puerto Rico – Aguadilla

Undergraduate Degree: Biological Sciences

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Biological Sciences

Purdue University SROP College: College of Science

Purdue University SROP Faculty Mentor: Dr. Catherine Searle

Abstract

Demographic rescue: The effect of supplementation and the introduction of a deadly pathogen

Alana López-Cruz^{1,2}, Stephanie Gutierrez² and Catherine Searle²

Department of Natural Sciences, University of Puerto Rico at Aguadilla, PR 00604 1 , Department of Biological Sciences Purdue University, West Lafayette, IN 479072Demographic rescue is the process of adding individuals to a small population to reduce the possibility of extinction. By increasing the individuals in a population, Supplementation programs can help stop the extinction of populations by buffering stochastic fluctuations. If the individuals that are added through the supplementation program are infected by a pathogen, they can decrease the probability of success in the "rescue". For that reason, it is important to understand how supplementation programs affect population size, stability, and persistence when infected individuals are introduced. In this work, we examined the overall demographic effect of supplementation when individuals added to populations are infected with a deadly pathogen. We used the combination of two principal variables, pathogen treatments (infected and uninfected) and supplementation treatments (none, low and high), to make 6 treatments total. Each treatment was replicated 10 times for a total of 60 replicates. These beakers each contained a population of *Daphnia dentifera* (a single clone). For the infected treatments, we added the spores of *Metschnikowia bicuspidata*, a fungal parasite lethal for them, to infected *Daphnia dentifera*. To monitor the progress of the treatments, samples were taken weekly in random order to quantify the number of individuals. We counted in the sample: uninfected and infected adults females, uninfected and infected juveniles females, uninfected and infected adults males, uninfected and infected juveniles males, and ephippia (resting eggs). For uninfected beakers, densities were highest in populations that received no supplementation compared to beakers where individuals were added. For infected beakers, results are more variable. Populations that received any level of supplementation had a higher infection prevalence compared to those with no supplementation. Low supplementation had the highest infection prevalence. It is important to understand that research like this brings us closer to better understanding how we can give a second chance to species that need it.

DeAndre Malone



Undergraduate University: Truman State University

Undergraduate Degree: Agricultural Sciences

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Agricultural Economics

Purdue University SROP College: College of Agriculture

Purdue University SROP Faculty Mentor: Dr. Maria Marshall

Research

Post-Disaster Aid: Analyzing the Effects it has on the Perception of Profitability and Success Between Generations of Small Business Owners

Post-Disaster Aid has been shown in previous research to positively contribute to the success and survival of small businesses, namely in the form of SBA loans. Literature on this relationship between businesses' success and survival with post-disaster aid has been done previously and has shown for the most part to have a positive impact on business recovery (Marshall and Hiramatsu 2018 and Haynes et al. 2011), however, based on my reading, none was analyzing this relationship between various generations of small business owners. This study looks to determine whether post-disaster aid has a positive or negative effect on small business owners' perception of profitability and success while simultaneously comparing these perceptions between generations, categorized as Gen-Z, Millennials, Gen-X, and Boomers or older. Other forms of post-disaster aid that this study aims to look at in addition to SBA loans are aid from government organizations (FEMA, SEMA, Mayor's Office, Councilmen), charity or help from non-government organizations, insurance claims, bank loans, and loans from relatives or friends. The data used in this study is from the Rural Small Business Recovery and Resilience to Natural Hazards project, collected in November of 2021. 309 individual small business owners who were affected by a disaster and still operating were used in the logistic regression model for this study. The hypotheses tested in this study were: (1) based on previous literature, we expect to find that post-disaster aid will have a positive impact on how small business owners perceive the profitability and success of their business; (2) the biggest differences in perception of profitability and success after a disaster will be between the older groups of small business owners and the younger groups of small business owners, we do not believe that the differences will be as significant between the middle groups. The results of our study found that the major differences between how small business owners perceive how profitable they are were indeed between the youngest age groups (Gen-Z and Millennials) and the oldest age groups (Boomers and above), which showed that the younger age groups considered themselves to be less profitable and successful when compared to the Boomers and older age groups at a statistically significant level. It also showed that Gen-X had a negative and statistically significant difference in the perception of profitability when compared to the Boomers and older age group and a negative and statistically significant difference in the perception of success when compared to the younger age groups. SBA loans had a positive and statistically significant effect on the perception of profitability among small business owners while charity showed to have a negative and statistically significant effect on the perception of profitability. People who received loans from relatives also perceived themselves to be less successful at a statistically significant level.

Nnaemeka Onyeokoro



Undergraduate University: California State University - Sacramento

Undergraduate Degree: Electrical and Electronics Engineering

Undergraduate Graduation Date: August 2023

Graduate Field of Study: Electrical Engineering

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Brandon Pitts & Dr. Tahira Reid Smith

Research

Comparison Between Objective Driving performance and Subjective Automated Assistance Preferences

¹ Nnaemeka Onyeokoro, ² Quan Nguyen, ³ Nade Liang, ³ Maya Luster, ³ Dr. Brandon Pitts.

Semi-autonomous vehicles are presently on the road, providing some assistance to drivers. While fully autonomous vehicles will not be available in the next few years, they certainly will become reality in the future. For this to happen, we must understand human-vehicle interaction and measure ways in which these advanced systems could provide help to drivers in real-world scenarios. This research focused on analyzing subjective driver feedback and objective driver performance data. It was conducted using the National Advanced Driving Simulator (NADS), MiniSim. A total of 21 participants had to produce strategies to maneuver four obstacles: tire, walking Deer, construction zone, and rain/wind. A Latin Square Design was used to counterbalance ordering effect. All participants provided verbal feedback about the type of assistance, whether it be single or multi-functionality that they wanted from the vehicle. Based on their responses, we were able to group them into 3 distinct categories: No assistance, Partial assistance, and Full assistance. Analysis tools such as MATLAB and the Python programming language were utilized to measure driver performance data collected from the simulator. The end goal was to find matches, and mismatches between what the participants wanted and what they needed. Results obtained from this research could be used by car manufacturers to make their algorithms more robust and tailored towards the user's needs for improved driver performance, experience, and safety.

Nicole Jensen



Undergraduate University: University of Puerto Rico - Arecibo

Undergraduate Degree: Biological Sciences

Undergraduate Graduation Date: May 2024

Graduate Field of Study: Industrial Microbiology

Purdue University SROP Unit: Purdue Center for Cancer Research

Purdue University SROP Faculty Mentor: Dr. Sandro Matosevic

Research

Evaluation of Expansion of NK Cells for Cancer Immunotherapy

Natural Killer cells are a type of innate lymphoid cell that can recognize, detect, and kill virus-infected and tumor cells. These cells are used for cancer treatment due to their efficient cytotoxic ability. However, NK cells need to be activated and expanded to stimulate their anti-tumor responses and provide sufficient doses for adoptive transfer into patients. The NK-92 cell line is dependent on interleukin-2 (IL-2) and is normally grown in RPMI medium using 10% of Fetal Bovine Serum (FBS). However, expansion rates are low and inefficient, and FBS concentrations high. In order to identify new expansion media with clinical potential, we evaluated a new Endothelial Cell Basal Medium-2 (EBM-2) and compared it with various formulations of RPMI/FBS. EBM-2 is used for studying developmental and disease mechanisms in blood vessels and supports cell proliferation and expansion of human primary endothelial cells with low-serum conditions. The aim of our study was to establish the potential of new, safer NK cell expansion media that can be applied in a clinical setting while reducing potential toxicities and inefficiencies associated with traditional expansion media.

Luis Romaguera Rios



Undergraduate University: University of Puerto Rico - Mayaguez

Undergraduate Degree: Mechanical Engineering

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Mechanical Engineering

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Xiulin Ruan and Dr. Justin Weibel

Research

Energy-Free, Carbon Negative Water Harvesting Enabled by Radiative Cooling Surfaces

Radiation is a method of heat transfer that offers the unique opportunity of cooling below ambient temperature without requiring external energy. This is achieved by emitting radiation from a surface over a range of wavelengths that pass through the Earth's atmosphere, what is known as the "sky window", and using the cold temperatures of deep space as a heat sink. The Ruan group at Purdue developed the world's whitest paint that can achieve radiative cooling of surfaces to temperatures 4.5°C below the surrounding ambient. This project seeks to leverage these radiative cooling capabilities to reduce surface temperatures under the dew point and condense water vapor from the atmosphere that can then be harvested. However, one of the main challenges for realizing such a water harvesting system is determining the ideal surface wettability. Nonwetting hydrophobic surfaces facilitate water removal for collection, while wetting hydrophilic promotes nucleation of more condensate water droplets. Condensation tests are performed in an environmental chamber on surfaces with contrasting wettability. The surfaces are cooled using a cold plate to simulate the subambient temperatures reached by the paint. Two samples of paint, one hydrophilic and the other hydrophobic, are tested to compare their condensation and collection behavior. Their surface wettability is characterized by measuring the advancing and receding contact angles of water droplets using a goniometer. Initial testing shows the hydrophobic sample collected more water than the hydrophilic sample.

Soojay Jhugaroo



Undergraduate University: Lycoming College

Undergraduate Degree: Astrophysics

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Mechanical Engineering

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Neera Jain

Research

Cognitive Autonomy for Human CPS: A Heuristic Strategy for Cognitive State-based Feedback Control to Accelerate Human Learning.

Soojay Jhugaroo - Lycoming College, PA

Madeleine Yuh - Department of Mechanical Engineering, Purdue University, IN

With the increase on the reliance of automation in various fields to perform tasks and learn new skills [1], autonomous systems need to respond accordingly to human cognitive states to maximize efficiency during human-automation interaction and avoid misuse, disuse, and abuse [2] of automation. Human reliance on automation is heavily dictated by cognitive states of self-confidence and trust [3]. However, few human-automation reliance models in literature focus on the self-confidence state. Having autonomous systems predict these human cognitive states allows them to respond appropriately to increase task performance efficiency. In this work, we developed a probabilistic model to capture the dynamics of the human self-confidence cognitive state. We used 40 participant self-report behavioral data collected previously during a human subject study where the assistance of an automated agent was deemed effective in accelerating the learning process of learning to fly a quadrotor in a simulated environment. A Markov Decision Process (MDP) was used for the self-confidence model framework, which was subsequently trained using a genetic algorithm on Python and MATLAB. The prediction capability of the model was validated through the usage of 5-fold cross validation and receiver operator characteristic curves. The results obtained show that the trained model can be used to estimate human self-confidence in the context of learning. Preliminary findings therefore suggest that human self-confidence is crucial during human-automation interactions especially when using automation to learn new tasks. Future directions include collecting enough participant data to properly train a coupled self-confidence - trust cognitive states model as well as implementing physiological reactions such as gaze tracking data and pupil dilation to the model.

[1] Manzey, D., Luz, M., Mueller, S., Dietz, A., Meixensberger, J., and Strauss, G. (2011). Automation in Surgery: The Impact of Navigated-Control Assistance on Performance, Workload, Situation Awareness, and Acquisition of Surgical Skills. *Human Factors*, 53(6), 584–599.

[2] R. Parasuraman and V. Riley, "Humans and Automation: Use, Misuse, Disuse, Abuse," *Hum Factors*, vol. 39, no. 2, pp. 230–253, Jun. 1997

[3] J. D. Lee and N. Moray, "Trust, self-confidence, and operators' adaptation to automation," *International Journal of HumanComputer Studies*, vol. 40, no. 1, pp. 153–184, 1994.

Quan Nguyen



Undergraduate University: Gettysburg College

Undergraduate Degree: Computer Science

Undergraduate Graduation Date: May 2024

Graduate Field of Study: Computer Science / Artificial Intelligence

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Brandon Pitts

Research

Classification of obstacles encountered based on drivers' performance and eye behavior

Autonomous vehicles are developing rapidly. Thus, researchers are trying to design effective autonomous driving systems which is essential to understand human-vehicle interaction. Previous researchers have investigated the real-time classification of obstacles during autonomous driving utilizing vehicle sensors, but do not fully leverage behavioral measures, such as eye movements, to classify obstacle types. Research Gap: To use driving performance and eye behavior to classify roadway obstacles that drivers encounter. Therefore, the goal of our project was to take first steps toward building classification models using machine learning (ML). These models utilized drivers' performance and eye behavior to predict type of roadway obstacles that drivers needed to avoid. The drivers' performance and eye behavior datasets were collected from 32 participants who drove on a two-lane rural road with four types of obstacles (an obstacle each type), using 4x4 Latin Square Design order. The datasets were processed through windowing and calculating mean/standard deviation of 5s-period observation windows of each obstacle. Utilizing ML algorithms to classify type of obstacle, the results show that drivers' behaviors are different enough to classify obstacles, but not for eye behaviors. The most important features for drivers' performance data are features such as vehicle speed, steering wheel angle, and lane deviation while those for eye behaviors are eye position and pupil diameter. Future steps: using features such as fixations count, fixations duration since they relate to mental stress and lane-change intention when drivers encounter obstacles as well as applying models to time-series problems to predict obstacle types encountered

Amjad Samra



Undergraduate University: University of New Mexico

Undergraduate Degree: Mechanical Engineering

Undergraduate Graduation Date: May 2025

Graduate Field of Study: Aeronautics and Astronautics

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. James Goppert

Research

Comparison of SLAM Algorithms in a GPS-Denied Collapsed Building Environment

Simultaneous Localization And Mapping (SLAM) is one of the most fundamental frameworks for navigation in the field of autonomous systems. SLAM allows the robot to build a 3d map of unknown environments and localize itself simultaneously inside that map. Using Purdue's UAS and research test facility to create a collapsed building GPS denied environment, we will be able to compare and validate different SLAM algorithms to implement on the drone for search and rescue missions. The Conventional method of search and rescue missions when a building collapses is having firefighters go in what is left from the building and find survivors. However, our approach proposes a different and a more efficient way of searching for survivors in terms of time. In addition to that, our approach will be safer for the firefighters, since their search will be specific to certain areas in the collapsed building due to the information that the drone will provide about the location of the survivors.

Donte Woodget



Undergraduate University: University of Michigan

Undergraduate Degree: Mechanical Engineering

Undergraduate Graduation Date: Fall 2022

Graduate Field of Study: Mechanical Engineering

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Tahira Reid Smith

Research

Virtual Reality in Special Education: Assisting Children with Learning Disabilities in Flint Michigan

Donte Woodget , Dr. Tahira Reid Smith, Purdue University

The Flint water crisis started in 2014 when the city drinking water was contaminated by lead. Lead contaminated water can have adverse effects on people, especially young children. Lead poisoning in children under the age of six can severely affect one's mental and physical development. Examples include; damage to the brain and nervous system, learning and behavior problems, hearing and speech problems, and slowed development. Thousands of children under the age of seven were exposed to a dangerous amount of lead, potentially causing an increase in the number of special needs children. Flint's percentage of special education students increased by 56%, rising from 13.1% in 2012-2013, the school year before the water crisis, to 20.5% in 2018-2019. To help these students, virtual reality (VR) options should be implemented in the classroom. VR can provide special education students with multilevel learning. It can teach course material as well as "real world" skills in a controlled and safe environment. The simulations can reflect realistic scenarios without increasing the risk of entering an unfamiliar place for students. Examples of these simulations include; a tour of historical sites to learn diverse cultures, using Social Emotional Learning (SEL) to overcome anxiety/fear, and a virtual interview to prepare students for the transition into adulthood. Implementing and accessing VR into the classroom takes multiple steps. Includes, but is not limited to; setting up an implementation plan, selecting the correct VR devices, finding target areas, and figuring out a strategy that would best fit the student's needs. Future steps would involve partnering with a special education community organization to recruit diverse students to conduct a study.

Desiré Rivera Borges



Undergraduate University: University of Puerto Rico - Mayagüez

Undergraduate Degree: Chemical Engineering

Undergraduate Graduation Date: May 2024

Graduate Field of Study: Biomedical Engineering

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Hugh Lee

Research

PVA-PAA-NHS ester hydrogel films: Effects of spin speed and time on thickness

Ultra-thin bio-adhesive hydrogel films can be used to attach bio-sensors to wet tissues, reinforce sutures, dress wounds, and more. Controlling film thickness is important to limit device deformation caused by swelling and mechanical stress dissipation.¹ PVA-PAA-NHS ester bio-tapes work by absorbing excess moisture on the tissue surface, creating weak hydrogen bonds within 5s of application, and forming strong amide bonds within 30min of application. Spin-coating can be used to create these smooth thin films by rotating a substrate so that excess fluid spins off the edges. This technique is simple, reproducible, and cost-effective when compared to other techniques like dip-coating.^{1,2} This study aims to optimize spin-coating parameters to create ultra-thin crosslinked PVA-PAA-NHS ester films for bio-sensor applications. Spin speeds between 500 and 6,000 RPM were used to create films ranging from 30 μ m-100 μ m in thickness.

Weiland Wang



Undergraduate University: Carleton College

Undergraduate Degree: Chemistry

Undergraduate Graduation Date: June 2023

Graduate Field of Study: Medicine

Purdue University SROP Unit: Purdue Center for Cancer Research

Purdue University SROP Faculty Mentor: Dr. Rong Huang

Research

NatD Oncogenic Mutants Effects on Acetylation Kinetics and Localization

Protein N-terminal acetyltransferase D (NatD or Naa40) acetylates histones H4 & H2A at the N-terminal SGRRK sequence. Responsible in epigenetic pathways, abnormal regulation of these proteins can lead to increased transcription and gene expression directly linked with the development of cancer. Thus, studying the mechanisms behind these regulatory elements is a critical first step in developing effective cancer-specific therapeutics. In this study, three NatD oncogenic mutants were generated (E89K, R105Q, & R148Q) in order assess the acetylation activity (prevalent in several cancers: serous neoplasms & squamous cell carcinomas) in conjunction with FLAG NatD (WT) & short NatD (truncated). Transfection into HCT-116 cells allowed a visualization of the localization of NatD (WT) and short NatD in order to understand the function of protein and organization within colon cancer cells.

Rachel Chen



Undergraduate University: University of Texas at Austin

Undergraduate Degree: Sociology

Undergraduate Graduation Date: June 2024

Graduate Field of Study: Sociology

Purdue University SROP College: College of Liberal Arts

Purdue University SROP Faculty Mentor: Dr. Spencer Headworth

Research

Correctional Healthcare Workers During COVID-19

The National Commission on Correctional Healthcare (NCCHC) was founded in 1983 to establish best practices for correctional healthcare and formally endorse individual practitioners who uphold these standards. No studies have been done on the motivations for individuals to get accredited, but Headworth and Zaborenko (2021) hypothesize that it could be a response to lawsuits. During the COVID-19 pandemic, the National Commission on Correctional Healthcare noticed a spike in applications for individual accreditations. The pandemic was notably difficult for both inmates and workers in correctional facilities, as the poor living conditions in these facilities led to widespread coronavirus outbreaks. The present study attempts to understand the experiences of correctional healthcare professionals during the pandemic, the motivations they had for getting certified, the effects of accreditation on work performance, and the influence of the pandemic on the way practitioners thought about accreditation. Qualitative semi-structured interviews were conducted with 16 certified correctional healthcare professionals, and their responses were transcribed and coded using QSR NVivo Pro. Thematic analysis suggests that correctional healthcare professionals experienced stress and signs of burnout as a result of the pandemic, got certified to be more marketable and know the best practices, and noticed an improvement in their work performance after getting their certification.

Madison Pearson



Undergraduate University: New York University

Undergraduate Degree: History

Undergraduate Graduation Date: December 2023

Graduate Field of Study: History

Purdue University SROP College: College of Liberal Arts

Purdue University SROP Faculty Mentor: Dr. Cornelius Bynum

Research

Shirley Chisholm and the Black Feminist Tradition

Throughout her tenure in Congress, Representative Shirley Chisholm (1924-2005) advanced her own particular brand of Black feminism in the political sphere. Her intersectional approach to politics allowed her to fight multiple battles on many fronts to advocate for Black women's specific needs. Additionally, because of the time period in which she was working, she was able to work within and move between multiple movements to better advocate for Black women. However, while she can now be classified as a Black feminist, at the time, Chisholm was operating under her own humanist message. By using Chisholm's speeches and writings, this essay seeks to explore the Black feminist and humanist motivations in Chisholm's activism and well as the changes in her public message during her first decade in Congress.

Marc Saint-Louis



Undergraduate University: Rutgers University - Newark

Undergraduate Degree: Psychology - Neuroscience

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Psychological Sciences

Purdue University SROP College: College of Health and Human Sciences

Purdue University SROP Faculty Mentor: Dr. Sarah Karalunas

Research

Differences Between Race and Treatment of ADHD

Many different factors affect the treatment that Black individuals receive for mental health. A few examples include the reluctance of Black individuals to seek help for mental health, unconscious bias on the part of mental health professionals when seeking help, and poor experiences working with clinicians (Conner et al., 2010; Ward et al., 2013; Fadus et al., 2019; Miller et al., 2009). Previous research also reveals that although Black children are being diagnosed more with ADHD than in the past, they are still less likely to be diagnosed with ADHD and receive appropriate medication than White children (Fairman et al., 2020; Davis et al., 2021). The present study aims to investigate the relationship between race and the treatment of children with ADHD ($n = 676$; 9% Black), hypothesizing that Black children will be less likely to receive medications and therapy than White children. Findings suggest that Black children with ADHD are prescribed stimulant medication at lower rates than White children ($\chi^2 = 6.9$, $p = 0.008$). Additionally, although non-significant, some evidence suggested that Black children are less likely than White children to have their medication monitored by a psychiatrist ($\chi^2 = 5.2$, $p = 0.52$) and to have monitoring visits longer than 30 minutes ($\chi^2 = 3.7$, $p = 0.29$). Once enrolled in a medication, school, or therapy treatment, White and Black children with ADHD continue with that treatment at similar rates (all $p > 0.05$). Further research is needed to understand the discrepancies in treatment of those of different races, as well as the effectiveness of treatment received.

Alin Alshaheri



Undergraduate University: San Diego State University

Undergraduate Degree: Psychology

Undergraduate Graduation Date: May 2024

Graduate Field of Study: Psychological Sciences

Purdue University SROP College: College of Health and Human Sciences

Purdue University SROP Faculty Mentor: Dr. Nadia Brashier

Research

The Best Way to Fact-Check Fake News on The Internet

The rise of misinformation harms health, incites violence, and undermines democracy around the world. Public concern over issues is high, many consider misinformation more dangerous than modern terrorism or climate change. In response, social media companies have responded by hiring third-party fact-checkers. MTurk workers were separated into three groups, one is shown the fact-checking of a headline before shown the news headline, one is displayed with the headline, and one is shown after the headline. After a week participants are brought in, they are shown given a quiz with news headlines without the fact-checkers and are asked if they are true or false. The experiment is currently in progress, and the results of this study can be reflective of past studies done in the lab that had the same structure. The present work examined how fact-checking affects young and older adults' memory recollection. Going forward into future studies our lab would want to go extending across lifespans, to view whether cognitive mechanisms work differently during stages in a lifespan.

Daniel Rodrigues de Souza



Undergraduate University: University of Florida

Undergraduate Degree: Mechanical Engineering

Undergraduate Graduation Date: June 2024

Graduate Field of Study: Mechanical Engineering

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. James Goppert

Research

Comparison of SLAM Algorithms in a GPS-Denied Collapsed Building Environment

Daniel Souza¹, Amjad Samra¹, Riley Franklin¹, and James Goppert¹
Purdue University, School of Aeronautics and Astronautics¹

Cyber-Physical Systems (CPS) are smart systems controlled by computer-based programs, often used with sensors to read and analyze the physical environment around it. An example of such an algorithm is Simultaneous Location And Mapping (SLAM); a program used for navigation in autonomous robotic systems. There are many different SLAM algorithms; all allowing the computer to create 3D maps. Through the use of a SLAM algorithm, a stereo camera, and a thermal camera, the Unmanned Aerial Systems (UAS), or drones, being used in this project have the intended use of being deployed in collapsed buildings, to navigate and create a 3D map of the area with heat signatures, so that first responders can do a premeditated rescue, minimizing rescue time, and maximizing victim survival rate. In order to find the best algorithm to be implemented, we can use Purdue's UAS Research and Test Facility to compare and validate SLAM implementation algorithms by recreating a collapsed building environment. We used ROS software to run the chosen SLAM programs. More specifically, our chosen SLAMs were Open VSLAM, ORB-SLAM₃, and RTAB-Map -- due to its benchmark values. For this initial phase, we decided to conduct tests through simulation, using a simulator for robotics application, Gazebo. It allows testing of algorithms in personalized digital environments. That way, we can simulate the drone's and program's performance in a collapsed building environment. Unfortunately, we are still trying to collect data from the simulations. Up until now, we have been trying to get the programs running correctly with Gazebo, making sure all required programs for each SLAM program are installed. Even if we don't collect any hard data to be analyzed, this initial research was important to make sure we could identify three viable programs that could be used in the final product. Furthermore, setting each program up might be the hardest part, and being able to finish that will allow future research to be conducted at a faster pace. We have also planned on writing a paper comparing the three chosen SLAM algorithms based on the -- to be - collected data from this research.

Maame Agyarko



Undergraduate University: University of Illinois Urbana - Champaign

Undergraduate Degree: Speech Hearing Science

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Speech, Language and Hearing Sciences

Purdue University SROP College: College of Health and Human Sciences

Purdue University SROP Faculty Mentor: Dr. Francoise Brosseau-Lapre

Research

Initial Consonant Deletion in Children with Speech Sound Disorder Speaking English or Spanish and English

The goal of the study was to investigate initial consonant deletion in children with speech sound disorder (SSD). Seven bilingual Spanish-English children with SSD, ages 4 to 6 years, were matched to seven monolingual English-speaking children with SSD. Participants completed a battery of speech and language tests, and produced a list of monosyllabic, dysyllabic, and multisyllabic words which are similar in Spanish and English. Monolingual English-speaking children omitted initial consonants at a significantly lower rate than bilingual children. Bilingual children were more likely to omit initial consonants in Spanish, but they also omitted consonants in their English productions. Implications for assessment and goal selection of children with speech sound disorders who speak both Spanish and English will be discussed.

Jenny Mendez Mendez



Undergraduate University: University of California - Berkeley

Undergraduate Degree: Applied Mathematics – Computer Science

Undergraduate Graduation Date: May 2024

Graduate Field of Study: Computer Science

Purdue University SROP College: College of Science

Purdue University SROP Faculty Mentor: Dr. Dave Tian

Research

Directed Fuzzing: Focusing on the Quality of Control Registers May Produce Better Coverage

Jenny Mendez Mendez¹ and Dave (Jing) Tian²

¹Department of Mathematics, College of Letters and Science, University for California, Berkeley

²Department of Computer Science, Purdue University

If there were flaws, known as security bugs, in the CPU (Central Processing Unit), it would negatively affect the computations. The computation consists of both software and hardware components. For instance, CPU bugs can produce incorrect results, reboot the computer, allow unwanted users to access sensitive data, etc. Several communities have attempted to use static or dynamic techniques, but it is difficult to find bugs using these techniques because of the complexity of CPU RTL designs. DifuzzRTL, an RTL fuzzer, introduces an approach called the register-coverage technique to identify security bugs, and its measurement is based on control registers. Thus, when fuzzing each module, it would find, track, and save these control registers. However, this fuzzer treats all the registers equally and does not consider the importance of the module. In this research, we attempt to use the directed fuzzing technique and concentrate on saving only control registers that come from essential modules. Our implementation is assigning each module a property called “weights” that represents its complexity. Thus, we would save only the control registers that belong to a module with high weights. We hope that running the fuzzer with this design would maximize the number of control registers and weights. On the other hand, there is a limitation; there can be modules that have low weights but are very important. Therefore, making the implementation more generic, for example, allowing the users to insert the weights, would be future work.

Hur, J., Song, S., Kwon, D., Baek, E., Kim, J., & Lee, B. (2021, May). Difuzzrtl: Differential fuzz testing to find cpu bugs. In 2021 IEEE Symposium on Security and Privacy (SP) (pp. 1286-1303). IEEE.

Shaswat Shukla



Undergraduate University: University of New Mexico

Undergraduate Degree: Computer Science

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Computer Science/ Engineering Technology

Purdue University SROP College: College of Engineering

Purdue University SROP Faculty Mentor: Dr. Richard Voyles

Research

Explorations in Safe, Printable, Biological Sensors and Sensor Systems

Shaswat Shukla¹, Richard Voyles² and Naveen Kusumanchi²

¹University of New Mexico and ²School of Engineering Technology, Purdue University

3-D printing technology emerged in the 1980s, but with the pseudonym of rapid prototyping, because of its inability to produce industry-level 3-D printed objects. However, with improved technology, 3-D printing has rapidly paved its way into industrial manufacturing. 3-D printing is used to make lightweight components for aerospace and defense because of its lightweight and material efficiency, which helps in aerodynamics. The concept of 4-D printing started in 2013, with the idea of using “smart materials” that change their shape with time when in contact with water, heat and light. Lately, this concept has been extended to include electrical components, thus giving us a possibility of being able to print 3-D printed objects, that have the functionality to sense, compute and actuate. In our work, we tried to 3-D print a bicycle crank, with power connector and a microprocessor embedded into it, which can be used like an intelligent sensor to measure the resistance or bending of the pedal crank, when the bicycle is in motion. We created a CAD model of the bicycle crank using Fusion360, and the model was customized in a way that it could accommodate electrical components like power connector, strain gauge and microprocessor. We embed electronics into the 3-D printed objects by first pausing the filament extrusion, to print conductive traces and pads, and then stick electronics by using anisotropic adhesive. To make the electronics stick to the print, we cured it by using the Integrated Circuit Infrared Heater. After the electronics stick to the pads, we resumed the print and waited till the print is completed. We were able to produce a strain gauge that changed resistance on bending of the bicycle crank. We designed a circuit to incorporate an ESP 8285 module, power jack, LED, resistor along with this sensor to transmit the voltage drop over a Wi-Fi signal for us to see on our computer screens. Using 3-D printing for creating “smart products”, which have the ability to sense, compute and actuate is still in its infancy stage and for now, we are only able to create prototypes of the ideal model that can be used for industry-level production in the future.

Jazlyn Ilamni



Undergraduate University: University of Maryland – Baltimore County

Undergraduate Degree: Computer Science

Undergraduate Graduation Date: May 2025

Graduate Field of Study: Computer Science

Purdue University SROP College: College of Science

Purdue University SROP Faculty Mentor: Dr. Dave Tian

Research

Detecting Discrepancies in Linux Capability Header File and Code Usage

Jazlyn Ilamni¹ and Dave (Jing) Tian¹

¹Department of Computer Science, College of Science, Purdue University

Linux capabilities are maintained by the kernel and allow processes and binary executables to gain root privileges. There are around 40 capabilities that are implemented into the Linux kernel to control the operations or behaviors of the process. The capabilities break down root privileges into smaller groups based on their actions. Allowing too many privileges to a user makes a program more susceptible to security risks. However, with the evolution of hackers coding skills, a single vulnerability within the capability's usage will allow hackers to easily take control over a process and increase the number of cyber-attacks. In this work, we develop a way to extract discrepancies within the capability header file descriptions and the usage of the capability. We created a python script to extract keywords from the header file descriptions. Then, we developed a shell script to extract lines of code that contained the keywords from the capability's code usage. We utilized fuzzy matching to group the lines of code based on their structure. From this method, computers will be able to detect outliers within the code usage that may be causing a vulnerability within the Linux Kernel. The next step would be to perform semantic matching to determine if the outliers in the code usage are creating weaknesses in the kernel. This research will aid in the development of computer-assisted techniques to detect vulnerabilities that need to be improved within the Linux kernel and create a more secure environment for users.

Kelly Drago



Undergraduate University: University of South Florida

Undergraduate Degree: Biomedical Sciences and Psychology

Undergraduate Graduation Date: May 2023

Graduate Field of Study: Veterinary Medicine

Purdue University SROP College: College of Veterinary Medicine

Purdue University SROP Faculty Mentor: Dr. Guang Jun Zhang

Research

Preparing CRISPR-Cas13d Plasmid Constructs for Targeting the Zebrafish Tyr Gene

Kelly Nicole Drago¹; GuangJun Zhang²

¹College of Arts and Sciences, University of South Florida

²Department of Comparative Pathobiology, College of Veterinary Medicine, Purdue University

Specific DNA sequence editing has greatly helped advance the understanding of how genes function in biology and has a great potential for human genetic disease treatment. Manipulating the RNA sequence has recently been demonstrated for being effective in modifying gene functions without altering DNA sequences. This allows for better understanding of how to manipulate genes to have different functions. Thus, RNA editing has a unique application niche in both research and medical applications. The overall goal is to develop a transgenic approach that allows us to knock down gene expression using the CRISPR-Cas13d system. In this study, we planned to prepare plasmid constructs that can be used to target tyr (tyrosinase) gene in zebrafish. The oligonucleotides with BsmBI adaptor sequences of these three guide RNAs were synthesized by IDT. Then, I prepared double-strand DNAs by denaturing and renaturing these oligonucleotides. The already made CRISPR-RfxCas13d cloning vector was digested by BsmBI-v2 enzyme and purified using a DNA agarose gel purification kit. Then, the dsDNAs and the vector were ligated together by T4 DNA ligase. Finally, I performed DNA transformation into E.coli, plasmid mini-preparation, and Colony-PCR. E.coli with targeted vector and gRNAs were made, positive clones are identified, and verified with NdeI enzyme digestion by running a gel. Future research is needed to finish cloning these plasmid constructs and test their functions toward the Cas13d transgenic approach development in zebrafish. Understanding the effects and causes of tyrosinase production will lead to better treatment plans to help combat human diseases in the future.

Kellyann Roman Cruz



Undergraduate University: University of Puerto Rico - Humacao

Undergraduate Degree: Microbiology

Undergraduate Graduation Date: May 2024

Graduate Field of Study: Molecular Cell Biology

Purdue University SROP College: College of Veterinary Medicine

Purdue University SROP Faculty Mentor: Dr. Sriveny Dangoudoubiyam

Research

Isolation and Determination of the Composition of Dense Granules, a Specialized Organelle of *Sarcocystis Neurona*

Kellyann Roman^{1,2}, Annapoorani Jegatheesan² and Sriveny Dangoudoubiyam²

[1] Department of Biology, University of Puerto Rico, Humacao campus

[2] Department of Comparative Pathobiology, College of Veterinary Medicine, Purdue University, West Lafayette, Indiana.

Sarcocystis neurona is an intracellular apicomplexan parasite that affects the central nervous system of horses and causes equine protozoal myeloencephalitis (EPM). It belongs to the phylum Apicomplexa, the members of which possess specialized secretory organelles required for the invasion and establishment of intracellular parasitism. *Toxoplasma gondii*, a model apicomplexan parasite uses its secretory organelles such as micronemes, rhoptries, and dense granules to infect host cells and lives in a parasitophorous vacuole (PV), but *Sarcocystis neurona* has only micronemes and dense granules, and lacks a PV. Thus, it differs in its intracellular lifestyle. Our interest is to understand the compositional nature of dense granules of *S. neurona* and their contribution to intracellular lifestyle of *S. neurona*. For isolation of dense granules, *S. neurona* grown in fibroblast monolayers were harvested and then lysed using a high-pressure cell disruptor. Microscopic examination of the lysate indicated that ~65% of the parasites lysed. This lysate was subjected to a sucrose density gradient ultracentrifugation process and the fraction specific to dense granules was collected. Nanoparticle tracking analysis (NTA) of this fraction indicated that the mean particle size of the contents of this fraction was ~200 nm, consistent with the size of apicomplexan dense granules. Western blot experiment further confirmed that this fraction was devoid of any proteins from micronemes suggesting there were no contaminating micronemes in the dense granule fraction. Finally, LC-MS/MS based proteomics was performed to determine the protein composition of dense granules. A BLAST search against *S. neurona* and *T. gondii* genes derived from toxodb.org did not reveal any known dense granule proteins (GRAs) except for *S. neurona* nucleoside triphosphate hydrolase (NTPase), a dense granule protein. Absence of other known dense granule specific GRA proteins indicates that the protocol needs further optimization. We conclude that further experiments are required to identify a dense granule protein and epitope tag it such that it can serve as a specific marker protein for this fraction in Western Blot assays. In addition to NTA, electron microscopy is required to confirm the isolation of dense granules.

Kerymar Molinary Ruiz



Undergraduate University: University of Puerto Rico - Aguadilla

Undergraduate Degree: Biological Sciences

Undergraduate Graduation Date: May 2024

Graduate Field of Study: Biological Sciences

Purdue University SROP Unit: Purdue Center for Cancer Research

Purdue University SROP Faculty Mentor: Dr. Kavita Shah

Research

Cyclin E is a Novel Regulator of Cyclin Dependent Kinase-5

Cyclin E is overexpressed in many human tumors, and is associated with high tumorigenic potential, metastasis, and poor prognosis. In addition, Cyclin E is also truncated in many human cancers. The most prevalent truncated Cyclin E forms are N-terminal truncation of the first 42 amino acids (42-Cyclin E) and N-terminal truncation of the first 66 amino acids (66-Cyclin E), which are highly expressed in human cancers. While Cdk2/Cyclin E complex has been very well studied, potential interaction of cyclin E with Cdk5 kinase remains unknown. The goal of our project is to clone full length Cyclin E and two truncated forms of Cyclin E (42-end and 66-end), express it in *E. coli*, purify and conduct kinase assays with CDK5 kinase. Successful completion of this project is expected to reveal whether Cyclin E and its truncated forms regulate CDK5 activity. Our results show that Cyclin E and its truncated forms inhibit CDK5 activity *in vitro*, when tested alone or in complex with CDK5/p35 activator. Future studies will investigate this phenomenon in human cancer cells to understand its impact on malignant phenotypes.

Zoey Grant



Undergraduate University: Brown University

Undergraduate Degree: English and Slavic Studies

Undergraduate Graduation Date: May 2024

Graduate Field of Study: Languages and Cultures – Slavic Studies

Purdue University SROP College: College of Liberal Arts

Purdue University SROP Faculty Mentor: Dr. Olga Lyanda-Geller

Research

Non-Freedom in Kafka, Gombrowicz, and Platonov's Parable Novels

This project examines Andrei Platonov's *The Foundation Pit* (1930), Franz Kafka's *The Castle* (1926), and Witold Gombrowicz's *Ferdydurke* (1937) as parable absurdist novels. In each of them, the authors belonging to three different cultures have a strikingly similar focus on the total lack of freedom, which we analyze on the textual levels of theme, plot, and language. Each of these angles reflect the conflicting boundaries between an individual's internal world and the external world of the other(s). Approached as parables, these novels provide a timely warning against our own world's unfreedom.









SROP Mentor Zulaida Soto Vargas and Mentees



SROP Mentor Xavier Ramos Cardona and Mentees



SROP Mentor Lisa Brown and Mentees



SROP Mentor Jose Ramos and Mentees



SROP Mentor Daniel Flores and Mentees

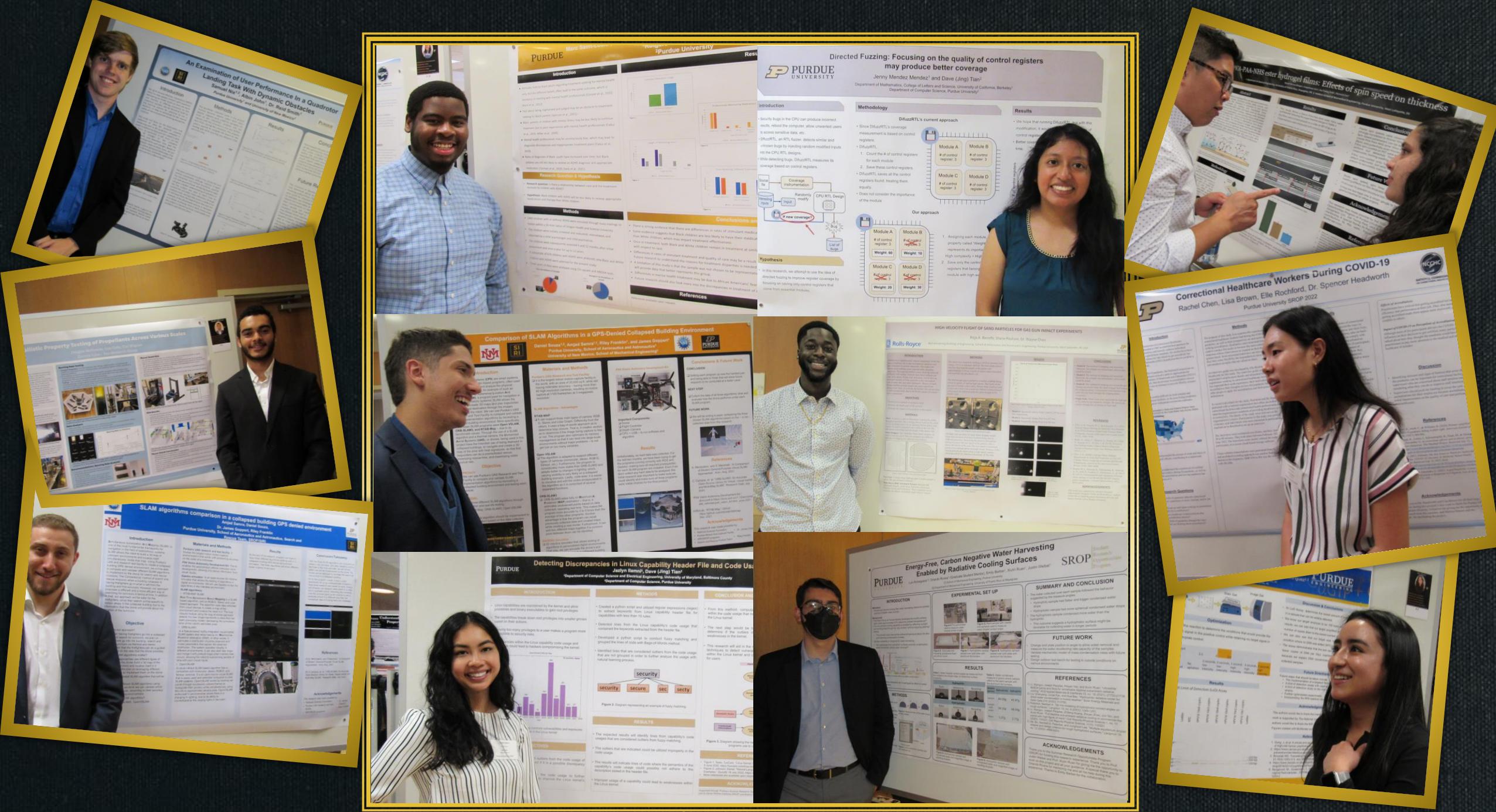


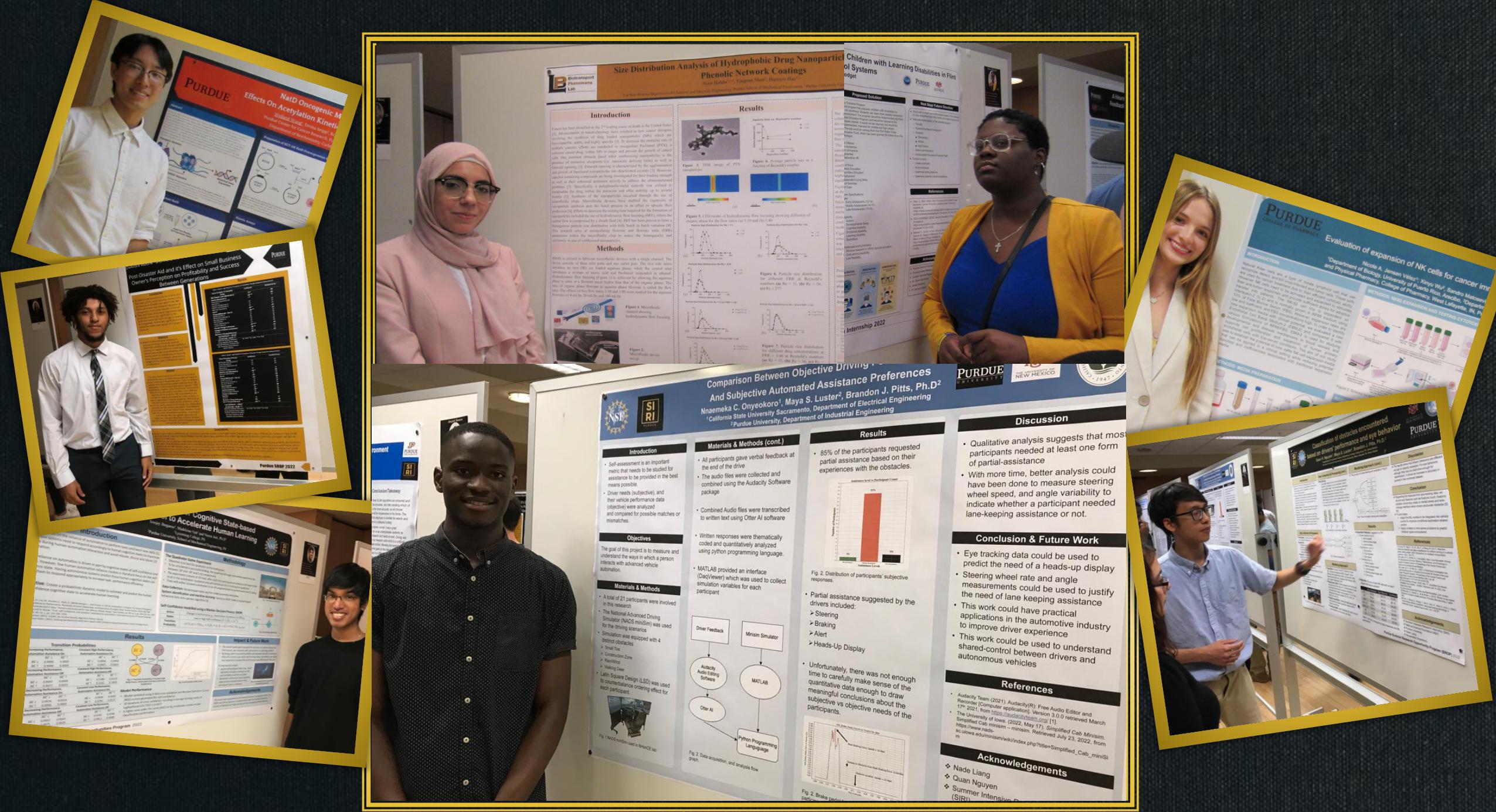
* Daniel was unable to make the picnic, so Xavier stepped in to help

2022

Purdue University SROP Poster Show







Awards Given

1st Place in Poster Show

Nnaemeka Onyeokoro

2nd Place in Poster Show

Alana López Cruz

3rd Place in Poster Show

Luis Romaguera Rios
Soojay Jhugaroo
Elijah Velasquez

Natural Born Leaders

Elijah Velasquez
DeAndre Malone
Rachel Chen

Special Thanks To:

The Purdue University Graduate School

College of Agriculture

College of Engineering

College of Health and Human Sciences

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College of Veterinary Medicine

Purdue Center for Cancer Research

Purdue University SROP Faculty Mentors

Purdue University Graduate Student Coordinators

University of New Mexico (SIRI) partnership

Dr. Ignacio Camarillo and the LSAMP program

Numerous volunteers, workshop presenters, faculty and staff

SROP participants for their creativity, hard work and dedication
throughout the summer

