Tool Stone Source Material in North Dakota from the Archaic to the Woodland Period
Madison Swartz, *College of Science*
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Mentor: Nicole Ramirez, *College of Engineering*

The Role of Protein Phosphatase 1 in Female Meiosis
Ilakkiya Venkatachalam, *College of Science & Honors College*
Mentors: Nicole Camlin and Janice Evans, *College of Science*

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PURDUE UNIVERSITY

WELCOME TO

CELEBRATE PURDUE'S THINKERS, CREATORS & EXPERIMENTERS

April 21, 2022

11:30am-2:30pm

Purdue Memorial Union
North Ballroom

OUR OFFICE OF UNDERGRADUATE RESEARCH

RESEARCH SHOWCASE

Presentations listed by first author's last name. Names listed as submitted.

How Does Preconception Paternal Alcohol Exposure (PAE) Affect the Behaviors and Development in Offspring? - A Review of the Current Evidence-Based Animal Studies
Anu Cherukara, *College of Pharmacy*
Mentor: Julia Chester, *College of Health & Human Sciences*

NASA Robotic Construction Competition : Designing Efficient Lunar Excavation and Deposition Hybrid Systems
Vertically Integrated Projects
Ryan DeAngelis, *College of Engineering*
Aditya Arjun Anibha, *College of Engineering*
Sarah Ruschke, *College of Engineering*
James Gilliam, *College of Engineering*
Carter Doby, *College of Engineering*
Keertana Yendru, *College of Engineering*
Dhruv Jha, *School of Management*
Mentors: Nichole Ramirez, Carla Zoltowski, and
Prabhpreet Dhir, *College of Engineering*

Fibroblast Activation Protein Targeted Radioligand Therapy for Treatment of Solid Tumors
Autumn Horner, *College of Health & Human Science & Honors College*
Mentors: Spencer Lindeman and Philip Low, *College of Science*

Designing and Testing an Unmanned Surface Vehicle to Analyze the Water Quality of the Amazon River
Vertically Integrated Projects
Ethan Kovalan, *College of Engineering*
Melchizedek Robinson, *College of Engineering*
Benjamin Davis, *College of Engineering*
Nick McKenzie, *College of Engineering*
Owen Hoerner, *College of Engineering*
Connor Gass, *College of Engineering*
Henry Wang, *College of Engineering*
Robert Heying, *College of Engineering*
Mentors: Nichole Ramirez and Prabhpreet Dhir, *College of Engineering*

Using Human Neurological Reactions to Predict Workload Variations
Eugene Lee, *College of Engineering*
Sitong Chen, *School of Management*
Mentors: Denny Yu and Jingkun Wang, *College of Engineering*

EPICS Vital Management
Emily Linder, *College of Engineering*
Maya Godbole, *College of Engineering*
Josephine Schlosser, *College of Engineering*
Trevor Sheehan, *College of Engineering*
Ella McCoy, *School of Management*
Carl Russell, *College of Engineering*
Mentors: Asem Aboelzahab, *College of Engineering*, and
Prasanna Janakiraman, *College of Science*

Modeling Early Human Migration Patterns in South America
Davin Miller, *College of Science & Krannert School of Management*
Mentor: Erik Otarola-Castillo, *College of Liberal Arts*

Protein Function Prediction using Neural Networks
Pratim Moulik, *College of Science & Honors College*
Mentor: Daisuke Kihara, *College of Science*

Earth History Visualization
Vertically Integrated Projects
Siddharth Narayanan, *College of Engineering*
Aron Gebre, *College of Engineering*
Vishrant Saagar, *College of Engineering*
Ching Chia Huang, *College of Engineering*
Mason Burgess, *College of Engineering*
Mentors: James Ogg, *College of Science*, and
Aaron Ault, *Purdue College of Engineering*

Characterizing Optimization Algorithms for Real-Time Image Processing Algorithms
Frances O'Leary, *College of Science*
Grace Szymanski, *College of Engineering*
Mentors: Song Zhang and Yi-Hong Liao, *College of Engineering*

NASA Robotic Construction Competition : Designing Efficient Lunar Excavation and Deposition Hybrid Systems

Author(s):

Ryan DeAngelis, College of Engineering

Aditya Arjun Anibha, College of Engineering

Sarah Ruschke, College of Engineering

James Gilliam, College of Engineering

Carter Doby, College of Engineering

Keertana Yendru, College of Engineering

Dhruv Jha, School of Management

Abstract:

In response to NASA's Artemis mission and the NASA Robotic Construction Competition, Our objective as part of the Lunabotics club and Vertically Integrated Projects program at Purdue University is to create an innovative, efficient and feasible excavation and deposition system design for the next iteration of NASA's Lunar Rover Mining Competition. We have researched excavation mechanisms ranging from bucket elevators, augers, circular drum excavators and more to create regolith trenches. We also investigated deposition systems with greater capacity and suitability for berm building. As part of our research, we have discovered advanced methods to calculate torque required for digging regolith using factors such as the digging angle and the shape of the digging tool. The primary design intent is to generate a system that is easily manufacturable, contains minimal complexity, is robust, and has longevity. This goal led us to a batch-processing mining and collection hybrid system which maximizes capacity beyond any past Lunabotics designs. Our overall design is a shovel-like excavation system with a large deposition bin on the body of the robot. While designing this system, we also discovered creative methods to reduce torque to match the nominal capabilities of cost-effective motors like mechanical advantage pulleys and materials-based weight reduction research into aluminum foams and plastics, UHMW in particular. Our contributions will have a genuine impact on the future of Lunabotics with the potential to support space exploration and settlement.

Mentor(s):

Nichole Ramirez, Purdue University

Carla Zoltowski, Purdue University

Prabhpreet Dhir, Purdue University

Fibroblast activation protein targeted radioligand therapy for treatment of solid tumors

Author(s):

Autumn Horner, College of Health & Human Sciences

Abstract:

In maladies such as cancer, fibroblasts become constitutively activated and play a critical role in the advancement of solid tumors. One biomarker of these cancer-associated fibroblasts is the cell-surface receptor fibroblast activation protein alpha (FAPα), which was shown to be expressed in 90% of human tumor biopsies. More recently, a European lab imaged 28 different types of solid tumors in human patients with a FAP-targeting radioactive molecule. Diagnosis and treatment of cancer with radioactive targeting molecules is a rapidly growing field. The Low lab synthesizes novel FAPα-targeting radioactive molecules then investigates their effectiveness by conducting preclinical radioactive scans and cancer radiotherapy treatments. The significance is that successful development of a FAP-targeting molecule for radiotherapy could in theory treat virtually all solid tumors. The key scientific problem to solve currently is identifying a FAP-targeting molecule that maximizes tumor uptake with simultaneous rapid clearance from healthy tissues. One of the fastest methods to evaluate whether new molecular structures for FAP-targeting molecules were fulfilling these criteria is by injecting said molecules into tumor-bearing mice and visualizing their biodistribution with radioactive imaging scans over time. We have generated, for the first time in the Low Lab, advanced radioimages by using the European software PMOD to perform sophisticated processing and analysis of SPECT/CT scans. Thus, we were able to evaluate the performance of multiple FAP-targeting molecules for the Low Lab and select the most promising candidate, directly leading to successful FAP-targeted radiotherapy treatment of tumors in preclinical mouse models.

Mentor(s):

Spencer Lindeman, Purdue University Institute for Drug Discovery

Philip Low, Purdue University Institute for Drug Discovery

Designing and Testing an Unmanned Surface Vehicle to Analyze the Water Quality of the Amazon River

Author(s):

Ethan Kovalan, College of Engineering

Melchizedek Robinson, College of Engineering

Benjamin Davis, College of Engineering

Nick McKenzie, College of Engineering

Owen Hoerner, College of Engineering

Connor Gass, College of Engineering

Henry Wang, College of Engineering

Robert Heying, College of Engineering

Abstract:

Water quality in rivers have become poorer over time, mostly due to the effects of agricultural and industrial waste – runoff from farms and waste products from industries contain harmful and/or toxic chemicals that pollute these rivers. The dispersion of these chemicals have led to a decrease in concentration of oxygen in certain bodies of water, causing large hypoxic zones that cannot support most marine life. Building upon previous research, we are in the process of designing an improved unmanned surface vehicle (USV) to test the water quality in the Amazon River. The design of the USV allows for it to steer through current while collecting samples of water autonomously using sensors. We will be using sensors to measure temperature, pH, turbidity, and total dissolved oxygen which will help gauge how suitable the body of water is for human use, while monitoring runoff in one of the world's most important rivers.

Mentor(s):

Nichole Ramirez, Purdue University

Preet Dhir, Purdue University

Protein Function Prediction using Neural Networks

Author(s):

Pratim Moulik, College of Science

Abstract:

Proteins consist of a sequence of amino acids. There are 20 specific amino acids in the proteins in our body and each protein has one or multiple functions. My project involves predicting function of proteins based of their constituent amino acid sequences. One major step in function prediction for a query protein is to mine of sequences in a protein database that are similar to the query protein sequence. One method that has been developed is PSI-Blast, used often by NIH and other health institutions. This method involves comparing the query protein sequence to each of the sequences using a similarity matrix. One problem is that it can take a long time to run. I specifically want to expedite the mining process using a convolutional neural network(used for classification of images). The major deliverable is going to be a computer program where a user can type in a protein sequence and can then see which other proteins in the database are similar. If I can, I would also like to have a ball and stick model of protein amino acid sequences just to give the audience an idea of the many different permutations and combinations of protein amino acid sequences. I feel my project will give users an idea of how complex our human body is, regarding different proteins.

Mentor(s):

Daisuke Kihara, Purdue University

Tool Stone Source Material in North Dakota from the Archaic to the Woodland Period

Author(s):

Madison Swartz, College of Science

Abstract:

Abstract Redacted.

Mentor(s):

Erik Otarola-Castillo, Purdue University

Designing and Testing of a Semi-Autonomous Drone

Author(s):

Aidan Velleca, College of Engineering

Alyssa Brewer, College of Engineering

Joseph Ma, College of Engineering

Natasha Gundapaneni, College of Engineering

Nick Sebal, College of Engineering

Tirth Desai, College of Engineering

Yunhao Lan, College of Engineering

Abstract:

Abstract Redacted.

Mentor(s):

Nicole Ramirez, Purdue University

The Role of Protein Phosphatase 1 in Female Meiosis

Author(s):

Ilakkiya Venkatachalam, College of Science

Abstract:

Kinase and phosphatase activity regulate cell cycle progression through changes in the phosphorylation state of proteins. Our study focused on Protein Phosphatase 1 (PP1), a candidate for regulatory function in mammalian oocytes (eggs), to understand the machinery regulating meiosis in this important cell type. Our approach was to experimentally manipulate PP1 to disrupt its normal pattern of activity during meiosis to test hypotheses about what this enzyme does in oocytes. This research will increase our knowledge of factors affecting female fertility.

Prior analyses of PP1 in starfish and mouse oocytes suggest PP1 is inactive during prophase I exit. We tested the hypothesis that inappropriate activity of PP1 at this stage would cause abnormalities in the G2/M transition by culturing mouse oocytes in a medium containing PDP-Nal, a PP1 activator. The PP1 experiment results show that inappropriate PP1 activation at prophase I exit kills oocytes and inhibits meiosis. PP1 inactivity is essential for successful prophase I exit and M-phase entry.

Mentor(s):

Nicole Camlin, Purdue University

Janice Evans, Purdue University