# 2019 PURDUE SUMMER UNDERGRADUATE RESEARCH SYMPOSIUM

## JULY 25, 2019

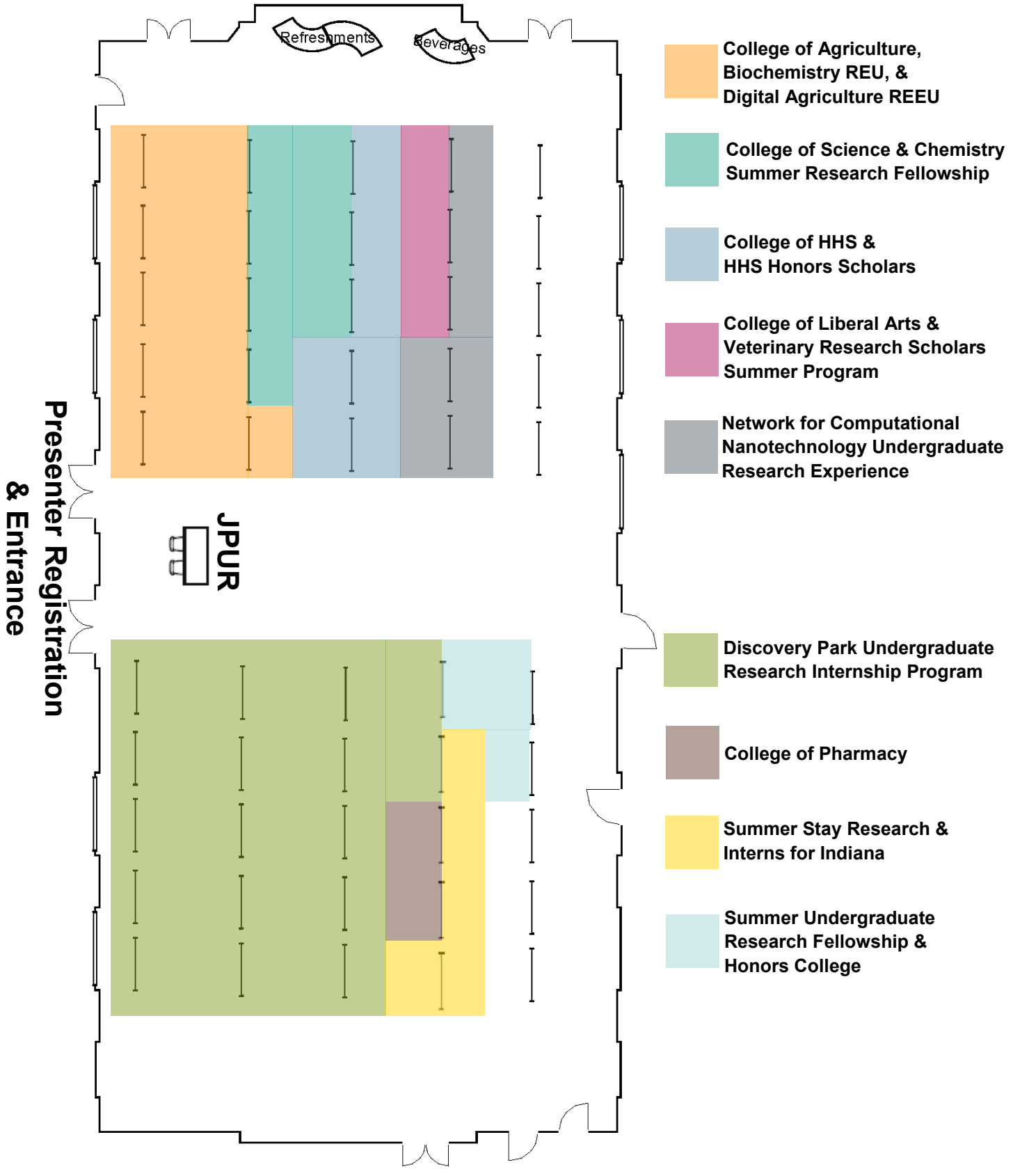
**PMU SOUTH BALLROOM | 10AM-12PM**

West Lafayette, Indiana

# Summer Undergraduate Research Symposium

July 25, 2019 :: 10am-12pm

## South Ballroom



# Poster Numbers by Program or Project's College

## College of Agriculture

1 *Heterologous Expression of a Fungal Mevalonate Pathway in* E. coli
Elizabeth Frazier
Mentors: Dr. Kevin Solomon & Ethan Hillman

## Biochemistry REU

2 *Development of a Fluorescently Labelled Unwinding Assay for Dbp2*
Woudasie Admasu
Mentors: Elizabeth Tran, Sara Cloutier, & Matthew Russon

3 *Kinetic Evaluation of Five Metallo-Beta-Lactamases That Cause Antibiotic Drug Resistance*
Jalyn Dickens
Mentors: Emma Lendy & Dr. Andrew Mesecar

4 *Knockdown of SET2 Methyltransferase in* Drosophila melanogaster
Arrianna Hagins
Mentors: Dr. Vikki Weake & Juan Pablo Jauregui

5 *Identifying and characterizing gene promoters to drive heterologous expression in anaerobic fungi*
Ja'Sean Holmes
Mentors: Dr. Kevin V. Solomon & Ethan T. Hillman

6 *Determining the substrate specificity of Cdc14 in* Tetrahymena thermophila
Michael Mensah-Mamfo, Angela Koeberlein, & Kedric Milholland
Mentors: Dr. Mark Hall, Kedric Milholland

7 *Developing a new proteomic strategy for blood-based biomarker discovery in Alzheimer's disease*
Chris Pintro
Mentors: Andy Tao & Leo Kao

8 *Purification and characterization of the WT and disease associated variants of DNMT3A PWWP domain*
Michelle Ramirez
Mentors: Dr. Humaira Gowher & Allison Norvil

9 *Determination of the midpoint potential of a regulatory lumenal disulfide bond in* Arabidopsis thaliana *State Transition 7 kinase*
Seth Weaver
Mentors: Sujith Puthiyaveetil & Iskander Ibrahim

## Digital Agriculture REEU

10 *Applications of Digital Agriculture: Using Python to Predict Field Outcomes*
Morgan Abraham & Katie Krick,
Mentor: Dr. Dennis Buckmaster

11 *Are you in a food desert?*
Tajah Billingsley
Mentors: Dr. Dharmendra Saraswat & Ben Hancock

12 *Economic and Informational Barriers to Eating Healthy*
Jaclyn Lee
Mentors: Dr. Dharmendra Saraswat & Ben Hancock

13 *Combine and Cart Harvest Efficiency*
Demetre Mitchell
Mentors: Dr. James Krogmeier & Yang Wang

14 *Supply Chain of Rice in the U.S.*
Eric Shim
Mentors: Dr. Dharmendra Saraswat & Ben Hancock

15 *Understanding topography as a factor in yield variation*
Jatavian Smith
Mentors: Dr. Dennis Buckmaster & Sam Noel

16 *Invasive Insect Species, The Gypsy Moth*
Bailey Walvoord
Mentors: Dr. Dharmendra Saraswat & Ben Hancock

## College of Science

17 *Sticky Materials from Walnut Juglone and Corn Zein Protein*
Nicholas Branson
Mentor: Gudrun Schmidt

18 *Analyzing Silicon Detectors for the High-Luminosity Upgrade of the Large Hadron Collider*
Eshwar K Puvvada
Mentors: Andreas Jung & Souvik Das

19 *Investigating FIC Proteins as Virulence Factors for the Gastric Pathogen,* Helicobacter pylori
Alexandra Stiffler
Mentor: Seema Mattoo

20 *Manufacturing and validation of carbon composite structures for CMS experiment at LHC*
Jack Wheeler
Mentors: Sushrut Karmarkar, Dr. Andreas Jung, & Dr. Souvik Das

## Chemistry Summer Research Fellowship

21 *Characterization of Adhesives from Protein and Phenolics from Plants*
Lawrence Xi-Bin Fung & Nicholas Branson
Mentor: Gudrun Schmidt

22 *Templated Assembly of Ultra-narrow AuNWs on Noncovalently Functionalized HOPG and MoS2*
Tianhong Ouyang
Mentors: Shelley A. Claridge & Erin Noel Lang

23 *Identification of C=C Positional Lipid Isomers Using Two Different Photochemical Reactions*
Sneha Swaroop
Mentors: Julia Laskin & Daisy Unsihuay

## College of Health & Human Sciences

24 *Characterizing the Broader Autism Phenotype in Early Childhood: Are children's vocalizations distinguishable during play?*
Emily Garza & Kelsie Thacker
Mentors: Dr. AJ Schwichtenberg & Ashleigh Kellerman

25 *The Value of Mentors for Young Adults*
Jayla Langford
Mentor: Dr. Sharon Christ

**SEARCHING FOR A RESEARCH OPP?**
Attend the **Research Roundtable** on Sept. 17 in the Co-Rec!

## HHS Honors Scholars

26 *Autonomous Motivation and Physical Actvity for Older Adults*
Margaret Becker
Mentors: Drs. Libby Richards & Melissa Franks

27 *Maternal depression and parent-mediated interventions for children at-risk of developing ASD*
Alexandria Bien
Mentors: Ashleigh Kellerman & Dr. AJ Schwichtenberg

28 *Toxicity of lead and atrazine mixture using the larval zebrafish model system*
Anusha Kotapalli, Janiel Ahkin Chin Tai, & Keturah Kiper
Mentor: Dr. Jennifer Freeman

29 *Reproductive Health Decision-Making: Extending the Shared Decision-Making Model into the Community Space*
Natalie Murdock
Mentors: Dr. Andrea DeMaria & Stephanie Meier

30 *Comparison of Metastatic and Non-Metastatic Breast Cancer Cell Survival in Extracellular Matrix Detached Conditions*
Kanika Garg
Mentors: Dr. Dorothy Teegarden & Madeline Sheeley

## College of Liberal Arts

31 *Live Organ Kidney Donation: Assessing Students' Hesitations and Motivations to Inform Future Message Strategies*
Natalie Moore
Mentor: Evan K. Perrault

## Veterinary Research Scholars Summer Program

32 *Novel* in vitro *injury model recapitulates TBI-linked increases of the clinical biomarker alpha-synuclein*
Jeannine Diab, Edmond Rogers, Brock Beauclair, & Andrew Thyen
Mentors: Riyi Shi & Edmond Rogers

33 *Quantitative evaluation of the progression of lung cancer brain metastases using bioluminescence imaging*
Alexandra Reddy
Mentors: L. Tiffany Lyle, Gozde Uzunalli, & Alexandra Dieterly

## Network for Computational Nanotechnology Undergraduate Research Experience

34 *Effect of Chemical Representations for Transfer Learning*
Bryan Antonio Arciniega
Mentors: Dr. Brett M. Savoie & Nicolae Iovanac

35 *Elastoplastic Response of Compacted Pharmaceutical Powder Blends: Model Development, Calibration, and Validation*
Paul Beckwith
Mentors: Dr. Marcial Gonzalez & Pedro Cidreiro

36 *Plasmonic Core-Multishell Nanowires for Optical Applications*
Raheem Carless
Mentors: Dr. Chen Yang & Amartya Dutta

37 *Hierarchical Structure Optimization using Neural Networks*
Miguel Arcilla Cuaycong & Valeria Grillo
Mentors: Dr. Pablo Zavattieri & Kristiaan Hector

38 *Machine Learning for Property Prediction and Materials Discovery*
Mackinzie S Farnell
Mentors: Dr. Brett M. Savoie & Nicolae Iovanac

39 *Food and Energy Farms Simulation Tool*
Hans Torsina
Mentors: Dr. Peter Bermel & Allison Perna

40 *Identifying Dimensionality of Periodic Crystals*
Franco Vera
Mentors: Dr. Richard G. Hennig, Joshua Paul, & Dr. Nancy J. Ruzycki

**PRESENT AT OR ATTEND THE FALL EXPO IN NOV!**

## Discovery Park Undergraduate Research Internship Program

41 *Long Range Wireless Sensor Network Solution for Soil Health Monitoring in Arequipa region*
Andrew Baldwin
Mentors: Daniel Leon-Salas & Jino Ramson

42 *Directing Sunlight to Meet Local Food, Energy, and Water Needs*
Daniela Cadena
Mentors: Peter Bermel & Elizabeth Grubbs

43 *Algorithmically-Generated Communities: A Case Study*
Michael A. Davidge, Jeongjin Park, & Gregory Sirko
Mentor: Austin L. Toombs

44 *Ecological Flow Requirements for Aquatic Macroinvertebrates in the Arequipa Region, Peru*
Paul Dawley
Mentors: Fariborz Daneshvar & Laura Bowling

45 *Modeling Atmospheric Circulation Effects on Water Stable Isotopes in Arequipa Peru*
Jonathan DeGraw
Mentors: Elizabeth Olson, Lisa Welp, & Greg Michalski

46 *Data Driven Identification of Impact of Information on Health-Related Choices*
Taher Dohadwala, Yufei Xu, & Katie Brinkers
Mentors: Munirul Haque & Mohammad Rahman

47 *Mechanical Properties of Guest-Host Affinity Polymers for 3D Bioprinting*
Eric Evory, Mazin Hakim, & Dr. Luis Solorio
Mentor: Mazin Hakim

48 *Water Origins and Flow Path Analysis of Groundwater in the Colca Canyon, Southern Peru*
Jack Fekete
Mentors: Drs. Lisa Welp, Marty Frisbee, & Elizabeth Olson

49 *Investigating the Source of Groundwater Springs in Arequipa, Peru*
Carol Salazar Mamani, Midhuar Arenas Carrion, & Wendy Roque Quispe
Mentors: Lisa Welp, Elizabeth Olson, Marty Frisbee, & Sebastian Zuniga

50 *Landscape Vegetation-Cover Classification across the Arequipa Region, Peru 2005*
Nicholas Hamp-Adams
Mentors: Zachary Brecheisen & Darrell Schulze

51 *Effects of Urbanization on Soil and Water Health in Arequipa, Peru*
Kayley Hodson
Mentors: Abigail Tomasek & Sara McMillan

52 *Describing STEM Students' Patterns of Ethical Concern*
Hunter Hollinger, Ilayda Karagol, Liyang Qu, & Min Gyeong Kang
Mentors: Dr. Colin M. Gray & Shruthi Chivukula

53 *Developing User Interfaces for the Biowall*
Rebecca Hutzel
Mentor: Mark Zimpfer

54 *Progress Towards the Synthesis of Phosphatidyl Glycerol*
Sooyeon Hyun
Mentors: Zachary J. Struzik & David H. Thompson

55 *pXRF Analysis of Heavy Metals in Peruvian Vineyard Soils*
Ally Jacoby
Mentors: Tim Filley & Erika Foster

56 *Evaluation of an Improved Automated Controls System for Purdue's Biowall*
Walter Kruger
Mentor: William Hutzel

57 *Carbon Accumulation in Vineyard Soils of the Peruvian Desert*
Andrew Lawrence
Mentors: Tim Filley & Erika Foster

58 *Plant Evaluation for a Botanical Air Filter*
Danielle LeClerc
Mentor: William Hutzel

59 *Solar Cell Performance on Multi-layer Thin Film by Using Stanford Stratified Structure Solver (S4) and GUI Development.*
Changkyun Lee
Mentors: Peter Bermel & Ze Wang



60 *Simplifying Geospatial Visualization and Analysis*
Edwin Lu
Mentors: Carol Song & Lan Zhao

61 *Predicting Solar Energy Generation Using Weather Forecasts to Limit Impact on the Power Grid*
Tina Mo & Daniel Lee Young
Mentors: Lisa Bosman, Jason Ostanek, & Bill Hutzel

62 *High Altitude Wind Energy Production over Complex Terrains*
Abigayle Moser, Kaitlin Kelsey, & Daniel Kwon
Mentors: Drs. Luciano Castillo & David M. Warsinger

63 *Instrumentation of Streams to Evaluate Seasonality of Heavy Metal Concentrations in the Arequipa Region*
Caelum Mroczek
Mentors: Chad Jafvert & Alexander Ccanccapa

64 *Extensible Geospatial Data Framework towards FAIR (Findable, Accessible, Interoperable, Reusable) Science*
Amrish Nayak
Mentor: Rajesh Kalyanam

65 *Thermodynamics of Water in Our Solar System*
Akshay Rao, Owen Li, & Abhimanyu Das
Mentor: David M. Warsinger

66 *Construction Management Students' Choice of Major*
Aayushi Sinha
Mentors: Anne Lucietto & Anthony E. Sparkling

67 *Developing Containerized Applications for Cybersecurity Education*
Noah Oller Smith & Takahide Iwai
Mentors: Rajesh Kalyanam & Baijian Yang

68 *Characterization of Microbial Communities From Vineyards in Majes, Peru*
Tess Snyder
Mentors: Lori Hoagland & Alejandro Rodriguez-Sanchez

69 *Impact of Augmented Reality, Virtual Reality, and Artificial Intelligence Improving Skill Acquisition in Flight Training*
Khari Stewart & Curtis Taylor
Mentor: Julius Keller

70 *Establishment of a Crop Mapping Methodology Using Remote Sensing for the Arequipa Region*
Alec Watkins
Mentors: Andre de Lima Moraes & Keith Cherkauer

71 *Ionic Composition of Precipitation in the Southern Peruvian Andes*
Brianna Westerberg
Mentors: Drs. Greg Michalski & Elizabeth Olson

72 *Evaluation of Virtual Internships Integrated Into College Engineering Coursework*
Daniel Young
Mentor: Lisa Bosman

## College of Pharmacy

73 *Spatiotemporal modulation of extracellular signal-regulated protein kinases 1 and 2 (ERK1/2) by opioid receptor signaling*
Angel Lin and Arbaaz A. Mukadam
Mentors: Richard van Rijn & Mee Jung Ko

74 *Pharmacological characterization of a potentially new class of delta-opioid receptor agonist*
Hongyu Su
Mentors: Richard van Rijn & Robert Cassell

## Interns for Indiana

75 *Parent-mediated intervention for children developing at-risk for an ASD: Are the number of elevated-risk concerns indicative of greater ASD-risk?*
Sabrina Hollis
Mentors: Dr. AJ Schwichtenberg & Ashleigh Kellerman

## Purdue Summer Stay Program

76 *Youth' Perceptions, Ideas, and Advice Regarding What Puts Peers At-Risk for Substance Use, How to Help Peers Avoid Substances, and Developing Prevention Activities*
Jordan Harris & Ruby Reyes
Mentor: Dr. Yumary Ruiz

77 *Indoor Environmental Quality from Arequipa, Peru*
Mason A. Merkel
Mentor: Bill Hutzel

78 *Youth's Openness and Willingness to Participate in Anti-Drug Programming Offered Within a Summer Camp Context.*
Nneka A. Ogbonnaya & Sophia M.Schadewald
Mentor: Dr. Yumary Ruiz

79 *Biowall Airflow Seal Improvement and Aerodynamic Path Characterization*
Austin Shores
Mentor: William Hutzel

## Summer Undergraduate Research Fellowship Program

80 *Impact of Residual Crystallinity on Dissolution Performance of Amorphous Solid Dispersions*
Isaac Corum
Mentors: Dana Moseson & Lynne Taylor

81 *Highly Flexible and Transparent Conductor for Solar Cells*
Thao Nguyen
Mentors: Blake Finkenauer & Professor Letian Dou

## Honors College

82 *The Effect of Expanding City Boundaries on Rates of Lyme Disease in the United States*
Daphne Fauber
Mentor: Dr. Hsin-Yi Weng

**Poster Number:** 1 :: Life Sciences

**College of Agriculture**

# Heterologous Expression of a Fungal Mevalonate Pathway in *E. coli*

Undergraduate Researcher:

Elizabeth Frazier

Abstract:

Presently, the production of many leading pharmaceuticals is limited by the time-intensive and cost-prohibitive process of synthesizing precursor molecules. The multistep organic reactions yielding these intermediate forms are often intricately complex and generate unwanted byproducts. One such process is the production of the drug mevalonate. Mevalonate is a precursor to numerous polyisoprenoid metabolites and natural products, most notably the anticancer drug Taxol. Historically, mevalonate was commercially produced in a synthetic manner at a cost of roughly $20,000/gram. However, natural mevalonate pathways converting acetyl-CoA to isopentenyl 5-diphosphate that function in most eukaryotes, archaea, and eubacteria were recently discovered. Other labs have successfully developed the upstream portion of one such mevalonate pathway using three genes isolated from the yeast species Saccharomyces cerevisiae. Noting the higher activity level of homologous fungal genes, we used microbial enzymes sourced from Piromyces indianae, a species of early-diverging fungi dwelling in the digestive tracts of large herbivores, to create a parallel mevalonate pathway in E. coli host cells. While the yeast homologs produce roughly 1 gram/liter of mevalonate, the higher activity level of fungal genes predicts even higher mevalonate yields. Here, we demonstrate the ability of our fungal pathway to yield mevalonate and provide evidence to suggest that, under optimized conditions, these genes may surpass existing mevalonate pathways in productivity. This work can serve as a rationale for continued sourcing of these fungi for beneficial genes, specifically those that can be used to increase the efficiency of chemical reagent production, effectively decreasing the global cost of medicines.

*Research Mentors:*

*Dr. Kevin Solomon & Ethan Hillman; Agricultural & Biological Engineering*

**Poster Number:** 2 :: Life Sciences

**Biochemistry REU**

# Development of a Fluorescently Labelled Unwinding Assay for Dbp2

Undergraduate Researcher:

Woudasie Admasu

Abstract:

DEAD Box proteins are ATP-dependent RNA helicases that are involved in every step of RNA metabolism. DEAD Box protein DDX5 is the mammalian ortholog of Dbp2 in S. cerevisiae, and has been shown to be involved in various types of cancer. DDX5 and Dbp2 share conserved roles in metabolism, implying that Dbp2 may share other roles with DDX5. The goal of this investigation was to establish a fluorescent unwinding assay for Dbp2. We induced the expression of the DBP2 gene in Rosetta E. coli cells with IPTG, along with the gene for maltose-binding protein (MBP) to produce MBP-tagged Dbp2, and purified it after removing the MBP tag. We then measured the rate of ATP hydrolysis with the use of an ATPase assay to ensure that the protein was enzymatically active. We report that the ATP hydrolysis rate of Dbp2 in vitro is very slow. Progress on the fluorescent unwinding assay will be reported. The development of a fluorescent unwinding assay would enable high throughput studies of the unwinding mechanism of Dbp2, which could be used for drug design.

*Research Mentosr:*

*Elizabeth Tran, Sara Cloutier, and Matthew Russon; Biochemistry*

**Poster Number:** 3 :: Life Sciences

**Biochemistry REU**

# Kinetic Evaluation of Five Metallo-Beta-Lactamases That Cause Antibiotic Drug Resistance

Undergraduate Researcher:

Jalyn Dickens

Abstract:

Worldwide, antibiotics are no longer doing their job. Antibiotic resistance has become a difficult problem to solve due to the appearance of beta-lactamase enzymes that destroy beta-lactam antibiotics, the most commonly used antibiotics. To take care of this threat to public health, the first step in developing drugs that target beta-lactamases is to gain a better understanding of how these enzymes function.

One important component of the characterization of these enzymes is determining their Km values. Km values reflect how tightly the substrate binds to the enzyme, with a lower value meaning a more tightly bound substrate. Experimentally determining the Km of an enzyme is a necessary first step in kinetic characterization. A second step is determining IC50 values through a kinetic assay performed with the substrate concentration at the Km. The Km values and IC50 values of L-Captopril were determined for five beta-lactamases from K.pneumoniae, P.aeruginosa, E.litoralis and H.baltica. The Km values with nitrocefin as a substrate were found to range from 4 to 8 Î¼M, and the IC50 values for L-Captopril ranged from 7 to 92 Î¼M. The IC50 values are now helping guide the design of better inhibitors.

Through these experiments an inhibitor for antibiotic resistant bacteria was found. L-Captopril was found to inhibit all five beta-lactamases tested, proving itself as a novel inhibitor for four out of the five enzymes. This characterization of beta-lactamases are the beginning steps to finding effective inhibitors that can be clinically used to stop antibiotic resistance.

*Research Mentors:*

*Emma Lendy and Dr. Andrew Mesecar; Biochemistry*

**Poster Number:** 4 :: Life Sciences

**Biochemistry REU**

# Knockdown of SET2 Methyltransferase in *Drosophila melanogaster*

Undergraduate Researcher:

Arrianna Hagins

Abstract:

In humans, aging leads to an accumulation of reactive oxygen species and weakened antioxidant defense causing neurodengerative disorders as a result of lipid peroxidation and oxidative stress. The effects of aging on the retina can be mimicked in Drosophila melanogaster by exposing them to prolonged blue light as blue light stress has been found to cause rapid degenerative effects in the photoreceptor cells of this species. Epigenetic factors such as methyltransferases possibly play a role in the defense mechanisms that Drosophila use to protect themselves from damage to photoreceptors induced by blue light stress. In this project we want to determine whether histone methyltransferase Set2 functions as neuroprotective protein by knocking down its expression, specifically in photoreceptor cells of Drosophila melanogaster. To do this we downregulate the expression of this protein using a shRNA against its mRNA. We have a shRNA targeting Set2, and I am validating the knockdown efficiency of this shRNA. We express the shRNA using the GAL4-UAS system. GAL4 is a transcription factor that binds to a UAS sequence, and activates the transcription of any sequence downstream of UAS. Expressing GAL4 in photoreceptors leads to the expression of shRNA, specifically in this tissue, which will bind to the target mRNA and cause the degradation of it, leading to decreased expression of the gene of interest. Histones are extracted from the larvae of Drosophila melanogaster expressing the GAL4-UAS system and are ran on western blots to determine whether there are decreased levels of expression of the Set2 methyltransferase.

*Research Mentors:*

*Dr. Vikki Weake and Juan Pablo Jauregui; Biochemistry*

**Poster Number:** 5 :: Life Sciences

**Biochemistry REU**

# Identifying and characterizing gene promoters to drive heterologous expression in anaerobic fungi

Undergraduate Researcher:

Ja'Sean Holmes

Abstract:

Anaerobic fungi (phylum Neocallimastigomycota) have key ecological roles and substantial potential for industry. Normally found hydrolyzing lignocellulosic biomass in herbivores (an ability necessary for economical biofuels), these organisms possess genomes encoding various secondary metabolites (SMs) that may serve as pharmaceuticals, pesticides, and biofuels. Thus, anaerobic fungi may advance medicine, agriculture, and renewable energy. Despite this vision, no tools exist to genetically engineer anaerobic fungi. Gene-editing systems such as CRISPR-Cas9 may enable manipulation of their genomes, but currently no promoters for anaerobic fungi have been isolated to drive endogenous Cas9 expression. Our team identified the most highly expressing genes within anaerobic fungal genomes, to identify promoters for use. The enolase (ENOL) gene was among the highest expressing and most conserved genes. We cloned the upstream region of ENOL (which should encompass a promoter) from the anaerobic fungus Neocallimastix sp. Gf-Ma at six different lengths into a pETM6 vector plasmid containing the synthetic reporter gene iLOV (encoding flavin-based fluorescence). Our next step is to transform these recombinant plasmids into cultures of N. Gf-Ma to test for iLOV expression, from which we will determine which region(s) of the full-length ENOL promoter are necessary to drive heterologous gene expression. Our long-term goal is to identify the strongest promoter(s) to induce heterologous expression of CRISPR-Cas9 in place of iLOV. With successful gene-editing in anaerobic fungi, we will eventually disclose gene pathways leading to potential SMs, for which we will implement integrated -omics approaches to determine real-world applications.

*Research Mentors:*

*Dr. Kevin V. Solomon and Ethan Hillman; Agricultural and Biological Engineering*

**Poster Number:** 6 :: Life Sciences

**Biochemistry REU**

# Determining the substrate specificity of Cdc14 in *Tetrahymena thermophila*

Undergraduate Researchers:

Michael Mensah-Mamfo

Angela Koeberlein

Kedric Milholland

Abstract:

Cdc14 is a dual-specificity phosphatase with a conserved catalytic domain, and consensus substrate-binding sequence, pS-P-(K/R/x)-(K/R)-(K/R/x). Cdc14 is important for mitotic exit in Saccharomyces cerevisiae but functions of the human Cdc14A and B orthologs are still poorly understood. A mutation in human Cdc14A (hCdc14A) causes inherited deafness as a result of degeneration of ciliated inner ear cells. The mechanism by which cilia function is regulated by hCdc14A is unknown. *Tetrahymena thermophila* will be used as a model to investigate the role of Cdc14 in cilia function and formation because of the abundance of cilia present in its structure. Tetrahymena possess six apparent Cdc14 orthologs. Enzymatic characterization of these Cdc14 orthologs will identify those most similar to yeast and human Cdc14 so that we can investigate their biological role in Tetrahymena cilia function and formation. We expect this to shed light on how hCdc14A promotes function of auditory cells in the inner ear. The Cdc14 orthologs of Tetrahymena (TTtCdc14-1 through TtCdc14-6) were expressed in Escherichia coli, purified by nickel affinity chromatography, and their substrate specificities compared to that of budding yeast Cdc14 (ScCdc14) using a steady state kinetic assay on a panel of synthetic phosphopeptide variants based on a well-established yeast Cdc14 substrate sequence. Overall, the specific activities of TtCdc14-1, TtCdc14-3, and TtCdc14-4 were considerably lower than ScCdc14 activity. TtCdc14-1 showed a relatively high preference for a phosphorylated tyrosine at the zero position. TtCdc14-1, TtCdc14-3, TtCdc14-4, and ScCdc14 showed low affinity for alanine and lysine at the +1 position.

*Research Mentors:*

*Dr. Mark Hall and Kedric Milholland; Biochemistry*

**Poster Number:** 7 :: Life Sciences

**Biochemistry REU**

# Developing a new proteomic strategy for blood-based biomarker discovery in Alzheimer's disease

Undergraduate Researcher:

Chris Pintro

Abstract:

Redacted.

*Research Mentors:*

*Andy Tao and Leo Kao; Biochemistry*

**Poster Number:** 8 :: Life Sciences

**Biochemistry REU**

# Purification and characterization of the WT and disease associated variants of DNMT3A PWWP domain

Undergraduate Researcher:

Michelle Ramirez

Abstract:

DNA methyltransferases (DNMTs) are enzymes that catalyze the transfer of methyl groups from S-Adenosylmethionine to DNA. DNA methylation in mammals is involved in regulation of gene expression. DNA methylation is catalyzed during early development by enzymes Dnmt3a and Dnmt3b. DNMT3a has a C-terminus that catalyzes methylation and an N-terminus that regulates methylation by binding to DNA and histones. Located in the N-terminus is a region composed of proline, tryptophan, tryptophan and proline (PWWP domain) which binds with the di- or tri-methylated lysine 36 on histone 3 (H3K36me2/3) and DNA. These interactions have been associated with the regulation of gene expression by DNA methylation. Mutations in this region are associated with genetic diseases such as Tatton-Brown-Rahman syndrome (TBRS), Microcephalic dwarfism (MD), and heritable cancers such as Pheochromocytoma/paraganglioma (PCC/PGL). The effect of two mutations on the PWWP domain and activity of DNMT3A has been characterized in MD. However, the effect of other mutations on PWWP domain activity has not been characterized. In this study we investigated and characterized the effect of the TBRS and PCC/PGL associated mutations on DNA binding and histone binding activity of PWWP domain. Site directed mutagenesis was performed using rolling circle PCR, followed by bacterial expression and purification of the recombinant wildtype and variant proteins. DNA and histone binding was tested by using Dot-Blot method. The wildtype PWWP domain and variant proteins were expressed and purified. A dot blot analysis showed that R301W mutation had no effect on DNA binding to the PWWP domain.

*Research Mentors:*

*Dr. Humaira Gowher and Allison Norvil; Biochemistry and Purdue Center for Cancer Research*

**Poster Number:** 9 :: Life Sciences

**Biochemistry REU**

# Determination of the midpoint potential of a regulatory lumenal disulfide bond in *Arabidopsis thaliana* State Transition 7 kinase

Undergraduate Researcher:

Seth Weaver

Abstract:

Green plants convert photon energy from the sun into chemical energy through the process of oxygenic photosynthesis. Photosystems I and II (PS I and II) are major protein complexes in the electron transport chain which harvests photon energy to excite electrons. The two photosystems are preferentially excited by different wavelengths of light. This imbalance in excitation pressure between the two photosystems due to rapidly changing light conditions is balanced by a process known as state transitions. The protein that initiates this phenomenon is known in Arabidopsis thaliana as State Transition 7 (Stn7). Under PS II specific light, Stn7 phosphorylates the LHC II that is loosely bound to PS II. Upon phosphorylation, phospho-LHC II migrates to the rate-limiting photosystem, PS I, to redistribute the excitation energy. It has been proposed that Stn7 kinase is activated upon reduction of its lumenal disulfide bond, which forms a homodimer with another polypeptide chain of Stn7 protein. The lumenal segment of Stn7 was cloned into an expression plasmid and expressed in BL21 E. coli cells. The Stn7 protein, which has an N-terminus His6-MBP tag, was purified with Ni2+ affinity and size exclusion chromatography. A redox titration assay, with sodium dithionite as a reductant allowed Stn7 to be sampled at a range of potentials. The dimer-monomer ratio under different potentials were visualized using SDS-PAGE and ImageJ. The titration assay is currently being optimized and other reduction schemes with DTT and glutathione are being explored.

*Research Mentors:*

*Sujith Puthiyaveetil and Iskander Ibrahim; Biochemistry*

**Poster Number:** 10 :: Life Sciences

**Digitial Agriculture REEU**

# Applications of Digital Agriculture: Using Python to Predict Field Outcomes

Undergraduate Researchers:

Morgan Abraham

Katie Krick

Abstract:

Weather is unpredictable and the â€œvolumeâ€• of tactical decisions so large that farmers often make decisions about their field operations only using instinct as informed by short-term weather predictions. This project will create a simulation framework and environment that analyzes weather data (past and forecasts), field/soil characteristics, and intended farming operations to provide farmers with suggestions backed by data. Initial use of this program will require an input of field/soil characteristics and location from the farmer. From there the farmer can run the simulator to receive predicted outcomes. Using different field data as well as weather data, a Python script was developed in order to provide a simulation of field outcomes including the date and order in which certain field operations should be performed. This simulation was created with the intent of helping farmers have handy and rapid access data-based recommendations. This project will further advancements in precision farming in terms of time efficiency as the script will output the most effective sequence according to the various inputs such as weather and desired application.

*Research Mentor:*

*Dennis Buckmaster; Agricultural & Biological Engineering*

**Poster Number:** 11 :: Life Sciences

**Digitial Agriculture REEU**

# Are you in a food desert?

Undergraduate Researcher:

Tajah Billingsley

Abstract:

Abstract- Food deserts are all over the world and have been linked to health issues like diabetes and obesity, especially in impoverished neighborhoods. What is a food desert? According to the American Nutrition Association these food deserts are in urban areas which lack supermarkets, health food stores, and even farmers markets. This means they lack fresh food and healthy options, which is a huge contribution to hypertension, cardiovascular diseases, diabetes, and obesity rates. There are usually many fast food options or convenient stores around these food deserts which are usually the quicker or cheaper options rather than commuting, buying, and cooking healthier options at home. This is a problem because people's health are at line. Understanding the area is the first step. Utilizing ArcGIS to map all of the fast food restaurants and convenience stores in specified poorer areas and certain counties will help gather data on these areas. Another great tool is the Community Commons which gives different types of statistics of a particular area like average income, health conditions, and number of people in an age group. Another database that was used is the USDA's Food Access Atlas 2015. It is a database that record the number of those who are living in food deserts. In this particular study those race and SNAP was focused on. Once the data is understood then the next step is to change the deserts so people can live in better conditions.

*Research Mentors:*

*Dr. Dharmendra Saraswat and Ben Hancock; Agricultural and Biological Engineering*

**Poster Number:** 12 :: Social Sciences/Humanities

**Digitial Agriculture REEU**

# Economic and Informational Barriers to Eating Healthy

Undergraduate Researcher:

Jaclyn Lee

Abstract:

Food deserts are communities that have low access to fresh fruits, vegetables, and other healthy foods such as whole grains and low-fat milk. There are various causes of food deserts including geographic barriers, economic barriers, and informational barriers. Previous research has measured and mapped geographic barriers to accessing fresh foods, but there hasn't been as much work regarding the economic and informational barriers. In the present study, a simple measure of economic and informational barriers to eating healthy across each state was developed by analyzing median household income, the relative cost of groceries, household computer and internet access and USDA Food and Nutrition Service Program data. This simple measure allow assessing the type of barriers that are associated with different demographics across each state. An understanding of which demographics see higher incidences of food deserts will help us understand how to better approach ameliorating food deserts and increase these communities' access to healthy foods.

*Research Mentors:*

*Dr. Dharmendra Saraswat and Ben Hancock; Agricultural and Biological Engineering*

**Poster Number:** 13 :: Life Sciences

**Digitial Agriculture REEU**

# Combine and Cart Harvest Efficiency

Undergraduate Researcher:

Demetre Mitchell

Abstract:

One aspect of farming is to be efficient. Whether it involves yield for crops or livestock, the goal is to maximize production in a timely manner. With this in mind, we are analyzing machine tracking data from select fields in Colorado to compare distance traveled per bushel harvested. This will determine the efficiency level of the harvest working day. Analyzing this information can help farmers increase production while minimizing labor costs. To analyze this data, we are using spatial packages in R studio. We start by taking the locations of cart and the combine to identify the unloading events. These points should help us create a metric for the distances traveled by the carts. The speed will be relevant once we've configured the unloading events.

*Research Mentor:*

*Dr. James Krogmeier; ABE*

*Yang Wang*

*ABE*

**Poster Number:** 14 :: Mathematical/Computation Sciences

**Digitial Agriculture REEU**

# Supply Chain of Rice in the U.S.

Undergraduate Researcher:

Eric Shim

Abstract:

Supply chain management is the management of the flow of goods and services, involving the movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption. The grain supply chain is critical for US agriculture; the focus of this work was rice. Annually, about 18 billion pounds of rice are grown and harvested in the United States, specifically in Arkansas, California, Louisiana, Mississippi, Missouri, and Texas. These states are located in the southern areas of the U.S. since rice requires long, warm growing seasons, and constant soil moisture. Using United States Department of Agriculture and the National Oceanic and Atmospheric Administration data, we compiled information about the amount of rice planted and harvested in the six states, the weather and climate that allows them to grow their rice, and the transport routes for rice distributed to states unable to grow their own rice. By analyzing the components of the rice supply chain, we were able to determine barriers that may disrupt the supply chain (atmospheric or geographic) and how the distribution of this important food can be improved.

*Research Mentors:*

*Dr. Dharmendra Saraswat and Ben Hancock; Agricultural and Biological Engineering*

**Poster Number:** 15 :: Life Sciences

**Digitial Agriculture REEU**

# Understanding topography as a factor in yield variation

Undergraduate Researcher:

Jatavian Smith

Abstract:

Crop yield has a significant impact on food security and are influenced by factors such as topography, soil fertility, availability of water, climate, and diseases or pests. The increasing risk of these influences makes it necessary to manage the crop properly to maximize yield and quality of the crops. Topographical land features are among the most important yield-affecting factors as they influenced soil formation (long-term) and also influence water flow and nutrient access (within season). The objective of this study was to determine if flow accumulation could serve as a proxy for productivity in select crop fields. A Sequential Depression Filling Algorithm and high resolution LiDAR topography data were used to generate flow accumulation values. Then, 10 years of crop yield data (for a Purdue research farm field - 5 corn + 5 soybean), ArcGIS Pro was used to give visual representations of this key topographical features. Then a statistical analysis was used to explore the relationship between flow accumulation on crop yield. This insight can improve management practices for fields with highly varied flow accumulation (due either to large topography differences or due to field size and slope length)

*Research Mentors:*

*Dr. Dennis Buckmaster and Sam Noel; Agricultural and Biological Engineering*

**Poster Number:** 16 :: Life Sciences

**Digitial Agriculture REEU**

# Invasive Insect Species, The Gypsy Moth

Undergraduate Researcher:

Bailey Walvoord

Abstract:

Invasive species are a continual problem as the world becomes a smaller place and international travel becomes even more common. Through travel and accidental importation of non-native species, native species can be negatively affected and damage naturally occurring ecosystems. The Gypsy Moth, an invasive insect species, introduced from France to the United States, destroys trees and has the potential to bring about decimation of entire forests. As this insect continues to spread, damage forests, and cause immense economical loss to communities, there has been considerable interest in detailing the historical expansion of this insect in the country. This study deals with using ArcGIS Pro software to plot the spread of Gypsy Moths from their original induction points in Medford, Massachusetts and Midland, Michigan by analyzing their population data from 1900 to 2008. The speed of Gypsy Moth's travel from Massachusetts to Missouri was 12.5 kilometers per year, whereas from Wisconsin to Michigan was 16.13 kilometers per year. At this rate, moth will travel from Medford, Massachusetts to St. Louis Missouri in 132 years and from Midland, Michigan to Minneapolis, Minnesota in 55 years. Using this data, we hope to use similar models to make maps, track, and control the spread of invasive non-native species that have damaging effects on native ecosystems.

*Research Mentors:*

*Dr. Dharmendra Saraswat and Ben Hancock; Agricultural and Biological Engineering*

**Poster Number:** 17 :: Physical Sciences

**College of Science**

# Sticky Materials from Walnut Juglone and Corn Zein Protein

Undergraduate Researcher:

Nicholas Branson

Abstract:

Juglone is a phenolic component produced by most walnut tree species, among them the black walnut tree found in Indiana. The chemical structure of juglone is that of a naphthoquinone. Its biological properties include insecticidal, antimicrobial and antifungal effects that protect the tree from disease. When juglone is combined with corn protein, antimicrobial properties may transfer to the blended polymer material. Corn zein protein is a renewable and low cost polymer often obtained as plant waste. Here we investigate compositions of zein protein plus juglone for potential use as adhesive and packaging material. We use lap shear testing experiments and aluminum substrates to determine the adhesive strength of various zein-juglone formulations under different conditions. Adhesive versus cohesive failure is evaluated after the interface and the substrate are separated and the glue is retained or absent from the surfaces. Fourier transform infrared spectroscopy is used to provide information about possible molecular interactions between zein and juglone during curing. We compare our results to the materials chemistry of other phenolic components in an attempt to improve materials design.

*Research Mentor:*

*Gudrun Schmidt; Chemistry*

**Poster Number:** 18 :: Physical Sciences

**College of Science**

# Analyzing Silicon Detectors for the High-Luminosity Upgrade of the Large Hadron Collider

Undergraduate Researcher:

Eshwar K Puvvada

Abstract:

The Large Hadron Collider (LHC) at CERN is the preeminent place in the world for research in particle physics, most recently made famous by confirming the existence of the Higgs Boson in 2012. The next major upgrade of the LHC, scheduled for 2023, will generate a higher particle flux than ever before. The goal of our research is to design, build, and test a configuration of light-weight silicon detector modules that can withstand the additional energy caused by the higher particle flux. In order to achieve this goal, we are taking a two-fold approach: developing a thermal and mechanical model of possible low-mass detector designs in ANSYS and building physical prototypes for thermal and mechanical testing to compare to the simulations. Ultimately, we will determine an optimal shape and material composition to meet the needs of the High Luminosity (HL) LHC upgrade.

*Research Mentors:*

*Drs. Andreas Jung and Souvik Das; Physics*

**Poster Number:** 19 :: Life Sciences

**College of Science**

# Investigating FIC Proteins as Virulence Factors for the Gastric Pathogen, *Helicobacter pylori*

Undergraduate Researcher:

Alexandra Stiffler

Abstract:

Redacted.

*Research Mentor:*

*Seema Mattoo; Biology*

**Poster Number:** 20 :: Physical Sciences

**College of Science**

# Manufacturing and validation of carbon composite structures for CMS experiment at LHC

Undergraduate Researcher:

Jack Wheeler

Abstract:

The Large Hadron Collider (LHC) at CERN is a high energy particle physics experiment with the purpose of answering fundamental questions ranging from the fundamental forces that govern all physical objects to the nature of space and time. The High-Luminosity upgrade currently underway at LHC is to increase the luminosity (the number of collisions per second) in LHC by an order of magnitude. Components of existing detectors like the Compact Muon Solenoid (CMS) must be redesigned to meet the higher energy associated with the larger number of collisions and stricter dimensional tolerances. My research is primarily focused on validating the as manufactured shape of the Inner Tracker Service Cylinder, a carbon composite support structure housing detector components. A prototype of the service cylinder was designed and manufactured at the Composites Manufacturing and Simulation Center, Purdue University to meet the requirements, but it begs the question- how good is it? A FARO laser scanning arm with Geomagic analysis software is used to create a 3D rendering of the prototype. These renderings are compared to a CAD model and deviation analysis is performed to determine if the prototype is within the dimensional tolerances. I also manufactured flat plates that are used to support the silicon detector modules. The goal of this research is to understand the challenges associated with manufacturing and validation (metrology) of the carbon composite structures. The preliminary results are reported, identifying the challenges associated and the subsequent effort to better the manufacturing and validation methods.

*Research Mentors:*

*Sushrut Karmarkar, Dr. Andreas Jung, and Dr. Souvik Das; School of Aeronautics and Astronautics*

**Poster Number:** 21 :: Physical Sciences

**Chemistry Summer Research Fellowship**

# Characterization of Adhesives from Protein and Phenolics from Plants

Undergraduate Researchers:

Lawrence Xi-Bin Fung

Nicholas Branson

Abstract:

Corn zein protein is a nontoxic polymer often obtained as plant waste and biofuel byproduct. Tannic acid is a large polyphenolic molecule composed of condensed gallic acid units. Gallic acid, catechol and juglone are small phenolic molecules frequently found in plants. Large polyphenolic and small phenolic components can provide cohesive strength to polymers such as corn zein protein when used as cross-linking agent. This functionality is quite useful when designing nontoxic polymer glues and packaging materials. We use lap shear testing experiments to determine the adhesive strength of various zein-phenolic compositions under different conditions. Fourier transform infrared (FTIR) spectroscopy provides certain molecular-level information regarding cross-linking reactions that may have taken place during curing of various adhesive compositions. We compare our results to the cross-linking chemistry of catechol in an attempt to elucidate the role of the phenolic component in making glue.

*Research Mentor:*

*Gudrun Schmidt; Chemistry*

**Poster Number:** 22 :: Physical Sciences

**Chemistry Summer Research Fellowship**

# Templated Assembly of Ultra-narrow AuNWs on Noncovalently Functionalized HOPG and MoS2

Undergraduate Researcher:

Tianhong Ouyang

Abstract:

For current electronics, lithographic fabrication methods only allow for patterning at the 12 nm scale, whereas next-generation electronics require 5-7 nm metal/oxide patterns. The 6 nm hydrophilic-hydrophobic chemical orthogonality provided by phospholipids in the cell membrane is ideal for addressing this need. Our group has found lying down phase monolayers of photopolymerizable amphiphiles on 2D materials can act as templates for assembling gold nanowires (Au NWs). We have observed differences templating behavior for AuNWs on 2D materials with different lattice structures. In a previous result from our group, we found a difference in monolayer structure for 23:2 diyne phosphoethanolamine (Diyne PE) on highly oriented pyrolytic graphite (HOPG) compared to molybdenum disulfide (MoS2). Diyne PE has an amine group with two fatty acyl chains. The fatty acyl chains are lying-down on the HOPG but have an edge-on conformation on MoS2. This difference in monolayer structure leads to the Au NWs templating in a different orientation on HOPG and MoS2. Furthermore, we found that the length of the wires also affects the template orientation. Shorter AuNWs have a stronger preference to bundle closely, forming ribbon phases, while longer wires tend to space further apart on the diyne PE monolayer. This trend is more pronounced on MoS2 than on HOPG. These results suggest that noncovalently functionalized 2D materials can be used for templating inorganic nanowires in a controllable fashion and the substrate plays a role in mediating the interaction.

*Research Mentors:*

*Shelley A. Claridge and Erin Noel Lang; Chemistry*

**Poster Number:** 23 :: Life Sciences

**Chemistry Summer Research Fellowship**

# Identification of C=C Positional Lipid Isomers Using Two Different Photochemical Reactions

Undergraduate Researcher:

Sneha Swaroop

Abstract:

Lipids play a key role in determining the structure of cell membranes and intracellular signaling. The presence of a double bond in lipids can greatly affect the cell membrane properties. It has been reported that C=C positional lipid isomers are closely involved in the pathologies of diseases such as cancer and type 2 diabetes. Therefore, their study is vital to understanding how they are associated with specific metabolic pathways. High-resolution mass spectrometry (MS) enables label-free detection and identification of hundreds of lipids in biological samples. However, positional isomers cannot be distinguished based on the accurate mass. In this study, we used selective chemical derivatization coupled Tandem Mass Spectrometry (MS/MS) to distinguish such positional isomers. Two different derivatization reactions were evaluated - the Paterno-Buchi reaction and Singlet-Oxygen reaction. These two photochemical reactions target double bonds in a lipid such that their position may be identified using conventional MS approaches. The purpose of this project is to optimize the yield of the two reactions in order to determine which may be used on a timescale compatible with MS imaging experiments. We found that both reactions yield products within 5-10 seconds. The MS/MS spectra of these products provided diagnostic fragments uniquely associated to the double bond position, making the identification of positional isomers possible. Thus, these photochemical reactions may provide a quick and efficient approach to spatially map lipid isomers and distinguish their double bond positions in tissues and other biological samples.

*Research Mentors:*

*Julia Laskin and Daisy Unsihuay; Chemistry*

**Poster Number:** 24 :: Social Sciences/Humanities

**College of Health and Human Sciences**

# Characterizing the Broader Autism Phenotype in Early Childhood: Are children's vocalizations distinguishable during play?

Undergraduate Researchers:

Emily Garza

Kelsie Thacker

Abstract:

Infant siblings of Autism Spectrum Disorder (ASD) are at increased risks for social communication difficulties, including expressive language concerns. Prospective developmental monitoring efforts within families raising children with an ASD, have identified (1) higher familial ASD prevalence estimates, and (2) children exhibit subclinical symptoms (often called the Broader Autism Phenotypeâ€"BAP) that may also benefit from early intervention. By 24 months, previous research demonstrates that children exhibiting BAP score significantly lower on standardized language assessments, compared to their typically developing peers (TYP). However, it is currently unclear whether children exhibiting BAP present distinguish-able vocalizations/language use, within a naturalistic context.

The present study assessed children's vocalizations during play with their mothers at 24-months to examine whether children exhibiting BAP are distinguishable from TYP, as indexed by the frequency, duration, and quality of vocalizations during play. As part of a prospective study, 51 children completed a mother-child play interaction during their 24-month laboratory visit. Interactions were micro-analytically coded for the frequency and duration of vocalizations. Videos were also rated for the quality of expressive language use (e.g., single words; two-word phrases). At their final laboratory visit, outcome classifications of BAP (n=17) or TYP (n=34) were assigned. A series of ANCOVAS, with infant sex as a covariate were conducted. No significant group differences emerged for frequency or duration of vocalizations. However, the BAP group did exhibit significantly lower expressive language use, $F(1,50)=6.22$, $p=.02$. Overall, these findings provide preliminary support for exploring the importance of language quality in BAP, to inform ongoing early intervention efforts.

*Research Mentors:*

*Dr. AJ Schwichtenberg and Ashleigh Kellerman; Human Development & Family Studies*

**Poster Number:** 25 :: Social Sciences/Humanities

**College of Health and Human Sciences**

# The Value of Mentors for Young Adults

Undergraduate Researcher:

Jayla Langford

Abstract:

The goal of this study is to understand the nature and impact that adult mentors have on adolescents and young adults in the U.S. population. Using the National Longitudinal Study of Adolescent to Adult Health (Add Health), I evaluate a sample of 11,434 young adults (ages 18â€“26 in 2001-2002) on their experiences with non-parental mentors during adolescence and young adulthood. Description of the characteristics of mentors and the type of mentorship provided are presented. The association of characteristics of mentors and type of mentorship with young adult well-being were estimated. Seventy-six percent of young adults indicated that they had a non-parental adult who made a positive difference in their life. For these young adults, 66% say these mentors are still important in their lives. These mentors were described as relatives (26%), teachers or counselors (15%), or friends (13%). These mentors were reported to primarily provide advice and guidance, emotional support, and role modeling. Preliminary analyses suggest that having an adult mentor in adolescence and young adulthood is generally associated with positive outcomes in several domains. The benefits of different types of mentorship will be described. Descriptive and inferential statistics were obtained using The STATA Programming Language version 15.

*Research Mentor:*

*Dr. Sharon Christ; Department of Human Development and Family Studies & Statistics*

**Poster Number:** 26 :: Social Sciences/Humanities

**HHS Honors Scholars**

# Autonomous Motivation and Physical Actvity for Older Adults

Undergraduate Researcher:

Margaret Becker

Abstract:

Autonomous motivation is defined as the motivation in which people have identified with the value of an activity and have integrated these values into their sense of self. Prior research indicates a relation between autonomous motivation and increased levels of physical activity. The purpose of the current study was to investigate this relationship for older adults as this relationship has primarily been studied in younger populations. Participants for the current study included thirty-nine older adult couple dyads. Because physical activity rates among older adults have been found to be lower in comparison to adults and young adults, it is necessary to address factors that promote or hinder their physical activity, such as motivation. In contrast to past findings for young adult populations, autonomous motivation was found to be unrelated to physical activity levels for older adults. These results contribute to the importance of considering age in the study of motivation and physical activity.

*Research Mentors:*

*Drs. Libby Richards and Melissa Franks; Nursing*

**Poster Number:** 27 :: Social Sciences/Humanities

**HHS Honors Scholars**

# Maternal depression and parent-mediated interventions for children at-risk of developing ASD

Undergraduate Researcher:

Alexandria Bien

Abstract:

With the current Autism Spectrum Disorder (ASD) prevalence of 1 in 59, it is important to improve early developmental monitoring and intervention efforts to optimize child development. Early interventions targeting social communication skills in children with or at elevated-risks of ASD have shown social improvements in clinician- and parent-mediated intervention (PMI) contexts. As researchers design PMIs, it is also important to consider family factors that contribute to perceived parental burden/well-being, such as depression. However, signs of maternal depression are not commonly reported within an intervention context. It may be especially salient to consider maternal depression risk, within a PMI, to identify mothers who may require additional support.

The present study expands our understanding of maternal depression risk by (1) identifying whether mothers endorse depressive symptoms, and (2) if so, whether symptoms decrease following an 8-session intervention. Twenty-seven mothers, raising children with social communication concerns participated in a family-routine based PMI. Families completed pre- and post-intervention assessments, including the Center for Epidemiologic Studies Depression Scale (CES-D). The CES-D is a validated screener, with a 16-point cutoff for clinical depression concerns. Overall, mothers endorsed an average of 15.3 (Range, 7-29) depressive symptoms with 33% of mothers endorsing clinical-level concerns. To examine symptoms pre- to post-intervention, a paired samples t-test was conducted. No significant differences were evident, $t(9)=-0.68$, $p=0.52$. Unexpectedly, a subtle symptom increase pre- ($M=15.3$, $SE=2.5$) to post-intervention ($M=16.3$, $SE=2.7$) was descriptively present. Future research may build upon these findings by considering severity of depression symptoms across treatment modalities in PMI settings.

*Research Mentors:*

*Dr. AJ Schwichtenberg and Ashleigh Kellerman; Human Development & Family Studies*

**Poster Number:** 28 :: Life Sciences

**HHS Honors Scholars**

# Toxicity of lead and atrazine mixture using the larval zebrafish model system

Undergraduate Researchers:

Anusha Kotapalli

Janiel Ahkin Chin Tai

Keturah Kiper

Abstract:

Lead (Pb) and atrazine are hazardous environmental toxicants that can exist as a mixture in potable water. Pb exposure happens through pipes of plumbing systems in households built before 1986. Atrazine is a runoff herbicide applied to cornfields. Numerous single-chemical studies on Pb and atrazine support adverse health outcomes, including neurotoxicity, but mixture studies are limited. We hypothesize that Pb and atrazine mixtures result in a greater than additive toxicity, causing increased adverse health outcomes than single chemical exposure using larval zebrafish. The Environmental Protection Agency set the maximum contaminant level for drinking water of Pb to 10 parts per billion (ppb) and atrazine to 3 ppb. The sublethal concentrations used were 3 ppb atrazine, 30 ppb atrazine, and 100 ppb Pb, which are environmentally relevant concentrations. Zebrafish embryos were exposed from 1-hour post fertilization (hpf) to 120 hpf with single chemical exposures and mixtures. Toxicity was evaluated with larval behavior at 120 hpf using a light/dark behavioral routine on the Noldus DanioVision to determine if exposure changes behavior. Data collected were analyzed with analysis of variance (ANOVA) and post-hoc test (Î±=0.05). Preliminary behavioral data showed a trend towards increased movement in the 30ppb atrazine/100ppb Pb mixture group compared to other mixtures and single chemical exposure groups. This suggests hyperactivity at higher concentrations; however, more replicates are needed. In the future, toxicity will be assessed by measuring morphological parameters, including head length, head width, body length, and brain length to confirm the presence of a greater than additive toxicity effect.

*Research Mentor:*

*Dr. Jennifer Freeman; College of Health and Human Sciences*

**Poster Number:** 29 :: Social Sciences/Humanities

**HHS Honors Scholars**

# Reproductive Health Decision-Making: Extending the Shared Decision-Making Model into the Community Space

Undergraduate Researcher:

Natalie Murdock

Abstract:

Background: Prior research demonstrated women are infrequently involved in their reproductive health decisions. Shared decision-making (SDM), which prioritizes two-way communication and listening between patients and providers, offers opportunities for increased involvement. Most research examines SDM between patients and doctors; however, understanding decision-making among allied health providers in community health settings may improve SDM reach and care quality. Additionally, women's reproductive health decisions often depend upon various personal factors; yet, this remains underexplored in the current SDM model.

Objective: Therefore, the purpose of the study is to understand SDM, including benefits and barriers, in community health settings and to identify the ecological factors impacting women's reproductive health decisions.

Methods: The mixed methods study will include three phases. Phase 1 encompasses focus groups with reproductive-aged women (18-45 years) living in Indiana who seek healthcare in community health settings. Four focus groups (6-10 participants) will be completed. Phase 2 includes 20 individual interviews with community health workers (e.g., nurse practitioners, nurses, midwives). Phase 1 & 2 findings will be analyzed using expanded grounded theory to identify emergent themes. Phase 3 includes an online survey built upon Phase 1 & 2 findings to build a model incorporating contextual factors in SDM. Analyses will include descriptive statistics and structural equation modeling.

Conclusions: Findings from this study will extend the SDM model to better account for lifestyle influences in women's reproductive health decisions. Additionally, findings will offer practical recommendations to increase SDM in community health provision, supporting a shift toward increased patient involvement outside traditional settings.

*Research Mentors:*

*Dr. Andrea DeMaria and Stephanie Meier; Consumer Science and Public Health*

**Poster Number:** 30 :: Life Sciences

**HHS Honors Scholars**

# Comparison of Metastatic and Non-Metastatic Breast Cancer Cell Survival in Extracellular Matrix Detached Conditions

Undergraduate Researcher:

Kanika Garg

Abstract:

For women, breast cancer is the most commonly diagnosed cancer and is the second leading cause of cancer death, with metastasis being the primary cause of most breast cancer related deaths. Glutamine is an amino acid that can be used as an energy source during metastatic progression through replenishing the TCA cycle intermediate, Î±-ketoglutarate. Studies have shown that cells experience decreased viability in the absence of glutamine. The purpose of this study was to investigate the effects of extracellular matrix (ECM) detached cell viability in the absence of glutamine. MCFC10CA1a cells and Harvey-ras oncogene transfected MCF10A-ras cells were used, which represent a metastatic and an early model of breast cancer, respectively. In ECM detached conditions, both the MCFC10CA1a and MCF10A-ras cells experienced decreased viability, with the MCF10A-ras cells experiencing a greater percent decrease in viability in comparison to the MCFC10CA1a cells. Comparison of the metastatic and early model of breast cancer cells can help provide insight into cancer cell progression in the body and develop new targets for prevention of breast cancer metastasis.

*Research Mentors:*

*Dr. Dorothy Teegarden and Madeline Sheeley; Nutrition Science*

**Poster Number:** 31 :: Social Sciences/Humanities

**College of Liberal Arts**

# Live Organ Kidney Donation: Assessing Students' Hesitations and Motivations to Inform Future Message Strategies

Undergraduate Researcher:

Natalie Moore

Abstract:

This research investigates college students' perceptions regarding live organ kidney donation (LOKD). An experiment was conducted where participants (n=508) were randomly exposed to one of three message conditions: 1) a list of LOKD facts, 2) a donor story, 3) a recipient story. Before and after reading the messages, participants' knowledge, self-efficacy to obtain information on LOKD, and perceived severity were assessed. Three 2 (time: pre vs. post message) x 3 (message: fact list, donor story, recipient story) mixed ANOVA were carried out with message type as the between-subjects factor. The analysis showed a significant main effect for time for all three dependent variables. There was no significant interaction present for message type x time for any of the measured variables. In other words, regardless of the message someone received, participants had significant knowledge gain, increased self-efficacy, and reduced perceived severity. Additionally, open-ended questions were analyzed to determine what makes students hesitant to undergo LOKD (n = 465) and what would make them more likely to donate (n = 456). Responses indicated that undergoing surgery, and the belief that having only one remaining kidney would put them at higher risk for future kidney problems, were the strongest reasons students hesitated to donate. Most respondents also indicated they would be more willing to donate to someone they already were close to, or to a recipient they could get to know before donating. These results provide insights into how to communicate with potential donors and address their concerns in future messaging attempts.

*Research Mentor:*

*Evan K Perrault; Brian Lamb School of Communication*

**Poster Number:** 32 :: Life Sciences

**Veterinary Research Scholars Summer Program**

# Novel in vitro injury model recapitulates TBI-linked increases of the clinical biomarker alpha-synuclein

Undergraduate Researchers:

Jeannine Diab

Edmond Rogers

Brock Beauclair

Andrew Thyen

Abstract:

Roughly 30% of all injury-related deaths in the United States (U.S.) involve a Traumatic Brain Injury (TBI) (Taylor et al., 2017), impacting an estimated 10 million Americans annually (Humphreys, et al., 2013). The associated financial burden is staggering, with direct and indirect costs for a single year calculated at 76.5 billion dollars (Soares de Souza, 2015). Unfortunately, due to the nature of these injuries and the type of sub-cellular investigative resolution required, these pathological mechanisms currently remain elusive.In clinical practice, the use of alpha-synuclein elevation as a biomarker for traumatic brain injury is already established (Mondello et al., 2013, Su et al., 2011). Recently, the novel use of a Ballistic Pendulum (BPA) was proposed to mimic closed head injuries in vitro (Rogers and Gross, 2019). In a preliminary study utilizing this new methodology and immunocytochemistry, murine cortical networks grown on micro electrode arrays (MEAs) were subjected to clinically-relevant g force levels (30-300g) and subsequently fixed (24 hrs post) and treated with a primary antibody capable of detecting alpha-synuclein. Compared to controls, impacted networks revealed significant increases of alpha-synuclein, which were pronounced in perinuclear, punctate patterns (n=6). While additional experiments are necessary to better quantify and describe this phenomenon, we hope that these pioneering studies will help pave the way for further investigations into trauma associated protein aggregation and possible pathway-links to neurodegeneration, in addition to supplementing this new and exciting model.

*Research Mentors:*

*Riyi Shi and Edmond Rogers; Purdue University College of Veterinary Medicine Dept. of Basic Medical Sciences, Weldon School of Biomedical Engineering*

**Poster Number:** 33 :: Physical Sciences

**Veterinary Research Scholars Summer Program**

# Quantitative evaluation of the progression of lung cancer brain metastases using bioluminescence imaging

Undergraduate Researcher:

Alexandra Reddy

Abstract:

Brain metastases of lung cancer are on the rise, and development of clinically relevant model systems is paramount to understanding this devastating disease. Evaluation of brain metastases of lung cancer is enhanced by in vivo bioluminescent imaging (BLI). The application of BLI in preclinical research has expanded due to its efficiency, sensitivity, and relatively low-cost. The overall signal intensity produced by luciferase activity within tumor cells provides a quantitative measurement of tumor burden. The signal intensity of luciferase activity is influenced by factors such as injection route, number of cells, tumor location, and the timing of image acquisition. This timing of image acquisition is critical for accurate, quantitative assessment of tumor burden in the progression of cancer. Herein, we hypothesized that following intracardiac injection of luciferase-labeled lung cancer cells, luciferase activity would predict overall tumor burden. Ten athymic nude mice were inoculated with luciferase-labeled non-small cell lung cancer cells (large cell carcinoma and squamous cell carcinoma types) via ultrasound-guided intracardiac injection. Animals were injected intraperitoneally with 150 mg/kg of luciferin, and luciferase activity was measured using the AMI Spectral Imaging System over 60 minutes. There was a 2.25-fold decrease in luciferase activity at minute 60 compared to minute 3. The maximum signal intensity for all animals was identified at minute 6. These findings support the use of rapid evaluation of BLI in experimental models of lung cancer brain metastases and will contribute to the development of clinically relevant translational models.

*Research Mentors:*

*L. Tiffany Lyle, Gozde Uzunalli, and Alexandra Dieterly; Comparative Pathobiology*

**Poster Number:** 34 :: Mathematical/Computation Sciences

**Network for Computational Nanotechnology Undergraduate Research Experience**

# Effect of Chemical Representations for Transfer Learning

Undergraduate Researcher:

Bryan Antonio Arciniega

Abstract:

Machine Learning models present a transformative method of optimization and prediction in science and engineering research. In the chemical sciences, unsupervised deep learning models such as autoencoders have shown to be useful for property prediction and material discovery. These methods take discrete chemical representations as input and map them to and from a continuous latent vector space. By providing a mathematical framework to operate within, these methods open the door for chemical optimization. However, one major question still remains as to the best chemical representation to utilize. To help address this question we present an online simulation tool hosted on nanoHUB that demonstrates the effect of representation and autoencoder type on property prediction and compound generation. Our autoencoder model allows the user to select various chemical representations, including canonical SMILES, non-canonical SMILES, and SMILES grammar. It also allows them to select between a variational autoencoder (maps inputs onto probability distributions) and a deterministic autoencoder (maps inputs onto points). The end-user inputs their desired chemical representations and any number of properties and jointly-trains a model to learn useful encodings/decodings and to predict the properties of novel species . A notable feature of the tool is an interpolation function where the user can decode between two points or around a single point in the latent space to find novel compounds. The use of a grammar based variational autoencoder displays more chemically varied and valid samplings from the latent space than traditional autoencoders, making it a more useful tool for chemical optimization.

*Research Mentors:*

*Dr. Brett M. Savoie and Nicolae Iovanac; Chemical Engineering*

**Poster Number:** 35 :: Physical Sciences

**Network for Computational Nanotechnology Undergraduate Research Experience**

# Elastoplastic Response of Compacted Pharmaceutical Powder Blends: Model Development, Calibration, and Validation

Undergraduate Researcher:

Paul Beckwith

Abstract:

The compaction of granular materials is a common operation in many industrial manufacturing processes, ranging from farming to pharmaceuticals, dietary supplements to diagnostics, and many others. The operation involves combining a mixture of powdered substances into a single bonded compact, or tablet, through the application of compressive forces. The process mainly consists of four stages: die filling, compaction, unloading, and ejection. During the compaction, particles are rearranged and undergo elastic and plastic deformation, which leads to particle bonds formation. In the last two steps, the whole compact experiences elastic relaxation after being plastically deformed during fabrication. It is well known that the performance of compacted particulate products is directly related to their microstructure. However, how the properties at mesoscale and nanoscale manifest at the continuum level for granular compacted materials is still an open question. Here we introduce an update of the nanoHUB Powder Compaction tool that is capable of modeling the first three manufacturing steps mentioned above. The tool includes a particle mechanics approach to model the compaction process using generalized loading-unloading contact laws for elastoplastic spheres with bonding strength. We calibrate and validate the model using experimental data obtained with a bench top tablet press. We anticipate that our tool will provide the research community the means to better understand the underlying mechanics of compaction, up to porosities close to zero, and we demonstrate that seamless integration of experimental and computational methods is paramount for the development of the powder compaction field.

*Research Mentor:*

*Dr. Marcial Gonzalez and Pedro Cidreiro; School of Mechanical Engineering*

**Poster Number:** 36 :: Mathematical/Computation Sciences

**Network for Computational Nanotechnology Undergraduate Research Experience**

# Plasmonic Core-Multishell Nanowires for Optical Applications

Undergraduate Researcher:

Raheem Carless

Abstract:

LEDs are very useful in today's society, especially when compared to conventional incandescent and fluorescent lamps. According to the US Department of Energy, by 2027 the use of LEDs could save 348 TWh of electricity, which is the equivalent annual electrical output of 44 large electric power plants and a total savings of more than $30 billion at today's electricity prices. The goal of our tool is to improve the efficiency and color rendering of white LEDs. This can be done by implementing novel nanostructure devices called core-multishell nanowires, which has greater surface area and absorption efficiency when compared to typical phosphors used in white LEDs. This greater surface area gives the structure a larger cross-section, which allows it to emit stronger and absorb more efficiently. The core-multishell nanowire will be used as phosphors for the white LEDs to improve its optical properties. They are modeled as cylinders with infinite length and with the incident light perpendicular to its axis, so a handful of computational methods were carried out to obtain its properties. The properties that the tool calculates are the LDOS (Local Density of States) and Purcell factor of a single nanowire. I am currently working on a code which will also predict the wavelength and dipole position of the specific nanowire. Users will be able to find out which materials and dimensions give the greatest efficiency for use as phosphors in white LEDs.

*Research Mentors:*

*Dr. Chen Yang and Amartya Dutta; Photonics*

**Poster Number:** 37 :: Innovative Technology/Entrepreneurship/Design

**Network for Computational Nanotechnology Undergraduate Research Experience**

# Hierarchical Structure Optimization using Neural Networks

Undergraduate Researchers:

Miguel Arcilla Cuaycong

Valeria Grillo

Abstract:

Material structures that occur in nature are commonly made up of complex architectures arranged in a hierarchy. These hierarchical architectures are made up of different structural levels consisting of a unique arrangement of simple constituents, acting as building blocks, that satisfy a local demand for certain mechanical properties. One structural level functions as a constituent of the next level in the hierarchy and so on, resulting in materials that can exhibit unique mechanical properties (i.e. different from those of the composing constituents). However, the design of hierarchical materials is challenging due to the enormous size of the design space. For example, in a single structural level, the number of constituent combinations can reach upwards to three orders of magnitude. Furthermore, the number of possible combinations increases exponentially from one structural level to the next. This research puts forward the proposition of utilizing a Neural Network (NN) to identify the optimal arrangements of constituents in a structural level. The hierarchical structure of interest to be studied with the NN is a tape spring ligament made of four different constituents capable of snap-through instabilities and energy dissipation. At this stage of research, we are investigating the most important features of the ligament such that the NN can correctly classify between good and bad structures. Training data is generated using finite element simulations, which are considered as ground truth. After the research group has successfully used the NN to find optimal structures, models will be fabricated with steel via stamping for experimental validation.

*Research Mentors:*

*Dr. Pablo Zavattieri and Kristiaan Hector; Civil Engineering*

**Poster Number:** 38 :: Mathematical/Computation Sciences

**Network for Computational Nanotechnology Undergraduate Research Experience**

# Machine Learning for Property Prediction and Materials Discovery

Undergraduate Researcher:

Mackinzie S Farnell

Abstract:

Machine learning displays excellent potential for generating material property predictions and discovering novel compounds with desirable properties. However, training these models requires copious amounts of data that can be prohibitively costly to obtain. One strategy for addressing this problem is to train models using data for related properties, or by utilizing data from multiple sources. To implement this strategy, we have created a computational tool that allows users to investigate how training models on multiple properties could lead to better prediction, even on datasets with missing property data. The framework for our model is an autoencoder, which consists of two parts: an encoder and a decoder. Discrete molecular structures are passed as input to the encoder, which projects them onto a continuous latent space. Vectors from this latent space are then used for property predictions and may be converted back into discrete molecular structures via the decoder. Our tool outputs principal component analysis plots, which project the high dimensional latent space encodings onto the two dimensions describing the greatest amount of variance in the data and colors the points according to property values. The plots help users visualize how compounds are arranged within the latent space with respect to certain properties. With these functionalities, users can investigate how training on different sets of properties affects the organization of the continuous latent space. In turn, by customizing the organization of the latent space with respect to selected properties, users can discover novel compounds of potential application.

*Research Mentors:*

*Dr. Brett M. Savoie and Nicolae Iovanac; Chemical Engineering*

**Poster Number:** 39 :: Mathematical/Computation Sciences

**Network for Computational Nanotechnology Undergraduate Research Experience**

# Food and Energy Farms Simulation Tool

Undergraduate Researcher:

Hans Torsina

Abstract:

With the continually increasing food and energy demands which require sustainability, novel solutions in which agrophotovoltaic is a part of are pushed to solve local land shortages and increase land productivity. Compared to traditional solar energy installations which casts deep shadows on the ground and prevent crops from growing, agrophotovoltaic can develop strategies on design optics that allows simultaneous coproduction of food and energy. Currently, however, there is not an easily accessible tool program that will assist in this push on agrophotovoltaics through simulation models. This is important for researchers looking to model certain agrophotovoltaic scenarios or even anyone exploring the prospect without a highly technical research context. The Agrophotovoltaic Simulation tool will calculate based on the solar panel parameters, geometries, patterns, and tracking system to provide outputs of contour shadowmaps, solar and electrical power output plots, along with input-output tables. The open-access simulation tool based on optical simulations built by our group, utilizes prior open-sourced code from PVLib, which will be hosted and run on nanoHUB. This provides a more accessible and approachable user interface that promotes dual-function land use and assists planning for an agrophotovoltaic system.

*Research Mentors:*

*Dr. Peter Bermel and Allison Perna; School of Electrical and Computer Engineering*

**Poster Number:** 40 :: Mathematical/Computation Sciences

**Network for Computational Nanotechnology Undergraduate Research Experience**

# Identifying Dimensionality of Periodic Crystals

Undergraduate Researcher:

Franco Vera

Abstract:

The advent of the internet has created and allowed for tools that are immensely helpful in learning about vastly different subjects, as well as accessing massive quantities of information relatively easily. Despite this, there are still many facets of materials science that are not well documented or whose. One such area is the electronic properties of materials: specifically, how lattice parameters affect the structure and band gap energy of a material. This project creates a tool which allows users to simulate how the lattice parameters of a material change the structure and band gap energy, using an available online materials database and the TSA algorithm developed by researchers at the University of Florida. The information regarding the material's properties (structure, lattice parameters, band gap energy, etc.) will be queried from the database. The information will then be passed to the TSA, along with the user's desired modifications. At this point, once calculations are made, the tool will render an interactive image of the resultant crystal structure.

*Research Mentors:*

*Dr. Richard G. Hennig, Joshua Paul, and Dr. Nancy J. Ruzycki; Materials Science and Engineering*

**Poster Number:** 41 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Long Range Wireless Sensor Network Solution for Soil Health Monitoring in Arequipa region

Undergraduate Researcher:

Andrew Baldwin

Abstract:

The Arequipa region is located in the southwestern part of Peru. The environment of Arequipa is facing many challenges including contamination due to mining, highland desertification, overgrazing, toxic mineral deposits due to glacial runoff, rapid climate change, and poor management of agricultural activities. Due to contamination, the people of Peru face several challenges in the sustainable use of soil. Technology-based decision making through soil characterization, monitoring, and visualization will help increase the agricultural productivity and health of the citizens of Arequipa. By monitoring parameters such as soil temperature, moisture and electrical conductivity local communities can start to identify and monitor their soil's health. Areas of agriculture in the Arequipa region lack ample architecture to support traditional soil monitoring systems. The main limitation of the existing systems is their short range transmission and high power consumption. This work presents the development a sensor network based on LoRa (Long Range) technology to monitor soil health. The nodes of this wireless sensor network are called Soil Health Monitoring Units (SHMU) and are installed in locations where soil health needs to be monitored. A SHMU unit consists of a soil sensor, processing unit, GPS module, solar panel, battery, and LoRa radio. The SHMU processes the sensor data and transmits it to a gateway. The gateway receives data from several SHMUs and uploads it into a server for storage and analysis. The performance and cost-effectiveness of the sensor network has been studied in this work, results will be presented at the poster presentation and workshop.

*Research Mentors:*

*Daniel Leon-Salas and Jino Ramson; Polytechnic Institute*

**Poster Number:** 42 :: Innovative Technology/Entrepreneurship/Design

**Discovery Park Undergraduate Research Internship Program**

# Directing Sunlight to Meet Local Food, Energy, and Water Needs

Undergraduate Researcher:

Daniela Cadena

Abstract:

A challenging conflict in the global photovoltaic market is to create a sustainable practice to achieve energy and food production in an efficient land use. The purpose of the PV system installation at the Purdue ACRE farm is to develop strategies in order to use collected sunlight to meet food, energy, and water needs in a single project. The local co-production of these three resources is attained by the installation of an agrophotovoltaic system. It consists of four rows with two different types of modules arrays in each one over a corn field by implementing irrigation and crop growth strategies. The first one is composed of 100W Polycrystalline Solar Panels installed with spaced intervals in between them. The second one is composed of 300W Polycrystalline Solar Panels placed together. The main constrain of the installation occurs when the modules obstruct the sunlight to ground and therefore create deep shadows that affect the crops' growth. In order to predict the field performance of the PV systems, a measurement model was created to illustrate the shadow depth with their positions on a monthly basis. The current goal is to verify the effects and accuracy of this model as well as the overall power density of the modules. A micro inverter system will be implemented to get real time voltage and current data to get the overall power output. In addition, a set of pyranometers will also be installed to measure the global horizontal irradiance (GHI).

*Research Mentor:*

*Dr. Peter Bermel and Elizabeth Grubbs; School of Electrical and Computer Engineering*

**Poster Number:** 43 :: Social Sciences/Humanities

**Discovery Park Undergraduate Research Internship Program**

# Algorithmically-Generated Communities: A Case Study

Undergraduate Researchers:

Michael A. Davidge

Jeongjin Park

Gregory Sirko

Abstract:

In this poster, we present a case study of the100.io, an online platform that sorts gamers into groups that support gameplay and other activities. We present the results of a thematic analysis of the groups' publicly available webpages as well as a preliminary analysis of an interview study we conducted with individuals who use the100.io platform. Through the webpage thematic analysis, we identified that communities in which individuals are algorithmically sorted can thrive, even when the conditions of that sorting are somewhat arbitrary. Through the preliminary results of our interview study with the100.io participants, we have uncovered that the100.io affords personal experiences of niche community engagement, supports guidance from one gamer to another, and complements thriving gaming interaction by mitigating the often difficult task of organizing gameplay. We identify opportunities for research in the fields of Human-Computer Interaction (HCI) and Computer Supported Cooperative Work and Social Computing (CSCW) to further engage in the presence of shared identities, conversations about group atmosphere, and engagement with external tools as a means of indicating group health and success.

*Research Mentor:*

*Austin L. Toombs; Computer Graphics Technology*

**Poster Number:** 44 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Ecological Flow Requirements for Aquatic Macroinvertebrates in the Arequipa Region, Peru

Undergraduate Researcher:

Paul Dawley

Abstract:

Aquatic macroinvertebrates are often investigated to assess the biological integrity of water bodies and stream health. Instream sampling and identification of macroinvertebrates are costly and time-intensive, especially for large scale assessments. The goal of this study is to develop a stream health predictive model to quantify a macroinvertebrate index based on ecologically relevant hydrological indices. The study area was the Pulpera and Colca Rivers in the Arequipa region of Peru. The Andean Biotic Index (ABI) was chosen due to its focus on macroinvertebrates inhabiting Andean areas higher than 2,000 meters above sea level. Macroinvertebrate samples were collected at seven sites using Surber samplers, and organisms were identified using a microscope. A Soil and Water Assessment Tool (SWAT) model was developed and calibrated for the period of 2010-2017. The calibrated model was then used to simulate daily streamflow for the lower Pulpera River and upper Colca River. The MATLAB Hydrological Index Tool (MHIT) was used to obtain 171 ecologically relevant hydrological indices of flow. Finally, a two-phase approach (including Partial Least Square Regression, PLSR, and Adaptive Neuro Fuzzy Inference System, ANFIS) was used to develop a biotic index predictive model based on the sampling sites, all of which fell in either the poor or bad water quality class. The model yielded a root-mean-square error (RMSE) of 0.03, and all predicted ABI values were in the same water quality class as their corresponding observed values. The developed model was used to predict the ABI score for all streams in the study area.

*Research Mentor:*

*Fariborz Daneshvar and Laura Bowling; Agricultural & Biological Engineering*

**Poster Number:** 45 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Modeling Atmospheric Circulation Effects on Water Stable Isotopes in Arequipa Peru

Undergraduate Researcher:

Jonathan DeGraw

Abstract:

Rainfall in the western slopes of the Andes occurs during the austral summer (December - March). While El NiÃ±o years are typically drier in the western Andes, recent research has found the opposite was true for Southern Peru during the 2009-2010 El NiÃ±o year. This project investigates atmospheric circulation patterns via multiple modeling techniques and water stable isotope analysis in the city of Arequipa, Peru during the 2019 weak El NiÃ±o. Rain samples were collected in January â€“ March 2019. Precipitation isotope values are lower (avg. ï• ¤18O = -9.8 â€°, avg. ï• ¤D = -71â€°) from Feb 1 to Feb 15, than those prior to or preceding the event (avg. ï• ¤18O = -4.2 â€°, avg. ï• ¤D = -23 â€°). NOAA's Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT) was used to investigate transport of atmospheric moisture. Back trajectory model runs (120 hr) were conducted at 9000 meters above mean sea level (MSL) for the periods Jan 15-31, Feb 1-15, and Feb 16-28. Geopotential height and wind speed vector plots were created from the National Centers for Environment Prediction (NCEP) and the National Center for Atmospheric Research (NCAR) reanalysis data. Both the HYSPLIT and the reanalysis data show a strong influence from the Bolivian high on upper and mid-level air circulation in Arequipa, Peru during Jan 15-31 and Feb 16-28. Atmospheric models show displacement of the Bolivian High which coincides with the isotope drop, suggesting that El NiÃ±o activity is influencing regional precipitation variability.

*Research Mentors:*

*Elizabeth Olson, Lisa Welp, and Greg Michalski; Earth, Atmospheric, and Planetary Sciences*

**Poster Number:** 46 :: Mathematical/Computation Sciences

**Discovery Park Undergraduate Research Internship Program**

# Data Driven Identification of Impact of Information on Health-Related Choices

Undergraduate Researchers:

Taher Dohadwala

Yufei Xu

Katie Brinkers

Abstract:

This project aims to measure and quantify the heterogeneous impact of information on health-related, in particular, public policy, choices made by individuals. We will develop a comprehensive understanding of how cheaply available data, primarily on social media, can be leveraged to unravel ground truth about individual preferences concerning health-related decisions or programs. We will exploit exogenous differences in various policies across geographic areas to identify the causal impact of information on the establishment of controversial health programs or individual health choices. The insights will not only enable better resource allocation for affecting individual choices but also shed light on how and when different stakeholders (e.g., Centers for Disease Control and Prevention (CDC) or opioid manufacturers) successfully or unsuccessfully influence individual and local decisions. While our approach can be adapted to different controversial programs, we will start with studying fluoride in the water debate and develop the initial analytical tools, capitalizing on geographic and demographic heterogeneities, to measure and quantify the effect of various information on those decisions. The rising popularity of social media, often specifically dedicated for discussing controversial health programs or solutions at a high level of granularity, provides us with a remarkable opportunity to study users' reactions to information and claims made by other users.

*Research Mentors:*

*Munirul Haque and Mohammad Rahman; Healthcare Engineering*

**Poster Number:** 47 :: Life Sciences

**Discovery Park Undergraduate Research Internship Program**

# Mechanical properties of guest-host affinity polymers for 3D bioprinting

Undergraduate Researchers:

Eric Evory

Mazin Hakim

Dr. Luis Solorio

Abstract:

Three-dimensional bioprinting(3DBP) of tissues and organs is on the forefront of tissue regeneration and engineering, but the technology is far from being able to deliver patient specific organs to the operating room for patients in need. However, 3DBP has made significant strides in developing and prototyping unique tissue environments for the improvement in vitro analysis. Easily printable, biocompatible, practical and accessible materials for 3DBP remain a challenge due to the variability in many polymers and the limited application of any one specific bioink. This research focuses on developing a class of materials called guestâ€"host polymers for 3D bioprinting. The affinity based interaction between the host polymer poly(beta-cyclodextrin) (PCD) and guest polymer adamantane-modified polyethylene glycol(AD-PEG) occurs in solution leading to a measureable change in composite material properties. Mixing of the two materials results in a rapid formation of hydrogel composed of guestâ€"host bonds. The physical properties of the gel vary based on cross-link density and network structure, which can be controlled by changing macromer molar ratios, molecular weight of each macromer, and overall polymer concentration. Preliminary results have shown these materials, and similar extracellular matrix based hydrogels, have the potential to serve as a tunable system for 3D bioprinting using many different printing parameters and cell types.

*Research Mentor:*

*Mazin Hakim; Biomedical Engineering*

**Poster Number:** 48 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Water Origins and Flow Path Analysis of Groundwater in the Colca Canyon, Southern Peru

Undergraduate Researcher:

Jack Fekete

Abstract:

Communities of the Andes Mountains live in a semi-arid climate and thus depend on groundwater springs for agricultural use. Due to the volcanic deposits in the Andes, groundwater recharge and flow paths of springs are not well understood. The study area, the Colca Canyon, sits in the shadow of several volcanoes in Southern Peru. Using GIS mapping of spring locations, 18O and general chemistry analysis, and geologic cross-sections, we addressed the origins of the waters used by these communities. The main areas of study are the towns of Maca, Yanque, and Callalli, Peru. Through GIS analysis, many of the springs were mapped as deriving from Paleogene to Quaternary volcanic, reworked volcanic, or alluvium deposits. However, general chemistry analysis of spring samples contained high concentrations of $Ca^{2+}$, $HCO_3^-$, and $CO_3^{2-}$ indicating that the groundwater was interacting with rocks other than volcanic deposits. Geologic cross-sections of spring locations revealed that the volcanic deposits were underlain by Mesozoic calcareous sandstones of the Hualhuani and Labra Formations as well spring locations sitting in near proximity to deep cutting faults. We believe that faults and joints create secondary permeability that allow infiltration of meteoric and glacial meltwater as well as upwelling and mixing of shallow and deep, geothermal groundwater. Therefore, springs that emerge in highly faulted and fractured areas, such as those on the southern side of the Colca River, can be replenished by deep groundwater and will be less susceptible to system perturbations such as climate change and excessive pumping.

*Research Mentors:*

*Drs. Lisa Welp, Marty Frisbee, and Elizabeth Olson; Earth, Atmospheric, and Planetary Sciences*

**Poster Number:** 49 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Investigating the source of groundwater springs in Arequipa, Peru

Undergraduate Researchers:

Carol Salazar Mamani

Midhuar Arenas Carrion

Wendy Roque Quispe

Abstract:

Farming in the Characato district of Arequipa, Peru relies on irrigation water from groundwater springs. The source of water of these springs is uncertain. They may be sourced from regional snowpack melt, a brine lake at higher elevation, or underground flow from another watershed through permeable and/or fractured rocks. We sampled 4 springs at their source, rivers in the area, and local rainfall. We analyzed the samples for stable water isotopes and basic chemical data to identify the likely source of the springs and their influence on local river flow. Samples were collected from March through June of 2019, which corresponds to surface flow decreasing from the wet season maximum to drier conditions. In March, the stable isotope values of the springs indicated they all had a similar source. Additionally, the rivers were also similar to the springs. We can not rule out that the springs and rivers are fed by local precipitation, but they likely require some snow melt influence to explain the isotope values. Continued analysis of this hydrologic system will further inform our understanding of water sources and how they change seasonally.

*Research Mentors:*

*Lisa Welp, Elizabeth Olson, Marty Frisbee, and Sebastian Zuniga; Earth, Atmospheric, and Planetary Science*

**Poster Number:** 50 :: Life Sciences

**Discovery Park Undergraduate Research Internship Program**

# Landscape Vegetation-Cover Classification across the Arequipa Region, Peru 2005

Undergraduate Researcher:

Nicholas Hamp-Adams

Abstract:

In the Arequipa Region of Peru, change in landscape land cover through time has not been thoroughly documented. The goal of this project is to use remote sensing techniques to identify different land cover types throughout the region, classify them according to the U.S. National Land Cover Database classes, and model land cover change through time. For this summer, the focus was on the decade between 2000 and 2009. The project began with the georectification of 1 m2 resolution OrbView data in ArcGIS version 10.7 so that high resolution imagery could be used to accurately identify different land covers throughout the landscape. This was backed with support from landcover data of the Arequipa Region published by the Peruvian Government. For the model, Landsat data was used to calculate different spectral indices for the area to better highlight areas of high and low vegetation density and to differentiate between barren land and snow, such that accurate delineation could take place for a training set for the model. The model used random forests, which are an ensemble learning method for classification that operates by constructing numerous decision trees at training time and outputting the class that is the mode of the classes. The training data included raw Landsat bands, various spectral indices, terrain data, and road density data. Once the model was trained, land classification was completed over the entire region of Arequipa for 2005 using the R software package version 3.6.0.

*Research Mentors:*

*Zachary Brecheisen and Darrell Schulze; Agronomy*

**Poster Number:** 51 :: Life Sciences

**Discovery Park Undergraduate Research Internship Program**

# Effects of Urbanization on Soil and Water Health in Arequipa, Peru

Undergraduate Researcher:

Kayley Hodson

Abstract:

This exploratory study investigates the possible environmental and agricultural issues local farmers face in the region and city of Arequipa, Peru in the hope that remediation techniques can be identified in the future. As the second largest city in Peru, Arequipa has grown by 16.9% in the last ten years and is projected to grow another 12.9% by 2030. It is expected that this continual commercial development would affect the water quality in the Rio Chile, and by extension, the water and soil quality in the irrigated fields surrounding the city. Salinity, pH, and nutrient levels from the city's untreated sewage were investigated.

Water and soil parameter data were collected from sample points along the Chile River and in the agricultural regions of Alto Cural, Alto Cayma, and Zamacola. Several points were also taken in the Colca Valley as a control, as these fields were irrigated with groundwater. It is expected that the salinities and nutrients found in the water and soils of Colca will be distinctly lower than that of the more urbanized Arequipa. It is also hypothesized that the river water downstream of the city is more highly contaminated than the water upstream of it. Preliminary results reveal (a a higher water conductivity and b) higher total nitrogen, carbon, and phosphate levels downstream of the city, suggesting a dramatic effect on water quality from urbanization.

*Research Mentor:*

*Abigail Tomasek and Sara McMillan; Agricultural Engineering*

**Poster Number:** 52 :: Innovative Technology/Entrepreneurship/Design

**Discovery Park Undergraduate Research Internship Program**

# Describing STEM Students' Patterns of Ethical Concern

Undergraduate Researchers:

Hunter Hollinger

Ilayda Karagol

Liyang Qu

Min Gyeong Kang

Abstract:

Technological systems are increasingly pervasive, impacting both our everyday lives and the current and future states of many STEM professions. Trends in technology present security and privacy concerns, threatening to disrupt individual control over data collection and use. Virtually all areas of STEM study are impacted by these challenges and opportunities, yet many struggle to identify ethical considerations to guide their practice.

In this interview study, we explore opportunities to enhance the preparation of STEM students by documenting current and emerging areas of ethical concern. We interviewed 20 undergraduate and graduate STEM students using a critical interview approach, asking about ethical concerns in everyday and professional interactions with technology. We iteratively conducted a thematic analysis to identify the ethical concerns shared by STEM students, revealing the patterns of ethical reasoning that they use to justify or avoid their use of technologies.

We identified multiple themes relating to matters of ethical concern, including drivers for unethical behavior, beliefs regarding responsibility for ethical technologies, means of engaging with matters of ethical concern, and reactions to unethical technology experiences. The participants' examples revealed ethical awareness manifest in privacy concerns. However, the locus of responsibility for these concerns varied widely. Participants consistently stated that their educational preparation to engage in ethical argumentation within their discipline was lacking. Based on these early results, we posit that our participants' lack of professional ethics capability will be problematic for the future of many technological fields, and should be addressed through new ethics education experiences.

*Research Mentors:*

*Dr. Colin M. Gray and Shruthi Chivukula; Computer Graphics Technology*

**Poster Number:** 53 :: Innovative Technology/Entrepreneurship/Design

**Discovery Park Undergraduate Research Internship Program**

# Developing User Interfaces for the Biowall

Undergraduate Researcher:

Rebecca Hutzel

Abstract:

This research is developing and evaluating a userÂ interface for aÂ Biowall. AÂ BiowallÂ is a plant-basedÂ air filter that improvesÂ aestheticsÂ and indoor airÂ quality in buildings. Behind the scenes there is a controllerÂ that manages the airflow, watering, lighting, andÂ data collection. The controller needs two interfaces, one is for a home owner and one is for an engineer who monitors and controls the Biowall behind the scenes. These interfaces differ in the type of information and level of complexity that is provided to the user.Â

*Research Mentor:*

*Mark Zimpfer; Building and Construction Management*

**Poster Number:** 54 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Progress Towards the Synthesis of Phosphatidyl Glycerol

Undergraduate Researcher:

Sooyeon Hyun

Abstract:

Niemann-Pick Type C Disease is a rare disease that affects 1 out of 120,000 people that is characterized by a mutant NPC protein, NPC 1 mutation in 95% of patients and NPC 2 in 5% of patients, that disturbs the cholesterol efflux from the lysosome and leads to a build-up of cholesterol in the lysosome. This disease mainly affects younger people and causes the patient to have a series of motor problems like ataxia, slow speech development, and seizures, and most do not survive past the age of 20.

The exact mechanism of the cholesterol efflux by the NPC 1 and 2 proteins remains unknown, but studies show that with increased bis(monoacylglycerophosphate)(BMP), a glysosomal specific membrane phospholipid, cholesterol efflux increased from the lysosome.

To understand how the increased BMP increased cholesterol efflux from the lysosome, the possible precursor to BMP, phosphatidyl glycerol (PG), was synthesized to explore two ideas; if BMP is synthesized from PG, and if increased levels of BMP lead to interaction with the NPC 2 protein in mutated NPC 1 models to increase cholesterol efflux from the lysosome. PG was synthesized in two parts: the glycerol backbone and the glycerol headgroup. With the synthesis of the PG with the backbone and headgroup, the relationship between the NPC protein and the BMP in the lysosome can be explored further.

*Research Mentors:*

*Zachary J. Struzik and David H. Thompson; Organic Chemistry*

**Poster Number:** 55 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# pXRF Analysis of Heavy Metals in Peruvian Vineyard Soils

Undergraduate Researcher:

Ally Jacoby

Abstract:

In the desert region of Arequipa, Peru, the Majes irrigation system is an important source of economic security. It has helped transform 150km2 of arid land into productive agricultural fields. However, this arid soil does not naturally contain the necessary nutrients for crops to survive, and the excessive water input promotes mildew and fungal growth. As a result, farmers must continually apply fertilizers, pesticides, and fungicides to the fields. These chemicals often contain heavy metals which can accumulate in soil and plant tissues. The goal of this study is to analyze heavy metal concentrations in vineyard soil from the Majes region using portable X-Ray fluorescence (pXRF). A total of 194 vineyard soil samples were collected at CIEPA research station in Arequipa; each was sieved to 2 mm in the field and air-dried. Sample preparation further included autoclaving and grinding before pXRF analysis of total concentrations of heavy metals. We compare the differences in metal concentrations from points between the vineyard rows and points among the rows . It is useful to understand this relationship because it can serve as a preliminary guide for developing sustainable vineyard management practices in arid regions and can help estimate heavy metal accumulation in crops. Additionally, this study is part of a larger collaboration between Purdue and Universidad de San Agustin with the goal of compiling physical and geochemical soil data in Arequipa to improve soil health throughout the region.

*Research Mentors:*

*Tim Filley and Erika Foster; Earth, Atmospheric, and Planetary Sciences*

**Poster Number:** 56 :: Innovative Technology/Entrepreneurship/Design

**Discovery Park Undergraduate Research Internship Program**

# Evaluation of an Improved Automated Controls System for Purdue's Biowall

Undergraduate Researcher:

Walter Kruger

Abstract:

This project's main focus is to evaluate and implement a smaller and more cost-effective controls system that can replace the large and expensive system currently installed at Purdue University's Biowall. The goal is to successfully assess and improve on the existing controls design of the Biowall, an energy efficient botanical air-filtration system for net-zero energy residential and commercial buildings. This air-filtration system, has been developed to enhance indoor air quality, and is equipped with an automated controls system that regulates air pass-through, plant watering, and lighting, while gathering temperature data, soil moisture, and differential pressure. To improve on the current controls, a big emphasis has been made on the quality of data gathered, and how it is stored in the system, as well as on the efficiency and safety of the control's code. Through this new controls system, more accurate data will be able to be acquired, leading to a better understanding of plant-based air filtration in enclosed living and working spaces.

*Research Mentor:*

*William Hutzel; Purdue Polytechnic*

**Poster Number:** 57 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Carbon Accumulation in Vineyard Soils of the Peruvian Desert

Undergraduate Researcher:

Andrew Lawrence

Abstract:

The recently created agricultural soils of the Mahes irrigation project in the Arequipa region of Peru are vulnerable to minor changes in the climate. These sandy soils rely on water from rivers up in the Andes. Carbon can be an indicator of how the agricultural soils are developing over time. Carbon can accumulate in organic forms (OC) from the vineyard or in inorganic forms(IC) such as calcium carbonate usually in the form of calcite. Also, this accumulation differs due proximity of plant: between the plant rows and among the plants. First, the sample soils are weighed out to 5 g and ball mill ground for 40s. In order to measure OC and IC carbonates from 1 g of sample are removed using 6 molar HCl with 3% ferrous chloride to prevent OC decomposition. Afterwards, the samples are then analyzed with the Trumacâ„¢ Leco carbon nitrogen analyzer with sufficient quality control before such as blanks and standards to get OC. One gram of the ground soil is not treated with the ferrous chloride HCl solution to get total carbon when analyzed through the leco analyzer. To get inorganic carbon the formula of total carbon - organic carbon= inorganic carbon is used. The data will be analyzed through R to check for normality. This data will help to show how this multimillion dollar irrigation project affects the sandy loam soil

*Research Mentors:*

*Tim Filley and Erika Foster; Earth, Atmospheric, and Planetary Sciences*

**Poster Number:** 58 :: Innovative Technology/Entrepreneurship/Design

**Discovery Park Undergraduate Research Internship Program**

# Plant Evaluation for a Botanical Air Filter

Undergraduate Researcher:

Danielle LeClerc

Abstract:

This research is evaluating different plant species for the phytoremediation process utilized with in a biowall. A biowall is a plant-based air filter that improves the indoor air quality and aesthetics in a residential space. Along with the visual aesthetic of the plants, the roots, durability, size, and toxicity are characteristics need to be tested for each plant species in a biowall. New plants are being propagated in laboratory setting, and will be transferred to the Purdue Biowall when they are ready.

*Research Mentor:*

*William Hutzel; Mechanical Engineering Technology*

**Poster Number:** 59 :: Mathematical/Computation Sciences

**Discovery Park Undergraduate Research Internship Program**

# Solar cell performance on Multi-layer thin film by using Stanford Stratified Structure Solver (S4) and GUI development.

Undergraduate Researcher:

Changkyun Lee

Abstract:

To understand working principles, structures and properties of TPV(Thermophotovoltaic) system, Stanford Stratified Structure Solver (S4) was used. This resource guided independent learners to go through the process of simulating the reflections and transmittance off a thin film or multi film layers using S4. And, S4 data were compared to analytical expressions model done by MATLAB for single or multi-layer reflection and transmittance, which include phase. This helped determine the accuracy of analytical model by data comparison. Then, the analytical model was compared to experimental data to determine the optical dispersion of samples. The data obtained could then be compared to relevant prior experiments as a sanity check, although an exact match is not expected. After all these works were done, a simple tool was built to assist in performing this procedure with future samples having similar geometries and testing conditions. This could be done in Python using editor named PyCharm. And, then a GUI (Graphical User Interface) could be added in Rappture workspace, which is a toolkit supporting Rapid application infrastructure, designing it quick and easy to develop powerful scientific applications.

**Note: The poster with this abstract will NOT be presented during the Summer Undergraduate Research Symposium.**

*Research Mentors:*

*Peter Bermel and Ze Wang; School of Electrical and Computer Engineering*

**Poster Number:** 60 :: Mathematical/Computation Sciences

**Discovery Park Undergraduate Research Internship Program**

# Simplifying Geospatial Visualization and Analysis

Undergraduate Researcher:

Edwin Lu

Abstract:

Funded by the NSF CSSI program, the Extensible Geospatial Data Framework (GeoEDF) project is the second phase of the Geospatial Data Analysis Building Blocks (GABBs) project, an open source project which helps researchers and educators easily create and share geospatial datasets using the HUBzero portal framework. Building from the foundation GABBs created, GeoEDF aims to create seamless connections between platforms, data and tools, allowing the direct application of large, remote geospatial datasets in scientific modeling and analysis. This connection would be another step towards facilitating domain science research under the findable, accessible, interoperable, and reusable (FAIR) principles by providing reusable standardized software tools. However, data extraction and modeling can still be a daunting task for domain researchers and students because they might not have enough experience programming such an application. Due to the nature of geospatial data, these researchers and students may deal with large volumes of data that is not only obtained through numerous websites, but are in different formats and accessed through different protocols. Thus, I worked on creating an online tutorial using a HUBzero course and Python Jupyter Notebooks aiming to develop students and domain scientists programming capabilities and introduce modeling and analysis techniques. These tutorials act as an example that could be followed and as a foundation researchers and students could use to develop a program suited for their needs. Additionally, these courses and tutorials create a bridge that could reduce training times for the next-generation of researches in the field.

*Research Mentors:*

*Carol Song and Lan Zhao; ITaP Research Computing*

**Poster Number:** 61 :: Innovative Technology/Entrepreneurship/Design

**Discovery Park Undergraduate Research Internship Program**

# Predicting Solar Energy Generation Using Weather Forecasts to Limit Impact on the Power Grid

Undergraduate Researchers:

Tina Mo

Daniel Lee Young

Abstract:

With the increase in solar panel efficiency and a decrease in the price of photovoltaic systems, homeowners are opting to supplement their power supply by generating photovoltaic power. The net metering policy allows for excess generated energy to be sold back to utility companies, but this process introduces a lot of variability in the power grid due to the fluctuations in photovoltaic energy generation resulting from constantly changing weather conditions. Utility companies need to be able to predict how much power will be generated by photovoltaic power systems in order to optimize how much energy they will need to generate on a day-to-day basis to meet allocative efficiency in the supply and demand side of power production.

Large amounts of data were collected and analyzed to find a relationship between the amount of photovoltaic power produced and weather parameters. The data set includes power production of an existing solar panel system, real-time weather data gathered by the solar panel system, and historical weather data localized at the solar system's site.

A regression model is created through the statistical analysis of the data and used to describe the relationship between solar irradiance and historical weather variables. To predict future solar irradiance and the amount of solar energy produced, the model is applied to weather forecasts. This method is used as a basis to create a user-friendly decision support system that helps users predict photovoltaic energy of their personal systems as well as suggest optimal times to perform energy-intensive tasks.

*Research Mentors:*

*Lisa Bosman, Jason Ostanek, and Bill Hutzel; Polytechnic Institute*

**Poster Number:** 62 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# High Altitude Wind Energy Production over Complex Terrains

Undergraduate Researchers:

Abigayle Moser

Kaitlin Kelsey

Daniel Kwon

Abstract:

The renewable energy sector has grown substantially in the past decades in terms of industrial expansion and utilization of natural resources. Wind farms, particularly, have shown to have great potential in the renewable energy industry. However, generating power at high altitudes has been a global challenge in harvesting wind energy, given the difficulty to implement and maintain wind farm operations.

This study explores the viability of exploiting high-altitude, complex-terrain wind farms in the mountainous regions of Peru. Peru's potential to generate wind energy would revolutionize the potential production of wind energy and provide a framework to implement similar systems on a global scale. Between January 2019 and the present day, a model has been developed and tested exploring the feasibility of large-scale high altitude wind farm implementation.

*Research Mentors:*

*Drs. Luciano Castillo and David M. Warsinger; School of Mechanical Engineering*

**Poster Number:** 63 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Instrumentation of Streams to Evaluate Seasonality of Heavy Metal Concentrations in the Arequipa Region

Undergraduate Researcher:

Caelum Mroczek

Abstract:

Because the Arequipa Region is one of the most important producers of metals in Peru, heavy metal contamination could affect the most commonly used sources of drinking water and irrigation areas. This project aims to investigate the transport and speciation of metals in several rivers in the Arequipa region that are impacted by mine drainage and natural sources. Special emphasis is given to seasonal trends in metal concentration due to known changes in seasonal flow conditions. Earlier sampling campaigns have provided a survey of metal concentrations and speciation in regional rivers, but long-term trends are necessary to understand seasonality of metal concentrations. In order to better evaluate the trends in metal concentrations over temporal and flow condition periods, three strategic sampling sites will be instrumented with automated samplers. The automated sampler has been programmed to take composite samples and is coupled with sensors to measure temperature, conductivity, elevation, pH, and turbidity. The sampling at each site will take place for at least a year and samples will be taken daily. Flow rate will be estimated based on the Parshall Flume at one site and rating curves at the other sites. Daily samples will provide a more comprehensive survey of metal concentrations in the rivers. Metals will be analyzed through ICP-OES. Additionally, speciation and form of metals will be investigated.

*Research Mentors:*

*Chad Jafvert and Alexander Ccanccapa; Civil Engineering*

**Poster Number:** 64 :: Innovative Technology/Entrepreneurship/Design

**Discovery Park Undergraduate Research Internship Program**

# Extensible Geospatial Data Framework towards FAIR (Findable, Accessible, Interoperable, Reusable) Science

Undergraduate Researcher:

Amrish Nayak

Abstract:

Geoscience researchers often need to use data collected and published by organizations such as NASA, USGS, etc. This data is typically organized in online public repositories with web GUI, API, or other interfaces for querying and downloading the data that a user is interested in. A typical use case thus involves the researcher first downloading the data to their local machine, then uploading it to the server their code runs on and then repeating the process as needed. This process quickly becomes very cumbersome, time-consuming, or even intractable as researchers deal with several different repositories, each employing their own interfaces. The overarching goal of this project is to simplify the access and use of these large, remote geospatial datasets directly from a researcher's scientific code. As part of this internship, several building blocks that can simplify the access and use of such data were developed. First, a data accessor for the U.N.'s FAOSTAT repository was developed that accepts a dataset name and parses the online JSON-formatted FAOSTAT catalog to retrieve the location of the corresponding data files. Second, legacy R code written for the Windows OS was converted into a parameterized Python library for pre-processing the FAO data and converting the results into â€œharâ€• files usable by the GEMPACK software. A data transformer was also built to convert geospatial data formats into the more easily interpretable CSV (comma-separated values) format. These building blocks will be used to construct an end-to-end workflow for evaluating a global resource sustainability model.

*Research Mentor:*

*Rajesh Kalyanam; ITaP Research Computing*

**Poster Number:** 65 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Thermodynamics of Water in Our Solar System

Undergraduate Researchers:

Akshay Rao

Owen Li

Abhimanyu Das

Abstract:

A new wave of space exploration is pushing the bounds of feasibility in terms of interplanetary travel and habitability and the availability of water is a primary metric for the habitability of an extraterrestrial system. On Earth, desalination systems are often characterized by their thermodynamic energy requirement. In this work, we investigate the minimum energy associated with obtaining pure water from its available states (ice, salty water, vapor), on Enceladus, Europa, Ganymede, Jupiter, Mars, and Venus. A comprehensive breakdown of the least work associated with obtaining pure water at consumable conditions (100 kPa and 300K) is presented. Results show that desalination of saline ocean water generally results in the least energy cost. When liquid water is not available, melting ice is generally more efficient than atmospheric vapor condensation. For vapor, as the ambient temperature increases and pressure decreases past the desired liquid state, the least work increases. Conversely for ice, cold high pressure systems require more energy. With this model, it is possible to begin to understand design parameters of real water systems in these harsh environments and develop water-energy focused habitability metrics for planets outside our solar system.

*Research Mentor:*

*David Warsinger; Mechanical Engineering*

**Poster Number:** 66 :: Social Sciences/Humanities

**Discovery Park Undergraduate Research Internship Program**

# Construction Management Students' Choice of Major

Undergraduate Researcher:

Aayushi Sinha

Abstract:

There is a lack of diversity in the STEM field and there are certain fields within STEM where this disparity is very prominent. The construction industry has historically been male-dominated and continues to be so. Our study focuses on why students choose to pursue Construction Management Technology(CMT) or Engineering Technology(ET). It explores the different factors that influence students when they decide their major. This study explores these research questions: 1) Who are the students that choose construction management as a major? 2) Are there any similarities or differences that provide insight into construction management student choice of career path? The study population consists of students from Engineering Technology and the Construction Management Technology department. A survey was sent out to all students with questions regarding our research questions. The results show us that gender, race, and family background are central factors that help students decide CMT/ET as their major. Other factors such as academic advisors and past experiences in CMT/ET or closely related fields also have a heavy influence in their major choice. This study aims to broaden the pool of knowledge in STEM education. It also offers an insight into students' choices to educational institutions and organizations that want to diversify.

*Research Mentors:*

*Anne Lucietto and Anthony E. Sparkling; School of Engineering Technology*

**Poster Number:** 67 :: Innovative Technology/Entrepreneurship/Design

**Discovery Park Undergraduate Research Internship Program**

# Developing Containerized Applications for Cybersecurity Education

Undergraduate Researchers:

Noah Oller Smith

Takahide Iwai

Abstract:

Cybersecurity has been a large and growing field, especially with the increase in reliance on technology by the average citizen. However, taking the first few steps into the realm of security is not an easy task. Using Linux containers with docker, we've developed an open-source platform for students and instructors to use that takes a more hands-on approach towards learning. Vulnerabilities and exploits can be tested on our site from any computer that has a physical keyboard and access to the internet. We hope that the project will make it much simpler to grasp computer security concepts for anybody that's willing to learn.

*Research Mentors:*

*Rajesh Kalyanam and Baijian Yang; ITaP Research Computing*

**Poster Number:** 68 :: Life Sciences

**Discovery Park Undergraduate Research Internship Program**

# Characterization of Microbial Communities From Vineyards in Majes, Peru

Undergraduate Researcher:

Tess Snyder

Abstract:

The Majes Siguas II project is a government funded agriculture expansion in Arequipa, Peru, that pumps water from the highlands to the lowlands to irrigate the Majes farms for agricultural use. This water introduces different stresses to the farming land, such as fertilizers and pesticides, also significantly increasing soil salinity. In this sense, it is necessary to see the effects that farming and irrigation have on the landscape and on microbes in the soil. It is especially important to observe this coupled to the high salinity in the soil which stresses plants and possibly select for some halotolerant microorganisms. In this research, the purpose was to characterize the microbial communities at vineyards located in the Majes region. The microbial communities of a vineyard chronosequence (three different aged vineyards of 5, 10-15 and 35 years) were studied. To analyze these communities, soil environmental DNA of Archaea, Bacteria and Fungi was extracted from the three vineyards, amplified and next-generation sequenced. Soil samples were also plated on selective media at different dilutions to look for fungi, oligotrophic and heterotrophic bacteria. After culturing, colonies of interest from each type of media were isolated and purified, then identified through molecular methods.

*Research Mentors:*

*Lori Hoagland and Alejandro Rodriguez-Sanchez; Horticulture*

**Poster Number:** 69 :: Innovative Technology/Entrepreneurship/Design

**Discovery Park Undergraduate Research Internship Program**

# Impact of Augmented Reality, Virtual Reality, and Artificial Intelligence Improving Skill Acquisition in Flight Training

Undergraduate Researchers:

Khari Stewart

Curtis Taylor

Abstract:

As the demand for air travel continues to increase, the aviation industry is in dire need of pilots who are experts and masters in all of the core areas within flight training. Current training and learning mechanisms used today could be enhanced by incorporating virtual reality, artificial intelligence, and mixed reality to assist in expediting knowledge, skills, and abilities. As these technologies emerge, there is an opportunity to investigate the effects with performance. Researchers of the current study utilized a post-experimental design to determine if there is a significant difference in time to solo. Thirty-six (n = 36) participants were randomly assigned into one of three groups: Control Group, Mixed Reality, or Guided Instruction (AI). Data was collected from a private course held at Purdue University. Researchers hypothesize there will be a significant difference with improved performance for the guided instructor group. An ANOVA will be conducted to analyze the dependent variable. Future analyses will include various independent variables such as average approach speed, time to private pilot, and checkride pass rate. Additional broader impacts include lowering the costs of training, improving engagement, and intentional practice.

*Research Mentor:*

*Julius Keller; Aviation Technology*

**Poster Number:** 70 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Establishment of a Crop Mapping Methodology Using Remote Sensing for the Arequipa Region

Undergraduate Researcher:

Alec Watkins

Abstract:

A common application of remote sensing technology in the field of agriculture is the creation of crop maps, i.e. maps detailing the spatial distribution of crop types. Local farmers desire crop maps for the region of Arequipa, Peru for use in agricultural planning, although such maps have other applications. Agriculture surrounding Arequipa city has certain particularities that complicate approaches used in other countries: for example, the topography of the region necessitates terracing and smaller fields, many crops are commonly grown in the same immediate area, and there is often a lack of distinct growing season patterns. The goal of this study was to test the possibility of creating detailed crop maps of the region surrounding Arequipa city using high-resolution satellite images. High-resolution, atmospherically-corrected RapidEye satellite images were used to create crop maps of the region. The maps were created using supervised image classification methods along with ground reference data collected from ground surveys using a method developed as part of this project. A subset of the ground reference data was used to assess the accuracy of the classification. Spectral signatures associated with the reference data were used to begin a crop-based spectral library for the region. The classification had a total accuracy of 89% for the 8 major crop classes considered. These maps also provided areal and percentage cover of the crop types. The classification results and ground reference survey methods are considered satisfactory, thus this work will be the basis for future research on crop classification in the region.

*Research Mentors:*

*Andre de Lima Moraes and Keith Cherkauer; Agricultural and Biological Engineering*

**Poster Number:** 71 :: Physical Sciences

**Discovery Park Undergraduate Research Internship Program**

# Ionic Composition of Precipitation in the Southern Peruvian Andes

Undergraduate Researcher:

Brianna Westerberg

Abstract:

Ionic Composition of Precipitation in the Southern Peruvian Andes

Abstract

In the atmosphere water condenses on aerosols causing their removal during rainout events via wet deposition. Aerosol deposition from the atmosphere is increased by rainout events while the concentration of aerosols is inversely related to rainfall amount (eg. light precipitation ion concentration in rainwater is high). This study analyzed the major ions in daily wet deposition in the region of Arequipa, Peru from January through March 2019. To determine the source of these ions in the environment, rain gauges were set out in various types of locations including near mines, the city of Arequipa, and rural farms. The samples were analyzed by Ionic Chromatography for major cations (Na+, K+, Ca2+,and Mg2+) and anions (Cl-, NO-3 and SO2-4). The deposition flux for SO4- and NO3- was highest at the town of Orcopampa for SO4- near a mine and Arequipa city for NO3- at values of 5.2 ppm and 6.4 ppm respectively. Nitrate concentration at sites ranges from 0.2 to 9.9 ppm. Sulfate concentration at sites range from 0.46 to 9.3 ppm. Calcium from crustal sources is abundant in precipitation comprising 51% of all cations at sites on average. The deposition flux for sulfate and nitrate indicate that the sources for these aerosols would be the burning of fossil fuels near mines and motor vehicles in the city. This work is the first to investigate anthropogenic aerosols in the region and is important to future management of air quality.

*Research Mentors:*

*Drs. Greg Michalski and Elizabeth Olson; Earth, Atmospheric, and Planetary Sciences*

**Poster Number:** 72 :: Innovative Technology/Entrepreneurship/Design

**Discovery Park Undergraduate Research Internship Program**

# Evaluation of Virtual Internships Integrated Into College Engineering Coursework

Undergraduate Researcher:

Daniel Young

Abstract:

Many engineering undergraduates in higher education struggle to find an internship before their junior or senior year. A common concern among potential employers is that the students do not possess enough real-world project experience to consider them for an internship. This study seeks to evaluate (1) the effectiveness of employing virtual internships through the US government sponsored Virtual Student Federal Service (VSFS) in a group setting, in order to provide students with experience solving real-life engineering industry challenges. (2) It will also provide insight into the potential implementation of these internships into the standard engineering curriculum in other universities. A group of seven undergraduate students volunteered to participate in a VSFS group-internship project for a length of two semesters. The project was conducted at Purdue University and was documented using a project management website called SprintBase. The results from this study found that the students enjoyed the VSFS project overall and gained valuable real-life project experiences such as website development and coding. The students also developed soft skills such as information literacy, problem scoping, and design thinking. This utilization of a virtual internship through VSFS in a group setting would provide a way for undergraduates to gain relevant project experience early on in their careers. This also benefits employers by having a more industry-ready selection of students to pick from when searching for internship candidates.

*Research Mentor:*

*Lisa Bosman; Polytechnic Institute*

**Poster Number:** 73 :: Life Sciences

**College of Pharmacy**

# Spatiotemporal modulation of extracellular signal-regulated protein kinases 1 and 2 (ERK1/2) by opioid receptor signaling

Undergraduate Researchers:

Angel Lin

Arbaaz A. Mukadam

Abstract:

The MAP kinases ERK1/2 are vital downstream signaling proteins of various receptors, including G protein-coupled receptors (GPCRs) and contribute to cell proliferation, cell survival, and gene expression. Following GPCR activation activated (phosphorylated) ERK1/2 can remain in the cytosol or translocate to the nucleus. An emerging area of research in the GPCR field pertains to GPCR mediated recruitment of Î²-arrestin proteins, which can scaffold with multiple different kinases including ERK1/2 and mediate unique cellular outcomes. However, it is still unclear â€˜when (temporal)' and â€˜where (spatial)' the Î²-arrestin-dependent ERK1/2 is activated following GPCR activation. Therefore, the goal of the study is to investigate the spatiotemporal dynamics of ERK1/2 phosphorylation specifically following activation of the Î´-opioid GPCR (Î´OR). First, we utilized two agonists that can after they selectively activate Î´OR, strongly recruit Î²-arrestin (SNC80) or poorly recruit Î²-arrestin (TAN67) in CHO cells endogenously overexpressing Î´OR and the Î²-arrestin 2 isoform. Then we collected CHO cells 0,3,30,60 minutes after the drug administration. We used a Cell Fractionation Kit (Abcam) to separate cytosolic from nuclear fractions and assessed ERK1/2 phosphorylation levels by Western blot analysis. Our results suggest a trend of weak, but persistent ERK1/2 activation in the cytoplasm by SNC80, whereas TAN67 produced a much more robust but transient ERK1/2 activation in the cytoplasm. Obvious ERK1/2 phosphorylation patterns were weaker and harder to discern in the nucleus for either agonist. Our finding suggests potential differences in ERK1/2 activation for agonists that do and those that do not strongly recruit Î²-arrestin 2.

*Research Mentor:*

*Richard van Rijn and Mee Jung Ko; Department of Medicinal Chemistry and Molecular Pharmacology*

**Poster Number:** 74 :: Life Sciences

**College of Pharmacy**

# Pharmacological characterization of a potentially new class of delta-opioid receptor agonist

Undergraduate Researcher:

Hongyu Su

Abstract:

Delta opioid receptors belong to the family of G protein-coupled receptors (GPCRs), that are commonly expressed across specific areas of the central nervous system, particularly those related with, pain and mood processing. As such, delta-opioid receptors may be an interesting target to treat psychiatric disorders, such as depression, alcohol addiction, and anxiety. An emerging area of research of GPCRs, including opioid receptors, is the concept of “biased signaling” in which a drug only activates a specific signal-transduction pathway, with the hypothesized benefit of circumventing pathways associated with drug side effects. Previous studies in the lab have revealed that delta-opioid receptor agonists, that activate the Gi protein- pathway can strongly reduce alcohol use in mice. In contrast, agonists that beta-arrestin may induce harmful side effects, including seizures. In our efforts to screen a drug library consisting of 5000 compounds in search of a ‘biased’ delta-opioid that activates Gi proteins but not beta-arrestin, we identified a potentially novel biased agonist (PVR001). To evaluate if we can improve this agonist, we performed a SAR (structure-activity relationship) by catalog. Here I characterized 14 structural analogs of our hit compound for their ability to activate Gi protein signaling. Using human cells transfected with DNA encoding the delta-opioid receptor and a cAMP sensor for measuring Gi-protein activity, I tested compounds PVR002 to PVR015 in a dose-dependent manner in triplicate. The current results suggest that the initial hit thus far is our most potent agonist. We will analyze the data to determine if we can gain insight into the binding mechanism of this class of opioids with the goal of identifying areas that can be modified to increase potency and affinity of the agonist.

*Research Mentors:*

*Richard van Rijn and Robert Cassell; Department of Medicinal Chemistry and Molecular Pharmacology*

**Poster Number:** 75 :: Social Sciences/Humanities

**Interns for Indiana**

# Parent-mediated intervention for children developing at-risk for an ASD: Are the number of elevated-risk concerns indicative of greater ASD-risk?

Undergraduate Researcher:

Sabrina Hollis

Abstract:

While the exact cause of Autism Spectrum Disorder (ASD) is unknown, many factors place children at elevated-risks for ASD: genetics, environmental exposures, maternal psychiatric disorders, and psychosocial stressors. Early interventions for children with ASD can positively impact their development. Parent involvement can also reduce children behavior problems and improve communication skills, appropriate play, and imitation skills. Recognizing current ASD prevalence estimates, clinical best practice efforts include providing services to children at elevated-risk to maximize treatment effects. To date, most elevated-risk interventions require prenatal or family history concern at enrollment (e.g., born preterm; infant sibling of ASD). However, it is unclear whether the quantity of elevated-risk concerns (ERCs) may account for ASD-specific concerns.

The present study expands our understanding of ERCs by (1) descriptively characterizing the frequency/variability of concerns and (2) examining associations between ERCs and scores on ASD-specific developmental screeners. Twenty-eight children with ERCs participated in an ongoing parent-mediated intervention. An Elevated Risk Total Score (Range 0-18) was derived from maternal report of prenatal/newborn concerns, parent/pediatrician developmental concerns, and family diagnostic history. Overall, parents endorsed an average of 4.29 ERCs at enrollment (Range 2-7). A series of partial correlations were conducted, including family income as a covariate, and did not reveal significant correlations between ERCs and scores on ASD-specific screeners. Our results suggest that the higher number of ERCs may not be indicative of greater ASD-risk. Future studies may build upon our study by assessing other possible ERCs, or combinations of ERCs to inform ongoing elevated-risk intervention efforts.

*Research Mentor:*

*Dr. AJ Schwichtenberg and Ashleigh Kellerman; Human Development and Family Studies*

**Poster Number:** 76 :: Social Sciences/Humanities

**Purdue Summer Stay**

# Youth' Perceptions, Ideas, and Advice Regarding What Puts Peers At-Risk for Substance Use, How to Help Peers Avoid Substances, and Developing Prevention Activities

Undergraduate Researchers:

Jordan Harris

Ruby Reyes

Abstract:

Background: Underage substance use during childhood and adolescence can lead to immediate and long-term problems such as increased likelihood of a substance use disorder in adulthood. Adult perspectives historically have largely informed youth prevention efforts; however, youth's views are essential when developing targeted anti-drug programs as these programs directly affect them. Objective: This study examined youth's perceptions about what puts peers at-risk for alcohol and tobacco, ideas for helping peers avoid these substances, and advice regarding developing prevention activities. Methods: Low-income youth ages 11-14 (N=39, Mage= 12.2, SD = 1.073, 51.3% male) who attended a summer sports camp participated in semi-structured interviews that were thematically analyzed. Results: Participants discussed family and friends as playing a strong role in youth's attitudes and access to alcohol and tobacco. While some expressed feeling unable to help peers avoid substances, most described strategies that they believed could help including having 1) youth talk to youth about avoiding substances, 2) adults that they could notify and whom could help the young user, and 3) stricter access from parents and stores. Regarding anti-drug programs, most experienced D.A.R.E, a school-based program led by police officers. Concerning specific programming, youth suggested that learning occur in a positive interactive environment using meaningful incentives (e.g., ribbons, encouragement) on topics including substance use in general, consequences that might result from usage, as well as current drug-related issues such as the legalization of marijuana. Conclusion: Findings have the potential to inform interventions focused on preventing substance use among youth.

*Research Mentor:*

*Dr. Yumary Ruiz; Health and Kinesiology*

**Poster Number:** 77 :: Innovative Technology/Entrepreneurship/Design

**Purdue Summer Stay**

# Indoor Environmental Quality from Arequipa, Peru

Undergraduate Researcher:

Mason A. Merkel

Abstract:

This study examines the indoor temperature, humidity, and air quality inside a university building in Arequipa, Peru, and how to make improvements, if needed, through an HVAC system or Biowall. The Biowall is a botanical air filter that leverages the natural ability of plants to clean polluted air in an energy-saving, aesthetically pleasing way. Polluted air flows through the plant root zone, where a microbial community metabolizes the air contaminants, and clean air returns through the HVAC system in a house. If there is an opportunity for improvement in Arequipa, the Biowall can greatly enhance the indoor environment to decrease illness and boost productivity.

*Research Mentor:*

*Bill Hutzel; Mechanical Engineering Technology*

**Poster Number:** 78 :: Social Sciences/Humanities

**Purdue Summer Stay**

# Youth's Openness and Willingness to Participate in Anti-Drug Programming Offered Within a Summer Camp Context.

Undergraduate Researchers:

Nneka A. Ogbonnaya

Sophia M.Schadewald

Abstract:

Youth tobacco and alcohol use continues to be a public health heath concern. In response, numerous state and local-level anti-drug interventions have been implemented. The overwhelming majority of these programs take place in school-based settings with relatively little prevention efforts implemented in out-of-school settings such as summer camps. Yet, an estimated 14.3 million U.S. children participate in summer learning programs, thus offering a unique forum to reach youth through non-traditional school settings. Objective: This study aimed to understand if youth would be willing to participate in tobacco and alcohol use prevention activities within a camp setting during the summer months. We also sought to identify potential barriers that would prevent youth from participating. Methods: Youth ages 11-14 (N = 39, Mage = 12.2, SD = 1.073, 51.3% male) from low-income families who attended a summer sports camp participated in semi-structured interviews (20-40 minutes) that were thematically analyzed. Results: A majority (64%) of youth reported being in favor of incorporating anti-drug programming within a summer camp setting. Youth also provided suggestions related to how they would prefer to learn about substance use prevention including wanting interactive activities that are provided by trusted leaders such as camp leaders in a safe and enriching environment. Conclusion: Results imply that youth are both willing and open to participate in tobacco and alcohol use prevention activities offered in summer camp settings, thus, providing support for developing out-of-school substance prevention programming.

*Research Mentor:*

*Dr. Yumary Ruiz; Health and Kinesiology*

**Poster Number:** 79 :: Innovative Technology/Entrepreneurship/Design

**Purdue Summer Stay**

# Biowall airflow seal improvement and aerodynamic path characterization

Undergraduate Researcher:

Austin Shores

Abstract:

This research consists of determining and implementing effective airflow sealing methods for a biowall to eliminate variation of air filtration and ensure regularity of airflow through the apparatus. A biowall is a botanical air filtration apparatus that combines horticulture and phytoremediation to reduce air pollution for indoor environments via the microbial ecosystems surrounding plant roots. A biowall requires a semi-automated control system to maintain a consistent and calculated schedule for watering, airflow, lighting, and safety of the biowall operation. In order for the mechanical system and control system to work in unison, an effective seal is needed for proper airflow characteristics â€“ to prevent leaks and irregularities in tray airflow balance.

*Research Mentor:*

*William Hutzel; Mechanical Engineering Technology*

**Poster Number:** 80 :: Physical Sciences

**Summer Undergraduate Research Fellowship**

# Impact of Residual Crystallinity on Dissolution Performance of Amorphous Solid Dispersions

Undergraduate Researcher:

Isaac Corum

Abstract:

In recent years, the preparation of amorphous solid dispersions (ASDs) to enhance the bioavailability of poorly water soluble active pharmaceutical ingredients (APIs) has become an increasingly more common approach. Amorphous solid dispersions are made by the combination of drug and polymer, along with the addition of other excipients in an attempt to increase dissolution rate and extent, decrease crystal nucleation and growth, and maintain supersaturation levels for long enough to cause an appropriate reaction in the body. Hot melt extrusion (HME) is the most common and cost effective technique to develop an ASD when the API is not temperature sensitive. However, a common issue that may arise when preparing a sample is that residual crystals may remain if processing conditions are not robust. Residual crystals can lead to a negative impact on the dissolution and absorption profile of an ASD. These crystals may grow in solution, reducing the amount of drug able to dissolve and preventing supersaturation, ultimately effecting the performance of the final dosage form. Dissolution testing can tell us important information regarding the presence and effect of residual crystals within a sample. If the presence of residual crystals is inevitable, formulation strategies must be implored to develop a dosage form that can still produce appropriate biological effects in vivo.

*Research Mentors:*

*Dana Moseson and Lynne Taylor; Department of Industrial and Physical Pharmacy*

**Poster Number:** 81 :: Innovative Technology/Entrepreneurship/Design

**Summer Undergraduate Research Fellowship**

# Highly Flexible and Transparent Conductor for Solar Cells

Undergraduate Researcher:

Thao Nguyen

Abstract:

Flexible and wearable electronic technology has recently gained a significant amount of attention because of its potential application in life improvement. Application of nouveau devices, such as electronic skin, human-machine interfaces, and health monitoring sensors, etc., can aid human and enhanced their comfort and convenience. Because the most commonly used transparent conducting material in photovoltaic devices, which is indium tin oxide (ITO), is rigid and brittle, it cannot be used in flexible devices. Given that, as the wearable electronic and optoelectrical technology grows, the demand for a highly flexible electrode to accommodate human body movement like folding limbs or stretching and shifting muscles for such devices emerges. In this paper, a flexible electrode comprising of fused silver nanowires (Ag NWs) and a conductive polymer blend has been developed having proficient conductivity, high optical transparency. The fabricated electrode can be made at low temperature and at low cost, making it efficient for mass production. After multiple bending and twisting cycles, the flexible electrode film still has a sheet resistance of less than 22 ohm/sq and average optical transmittance of 80%. The developed transparent electrode shows proficient flexibility and competent optoelectrical performance compared to commercial ITO, making it a promising candidate for flexible, transparent conductive layer in the solar cell.

*Research Mentors:*

*Blake Finkenauer and Prof. Letian Dou; School of Chemical Engineering*

**Poster Number:** 82 :: Life Sciences

**Purdue Honors College**

# The Effect of Expanding City Boundaries on Rates of Lyme Disease in the United States

Undergraduate Researcher:

Daphne Fauber

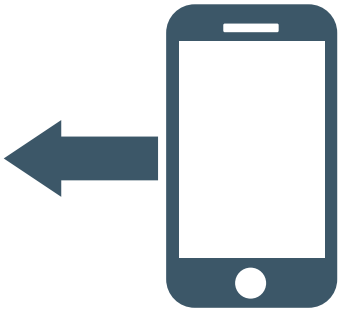
Abstract:

Over 30,000 cases of Lyme Disease are reported annually in the United States; however, according to the Center for Disease Control and Prevention (CDC) these reports are an underestimate of actual cases as between 300,000 and 400,000 Americans are likely infected annually. Since the 1990s, documented and estimated cases of Lyme Disease have been on the rise globally along with other diseases spread by human-animal contact. It has been well documented that urbanization—"[the] rapid intensification of agriculture, socioeconomic change, and ecological fragmentation"—is associated with an increase in zoonotic disease rates (Hassell, Begon, Ward, & Fèvre, 2017). Thus, the focus of the study was to break down urbanization in order to specifically examine the expansion of city boundaries and its relation to rates of Lyme Disease in the United States. The expected outcome was for the areas on the edge of expanding city boundaries to have increased risk of Lyme Disease due to the clash of a pre-existing natural ecosystem with the urban ecosystem moving in. Data from the CDC and US Census Bureau were merged including population density, the classification of county (urban, peri-urban, and rural), and rates of Lyme Disease. A generalized linear regression was used to examine the relation between rates of Lyme Disease, and the classification of each county controlling for population. Results indicated that there were greater instances per person of Lyme Disease in counties that were classified as urban.

*Research Mentor:*

*Dr. Hsin-Yi Weng; Comparative Pathobiology*

OUR OFFICE OF UNDERGRADUATE RESEARCH



**PLEASE...**
**Take a picture to provide feedback to undergraduate researchers you speak with.**

## Upcoming Events and Information:

### OUR Scholars Scholarship Application
Next deadline is July 31
Still accepting applications for some colleges. Check the OUR website.

### Undergraduate Research Pitch Competition
Sept. 24 | 7-9pm | WALC Hiler Theater
Submit your pitch recording by 8/29 to win up to $1,000
1st-3rd places and an audience favorite win awards

### Fall Undergraduate Research Expo
Nov. 18 | 8:30am-4:30pm | Stewart Center & PMU Ballrooms
Oral presentations and a poster symposium

### Purdue Undergraduate Research Conference
April 14 & 15 | 8:30am-4:30pm | Stewart Center & PMU Ballrooms
Judged oral presentations and poster symposium

**purdue.edu/undergrad-research**
**UGresearch@purdue.edu (765) 494-6503**

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