SPRING UNDERGRADUATE RESEARCH CONFERENCE

APRIL 11-18, 2022
West Lafayette, Indiana

PURDUE UNIVERSITY

SPRING UNDERGRADUATE RESEARCH CONFERENCE

SCHEDULE OF EVENTS

APRIL 12, 2022 | PMU BALLROOMS

9:30 — 12:00 PM   Morning Poster Session

1:00 — 3:30 PM   Afternoon Poster Session

APRIL 14, 2022 | STEW 214

9:30 — 12:00 PM   Morning Research Talks

1:00 — 4:45 PM   Afternoon Research Talks

APRIL 11-18, 2022 | ONLINE

Virtual poster session

Virtual research talks

Virtual presentations are available on the Spring Undergraduate Research Conference website.

We encourage participants and visitors to provide feedback to all presenters.
To submit informal feedback to the presenters, please scan this QR code with your device's camera.

THE LLLC COLLOQUIUM

THE LITERATURE, LINGUISTICS, LANGUAGES, & CULTURE COLLOQUIUM
APRIL 14, 2022 | STEW 218

Talks sorted by presentation time. Spelling of names and titles as submitted.

9:40   Understanding Russian Vocabulary: Upper Elementary to Intermediate Level
Drake Hershberger
Mentor: Olga Lyanda-Gellar

12:40 The Effects of Sociohistorical Factors on Translation
Quinlan Dulaney
Mentor: Erin Moodie

1:00   Surrealism and Antifascism in Paola Masino's La Nascita e Morte della Massaia
Brianna McCaffrey
Mentor: Elena Coda

1:20   Mental Illness in Fascist Italy and Nazi Germany
Ava Minolli
Mentor: Elena Coda

2:00   Heroes, Villains, Pros, and Antis: Identity Politics, Ethics, and the Line Between Fiction and Reality in Fandom
Fayth Schutter
Mentor: Megha Anwer

2:40   Russian Wooden Architecture
Joel Kong
Mentor: Amina Gabrielova

3:00   Goethe's Asymmetrical Relation to Composers: Beethoven, Schubert, and Mendelssohn
Colin Witt
Mentor: Beate Allert

3:20   Lyric Opera: The Renaissance's Legacy
Paula Rivera
Mentor: Elena Coda

3:40   Eugenics, Transhumanism, and Animality
Sarah Trepanier
Mentor: Maren Linett

TBD   Fascism in Trieste
Lauren Cook
Mentor: Elena Coda

Literature, Linguistics, Languages, & Culture Colloquium

Presentation Time: 9:40

Understanding Russian Vocabulary: Upper Elementary to Intermediate Level

Author(s):

Drake Hershberger, College of Science

Abstract:

For many learners of Russian, the undertaking of learning vocabulary can be overwhelming. Structurally, Russian words contain roots, stems, prefixes, suffixes, and endings; a better understanding in these areas can make working with the Russian language much more rewarding. Each of the parts of a Russian word tell the reader something about the word's meaning or function. This project seeks to explore the function of prefixes in the Russian language and present them in such a way as to aid in making the learning of Russian smoother and more intuitive for the average learner at university level. This project explores the topic of prefixes mainly within the textbook, Russian: From Intermediate to Advanced by Olga E. Kagan, Anna S. Kudyma, and Frank J. Miller; research was also done with Голоса: A Basic Course in Russian 5th edition books one and two, these are commonly used for the introductory and intermediate courses in Russian. The process followed during this research consisted of gathering a list of prefixes commonly used in Russian and found within these textbooks, organizing words that share the same prefix by grouping them together, and analyzing the function that the prefixes have in the production of new words, along with determining relative meanings for each prefix. The goal is to use these lists as a way of accelerating the average learner's pace of learning vocabulary, while also strengthening the learner's understanding and command of the Russian language by making it more intuitive.

Mentor(s):

Olga Lyanda-Geller, Purdue University

Literature, Linguistics, Languages, & Culture Colloquium

Presentation Time: 12:40

The Effects of Sociohistorical Factors on Translation

Author(s):

Quinlan Dulaney, College of Liberal Arts

Abstract:

Translation of written works between different languages is heavily dependent on opinion and personal style. The variance of these translations often comes from a combination of sociohistorical and culture specific context. As such, iconic literary works such as Shakespeare and Aristotle can vary greatly in meaning when translated into different languages. To determine exactly how much variance can occur in meaning between translations, I examined two Roman plays, "The Brothers" and "Amphitryon," written by Terence and Plautus respectively, in their original Latin versions, modern English translations, and 17th century translations by Molière. The purpose of this examination was to use Molière's French plays to determine how Molière used his sociohistorical and dramatic context to adjust the Roman plays to 17th century French society; as well as, how the audience/goal of the modern English version, which was intended to be as literal a translation as possible, also shaped its translation.

Mentor(s):

Erin Moodie, Purdue University

Presentation Time: 1:00

Surrealism and Antifascism in Paola Masino's La Nascita e Morte della Massaia

Author(s):

Brianna McCaffrey, College of Engineering

Abstract:

La Nascita e Morte della Massaia (The Birth and Death of the housewife) by Paola Masino is undoubtedly an antifascist work. This antifascist attitude is established by many elements in the novel. One such element is inclusion of surreal scenes that blur the line between reality and imagination. These scenes start off normal, such as the start of a dinner party or the beginning of a drive but quickly diverge into unbelievable almost dream like events. As a reader these scenes are puzzling to understand, from a superficial understanding of what is really happening in the scene to a deeper understanding of the author's purpose for including the scene. This puzzling feeling is a main characteristic of surrealism, that is making the reader/viewer of the work think while reading/viewing it, even if there is not set conclusion the author wants the reader to come to. This ambiguity is exactly what Fascism is not, fascism values concise, to the point, no room left for interpretation things. Which is precisely why the surrealism in Masino's novel is just one aspect that makes is antifascist.

In this paper I will primarily focus on how two of the scenes I choose from the book demonstrate surrealism and how by doing so makes the novel antifascist. There already exists much published research and work about Masino's La Nascita e Morte della Massaia. However, majority of those works focus on how her representation of the housewife in the novel is antifascist more so than anything else.

Mentor(s):

Elena Coda, Purdue University

Literature, Linguistics, Languages, & Culture Colloquium

Presentation Time: 1:20

Mental Illness in Fascist Italy and Nazi Germany

Author(s):

Ava Minolli, College of Health & Human Sciences

Abstract:

The focus of this research is on how Fascism and Nazism played a role in the diagnosis and treatment of mental illnesses between 1922 and 1945. Through the analysis of asylum conditions at the time, diagnosis criteria and government regulations from both Germany and Italy, the sterilization laws for people with mental illnesses seems to be where ideological theories and scientific misconceptions meet and influence one another. There are distinct differences between how mental illnesses were treated and approached in Germany and Italy. In a time where Fascism and Nazism were strongly tied in their political alliances and motivations, the aim is to address why there were differences in treatment of mental illnesses in Germany and Italy.

Mentor(s):

Elena Coda, Purdue University

Literature, Linguistics, Languages, & Culture Colloquium

Presentation Time: 2:00

Heroes, Villains, Pros, and Antis: Identity Politics, Ethics, and the Line Between Fiction and Reality in Fandom

Author(s):

Fayth Schutter, College of Liberal Arts

Abstract:

Fandom, as a place many find themselves and create community within, has become a contemporary venue for exploring critical media literacy. This extends to placing political and ethical obligations on media that fandoms form around. Although such critical consumption often has the greater good in mind, it can become counterproductive and silence the voices it often claims to lift. This report seeks to understand why and how fandom places such obligations and meaning on fiction, and why fandom has become a hotbed for such considerations. It also seeks to understand if this is a positive turn for the future of fandom and media itself, and how fans can address the need for critical consumption of their favorite series. Using two fandoms (the DreamWorks cartoon Voltron: Legendary Defender and the manga and anime Boku no Hero Academia) as case studies, this report explores fandom's interaction with fiction, reality, representation, and the subversion of all three. Through the analysis of Twitter and Tumblr posts from the last five years, this research will lead to a list of proposed steps that fans can take when faced with the ethical quandaries critical consumption creates, and how to address these questions with the nuance they deserve.

Mentor(s):

Megha Anwer, Purdue University

Russian Wooden Architecture

Author(s):

Joel Kong, College of Engineering

Abstract:

Among the many symbols of Russia, wooden architecture displays the civilization's culture in a unique way. Having the largest forest resources in the world, Russia has been treating wood as the primary architectural material since the Middle Ages. As a commodity, wood was sold in pre-made pieces that greatly reduced the complexity of construction. Having the modular logs stacked on top of each other, a simple yet effective frame formed the main structure of Russian architecture. While having a simple design of the physical frame, the Russian people endowed the buildings with great spiritual significance by applying artistic decorative elements. Bearing the weight of history, Russian wooden architecture continues to impact the future. From the basic physical structure to the sophisticated spiritual aesthetics, Russian wooden architecture illustrates the civilization's practical pursuit of effectiveness of tools, as well as the uncompromising pursuit of a higher-level spiritual beauty and harmony. This paper will take a close look into the architecture of peasant huts and churches of the Russian North. While having carefully decorated physical windows, Russian wooden architecture truly provided a window for people to peak into the glamorous hall of Russian civilization and culture.

Mentor(s):

Amina Gabrielova, Purdue University

Presentation Time: 3:00

Goethe's Asymmetrical Relation to Composers: Beethoven, Schubert, and Mendelssohn

Author(s):

Colin Witt, College of Science

Abstract:

Johann Wolfgang von Goethe was one of the most well-known writers of his time, writing 142 volumes of text comprising everything from scientific treatises to novels to poetry. He was the publisher and editor of the periodical Propyläen, and in that role provided support to other writers and artists looking to follow in his footsteps. As many artists as he supported, however, he turned even more away. Some of the best-known artists of Goethe's day were among those he considered unworthy of his attention.

Among the artists turned down by Goethe are composers still famous today, who idolized Goethe and dreamed of collaboration or even recognition from the artistic titan. From a modern perspective, these choices are bizarre. To Goethe, however, these composers represented an opposing worldview, even as they drew inspiration from his work. This conflict between the balanced Weimar Classicism and the emotional Romanticism was no concern to the Romantics, among who included names such as Ludwig van Beethoven, arguably more famous than Goethe himself and Franz Schubert, whose Lieder come directly from Goethe's poems. While these composers sought Goethe's approval, Goethe ignored their work. However, his distaste for their style could not be the only reason. He also took the young Felix Mendelssohn as a protégé, who became yet another Romantic composer, albeit one more influenced by Goethe's philosophy. Goethe's refusal of Beethoven and Schubert was perhaps costly for music and literature alike. Together, such great artists could have made something far better than they could alone.

Mentor(s):

Beate Allert, Purdue University

Literature, Linguistics, Languages, & Culture Colloquium

Presentation Time: 3:20

Lyric Opera: The Renaissance's Legacy

Author(s):

Paula Rivera, College of Science

Abstract:

This paper reviews the origin and development of the musical style opera lirica, lyric opera, through the evaluation of historical texts and scholarly literature. Currently, opera lirica is regarded as a baroque musical style that developed during the seventeenth century, however, evidence implies that opera lirica was a direct product of the Italian Renaissance. This evidence is based on three factors: the setting it developed in, the people that developed it, and the underlying inspiration for operas. The first operas were written and performed in Florence, Italy, the birthplace of the Renaissance. Between the already existing tradition of musical theatre and the expression of civic humanism brought about by the Renaissance, opera lirica was on track to be created. Additionally, the Renaissance left a legacy of humanistic intellectuals that sought to reform different forms of art. In the context of music, the Camerata dei Bardi decided to create a new melodic line that imitated those of the ancient Greeks. Lastly, the first operas emulated how the Italian Renaissance aimed to recreate ancient Greek classics through art by basing their plot on ancient Greek mythology. This incongruity between baroque labeling and actual Renaissance characteristic features of the opera lirica arises questions on the accuracy of historical labeling of different artforms. Efforts to attain historical accuracy are very important to not misrepresent and distort the understanding of our past.

Mentor(s):

Elena Coda, Purdue University

Literature, Linguistics, Languages, & Culture Colloquium

Presentation Time: 3:40

Eugenics, Transhumanism, and Animality

Author(s):

Sarah Trepanier, College of Liberal Arts

Abstract:

Eugenics is a global system of thought with roots in the rise of Social Darwinism in the late 19th and early 20th centuries. It exists first to establish the limits of acceptable humanity, as well as to propose organized human annihilation and/or directed human (re)production in order to "improve" the human race and meet eugenic goals. Its logic, goals, and outcomes are profusely embedded in various ideologies, including the work and teachings of transhumanists.

In her upcoming monograph: Making Us New: From Eugenics to Transhumanism in Modernist Culture, Dr. Maren Linett explores eugenic and transhumanist imaginations of "improved" humans. Throughout her work, she considers these ideas and their intersections with conceptions of animality. For research, in support of her work, I read through publications from both early and modern eugenicists and transhumanists to locate relevant material about the believed place of animals and animality in the evolved and evolving human race. This project presents the relevant excerpts and quote materials that have informed the work of Dr. Linett. Each presented excerpt is contextualized with information about the author and piece, as well as its significance and how it is representative of larger ideological entities. The presented material is organized into groups based on the five categories of research that I have completed thus far: "Eugenics and Animality," "Ape and Essence Literary Criticism," "The First Men in the Moon Literary Criticism," "Transhumanism and Animals," and "Sirius Literary Criticism." This work is educational and instrumental to our understandings of projects for human "improvement" and their place in global systems of oppression.

Mentor(s):

Maren Linett, Purdue University

Literature, Linguistics, Languages, & Culture Colloquium

Presentation Time: TBD

Fascism in Trieste

Author(s):

Lauren Cook, College of Health & Human Sciences

Abstract:

In the multicultural city of Trieste, fascism was perpetuated by and built upon anti-Semitic and anti-Slavic tensions that had already existed for many years and had not gone away. Trieste is a city that lies in the northeast of Italy, however it was not always a part of Italy. The city has long been under the rule of different countries and had only recently become a part of Italy in 1920 following the end of World War I when Austria-Hungary had dissolved. As a new city of Italy, Trieste was in an interesting position, as it was somewhat isolated from the rest of the country and surrounded by other countries like Slovenia, which it was not on amicable terms with. This unique and mixed history provides an interesting background when looking at how fascism existed and was cultivated in Trieste. Trieste helped to pave the way for many of the racial aspects of fascism as a result of already-existing ideas that many citizens had, so much so that Mussolini had commended the city as exemplary for fascism. Because of this, fascism in Trieste was able to thrive, and greatly harmed both Jewish and Slovenian populations.

Mentor(s):

Elena Coda, Purdue University

POSTER SYMPOSIUM

Posters sorted by last name of first author within each session. Spelling of names and titles as submitted.
‡ - Denotes interdisciplinary project.   ♦ - Denotes archival project.

MORNING POSTER SESSION | 9:30AM-12:00PM

100   *SeArre Abebe*
Mentors: Zahra Tehrani

101   *Shivangi Agarwal, Elise Miller*
Mentors: Marguerite O'Haire, Leanne Nieforth, Clare Jensen, Sarah Leighton

102   *Khunsha Ahmed*
Mentors: Ulrike Dydak, Roslyn Harold, Humberto Monsivais, Daniel Foti

103   *Olohitare Dorinda Ahonsi*
Mentors: Zahra Tehrani

104   *Olukunle Akinleye, Gouri Bellad, Hersh Thapar*
Mentors: Katherine Fowee-Gasaway, Steven Pugia, Alina Alexeenko, Anthony Cofer

105   *Isabelle Akoro*
Mentors: Jennifer Freeman, Janiel Ahkin Chin Tai, Sydney Stradtman

106   *William Alford, Jessie Lanzer, Sagnik Ballabh, Aniruddha Upreti*
Mentors: Juehang Qin, Rafael Lang

107   *Keita Arakawa*
Mentors: Lisa Bosman

108   *Samantha Barker*
Mentors: Cankui Zhang, Jing Huang

109 ‡ *Kalei Bass*
Mentors: Nicholas Anton, Denny Yu

110   *Molly Beatty, Nicole Stepp, Lucas Bottini*
Mentors: Keith Stantz

111 ‡ *Alexander Bergendorf*
Mentors: Douglas Brubaker, Javier Munoz, Mahmoud Rahal, Matthew Bohm

112   *Arsh Bhatia*
Mentors: Rakesh Agrawal, Zewei Chen

113   *Katelyn Biggs*
Mentors: Jonathan Shannahan, Li Xia

114   *Amelia Binau, Caden Glenn, Ben Hartings, Justina Riffell*
Mentors: Rafael Lang, Amanda Depoian

115   *Hannah Blum*
Mentors: Vikki Weake, Sarah Stanhope

116   *Jackson Brady*
Mentors: Sara McMillan, Jacob Hosen, Meghan Ciupak

117   *Ryan Branstetter, Manas Paranjape*
Mentors: Alexandria Volkening

118   *Luke Buscemi*
Mentors: Luciana Debs

119   *Reagan Bushok, Logan Cook, Fi Goode, Abby Simpson*
Mentors: Kari Clase, Taylor Sorrell

120   *Leonard Cahya*
Mentors: Zahra Tehrani

121   *Shangzhe Cai*
Mentors: Aaron Thompson

122   *Vincent Calhoun*
Mentors: Wei Zheng, Luqing Liu

123   *Robin Carpenter, Michael Agrillo, Conor Costello, Erin Smith, Manny Gil, Jack Reynolds*
Mentors: Danny Milisavljevic

124   *Raul Castro*
Mentors: Chris Rochet, Sehong Min

125 ‡ *Pou Hei Chan, Pou Ut Chan, Wai Teng Sin, Chon Weng Lei*
Mentors: Byung-Cheol Min

126 ‡ *Lahiri Chitturi*
Mentors: David Warsinger, Antonio Puentes, Akshay Rao, Abhimanyu Das

127   *Nicholas Cook*
Mentors: Aaron Thompson, Megan Hedges

128   *Justin Copenhaver*
Mentors: Jukka Vayrynen

129   *Amanda Coy*
Mentors: Zahra Tehrani

130 *Owen Crocker*
Mentors: Peter Bermel, Jie Zhu

131 *Eva Cullins*
Mentors: Julia Chester, Arbaaz Mukadam,
Soyol Enkh-Amgalan

132 *Perry Curtis*
Mentors: Ellen Wells

133 *Jasmina Davis*
Mentors: Hector Zumbado-Ulate,
Catherine Searle

134 *Shreya Desai*
Mentors: German Posada, Geurim Kim,
Muqing Liu

135 *Brandon Dimitri, Jeremy Frederick, Nathan
Arnold, Aditya Kini, Drew Lundin, Saron
Bhoopathy, David Huang, Matthew Murday*
Mentors: James Goppert, Nan Kong, Nicole
Adams, Riley Franklin

136 *Anna Donnelly*
Mentors: Brock Harpur, Stephanie Hathaway

137 *Luke Dubec, Emily Khoo*
Mentors: Dan Foti, Kim Galvez,
Wei-Siong Neo

138 *Sarah Dunn*
Mentors: Vetria Byrd

139 ‡ *Allison Earnhardt*
Mentors: Dave Cappelleri, Francis Robicheaux

140 *Husam Elgaali, Erika Micolta*
Mentors: Mirian Velay, Vito Francioso

141 *Audrey Ellis*
Mentors: Timothy Johnson, Junior Cheng,
Eunice Centeno Martinez

142 *Jamie Emerson*
Mentors: Matthew Olson, Sungtae Park

143 *Sarah Ettestad*
Mentors: Jozef Kokini, Harrison Helmick

144 *Rebecca Eyrick*
Mentors: Ellen Wells

145 *James Fazioli, Margaret Mulligan*
Mentors: Jonathan Pasternak, Erin Ison,
Ryan Cabot

146 *Dylan Forbes*
Mentors: Habib Gholipour-Ranjbar,
Julia Laskin

147 *Mariam Ghoneima*
Mentors: Jie Zhu, Peter Bermel

148 *Brenna Giese*
Mentors: Catherine Aime

149 *Molly Gillig*
Mentors: Qing Jiang, Cindy Nakatsu,
Suji Im, Yiying Zhao

150 *Bethany Grace, Katherine Xiong*
Mentors: Sudip Vhaduri

151 *Colton Griffin, Aneesh Khilnani*
Mentors: Thomas Sinclair

152 *Abigail Hackleman, Muhja Ibrahim*
Mentors: Susan Sangha, Sydney Trask,
Kevin Shim

153 *Madeline Harper*
Mentors: Cordelia Running

154 *Christabel J. Hartanto*
Mentors: Jozef Kokini

155 ‡ *Caroline Henson*
Mentors: Alexandria Volkening

156 *Adrik Herbert, Eric Reinhardt*
Mentors: Andreas Jung, Andrew James
Wildridge

157 *Rhenn Holliday*
Mentors: Zahra Tehrani

158 *Sydney Hummel*
Mentors: Xiaoping Bao, Yun Chang

159 *Elissa Jaensson*
Mentors: Seema Mattoo, Jill Cornell

160 *Rina Jiang*
Mentors: Philip Low, Fenghua Zhang

161 *Emily Johnson*
Mentors: Joseph Ogas, Jiaxin Long

162 *Simran Kadadi, Zhonghao Zhang*
Mentors: Majid Kazemian

163 *Kenneth Kanwischer*
Mentors: Cara Putman

164 *Neha Kapur*
Mentors: Cordelia Running, Kathryn Pacheco

165 *Navjot Kaur*
Mentors: Matthew Olson

166 *Vivek Khanolkar, Alan Chung Ma, Ashwin Senthilkumar, Pranav Ahuja, Sarah Clevenger, Kshaunish Soni, Shivansh -*
Mentors: Santiago Torres-Arias

167 *Renee Kohlmeier*
Mentors: Jessica Huber

168 *Thomas Komay*
Mentors: Igi Vilza, Angeline Lyon

169 *Michael Kuczajda, Kathleen Reyna, Rachel Riley, Sydney Thrasher*
Mentors: Sydney Trask

170 *Ian Kurz*
Mentors: Sa Liu, Jung Hyun Lee, Marwan Alajlouni, Antonios Tasoglou

171 *Max Lantz, Carly McKean, Ankit Mondal, Abhirama Rachabattuni, Yashoheet Sethi, Ata Toraman*
Mentors: Kate Fowee-Gasaway, Alina Alexeenko, Anthony Cofer, Steven Pugia

172 *Harry Lee*
Mentors: Garam Kim

173 *Hyunseo Lee*
Mentors: Joseph Rispoli, Folk Narongrit, Thejas Ramesh

174 *Kyu Been Lee*
Mentors: John Tesmer, Chun-Liang Chen

175 *David Li, Allen Liu, John Zylstra*
Mentors: James Davis

176 *Alexis Lowe, Daniel Ceglio*
Mentors: Caitlin Proctor

177 *Riya Mahajan*
Mentors: Mohit Verma, Mohsen Ranjbaran

178 *Alex Marks, Shaan Luthra, Adrien Dubois, Vishaak Narayan, Guna Avula, Aarohi Panzade, Jasper Koliba, Aakanksha Shripal, Anish Bhowmik*
Mentors: David Purpura

179 *Makayla Marlin*
Mentors: Juan Jauregui, Vikki Weake

180 *Abigail McDonald*
Mentors: Susan South

181 *A. Meenakshi McNamara*
Mentors: Rolando de Santiago

182 *Alexander McQuade*
Mentors: Zahra Tehrani

183 ‡ *Nicolas Medel*
Mentors: Jonathan Shannahan, Saeed Alqahtani

184 *Noah Mehringer*
Mentors: Chi Hwan Lee, Taewoong Park

185 *Kenneth Meng, Elizabeth Thomas, Matthew Tsortanidis*
Mentors: Dionysios Aliprantis, Loraine Navarro Estrada, Dakota Hamilton

186 *Isaac Meng*
Mentors: Muhammad Abdullah Arafat

187 ‡ *Katherine Meves*
Mentors: Alexandria Johnson

188 *Allison Milicia*
Mentors: Ann Kirchmaier, Ronard Kwizera

189 *Heather Milliron*
Mentors: Qin Xu

190 *Lillian Millspaugh*
Mentors: Carolyn McCormick, Rose Mason, Veronika Peskova

191 *Sydney Moeller*
Mentors: Shilpi Singh, Ximena Bernal

192 *Dilhara Moonesinghe*
Mentors: Jiayun Xu

193 *Kaylin Moore*
Mentors: Jennifer Freeman, Sydney Stradtman

194 *Tyler Morgan*
Mentors: Donna Riley, Caroline Camfield

195 *Kara Mosier*
Mentors: Timothy Johnson, Ruth Martinez, Johnnie Cheng

196 *Margaret Mulligan, Jocelyn Kleiman, Andrew Caldemeyer*
Mentors: Jonathan Pasternak

197 *Mitesh Mylvaganan*
Mentors: Sunghwan Lee

198 *Siddharth Nathella*
Mentors: Ryan Wagner

199 *Sam Nemeth*
Mentors: Patricia Thomas

200 *Bach Nguyen*
Mentors: Hrishikesh Pokharkar,
Sogand Hasanzadeh

201 *Trang Nguyen, C. Maximillia Otterbacher,*
Muhan Wang
Mentors: Maria Olivero-Acosta, Zhefu Que,
Yang Yang

202 *Jacob Nylen*
Mentors: Roshan Manibharathi, David Cannon

203 *Sean O'Sullivan*
Mentors: David Halbrooks, Mohit Goswami

204 *Hal Owens*
Mentors: Hosseini Mahdi, Haechan An

205 *Tikhon Pachin, Yu-Hsuan Lin, Shang-Hsuan*
Lee, Kotekar Annapoorna Prabhu, William
Stevens
Mentors: Edward Delp, Carla Zoltowski

206 *Isabel Panicker*
Mentors: Jonathan Turnley, Rakesh Agrawal

207 *Hajin Park*
Mentors: Brandon Boor, Chunxu Huang

208 *Feny Patel*
Mentors: James Davis

209 *Mili Patel*
Mentors: Carolyn McCormick, Veronika
Peskova, Bridgette Kelleher

210 *Sanika Pelnekar, Siddhi Shetty*
Mentors: Igi Vilza, Angeline Lyon

211 *Justin Petri*
Mentors: Deepak Nadig

212 *Julia Pirrello*
Mentors: Jill Newton

213 *Akshaj Prasannakumar, Peter Spina,*
Aidan Prendergast
Mentors: Matthew Swabey

214 *Mike Psimos*
Mentors: Zahra Tehrani

215 *Rhiana Ragheb*
Mentors: Natalya Kaganovich,
Jennifer Schumaker

216 *Sahana Rayan*
Mentors: Denny Yu, Guoyang Zhou

217 ‡ *Jordan Reining*
Mentors: Kathryn Seigfried-Spellar,
Stephen Elliott

218 *Fiona Ridenour*
Mentors: Candace Croney, Aynsley Romaniuk,
Shanis Barnard, Alessia Diana

219 *Mallory Roach*
Mentors: Emily Dykhuizen, Sandra Ordonez-
Rubiano, Surbhi Sood

220 *Laura Rubio*
Mentors: Lisa Welp, Elizabeth Olson

221 *Gracie Sanders*
Mentors: Zahra Tehrani

222 *Chintan Sawla, Nathan Kanter*
Mentors: Vetria Byrd, Oluwaseyi Jaiyeoba

223 *Zainab Shaikh*
Mentors: Julia Chester, Arbaaz Mukadam

224 *Perion Sharp, Mehul Shrivastava*
Mentors: Anupriya Karippadath,
Stephanie Gardner

225 *Amanda Shie, Rachel Young*
Mentors: Swati Srivastava

226 ‡ *Jasmine Singh*
Mentors: Alexandria Johnson, Kevin Walker

227 *Sidney Smith*
Mentors: Laura Schwab Reese

228 *Kiara Smith, Kristina Hobbib*
Mentors: Aaron Bowman, Anke Tukker

229 *Thomas St. Pere*
Mentors: Estuardo Robles

230 *Ronald Steinbrook*
Mentors: Vetria Byrd

231 *Lauren Stucky, Grace Francis*
Mentors: Ulrike Dydak, Humberto Monsivais

232 ♦ *Allison Sussman*
Mentors: Nancy Gabin

233 *Jacqueline Talbot*
Mentors: Carolyn McCormick, Mehreen
Hassan

234 *Chevelle Tallman*
Mentors: Elizabeth Mercier

235 *Haley Tate*
Mentors: Joanna Rogowski

236 *Oscar Teran*
Mentors: Kendrick Hardaway, Hua Cai

237 *Brandon Tso*
Mentors: Sa Liu, Marwan Alajlouni,
Jung Hyun Lee, Alaina Bryant

238 ‡ *Andrew Walke*
Mentors: Shalini Low-Nam, Kevin Scrudders

239 *Hannah Walls*
Mentors: Zahra Tehrani

240 *Melanie Werner*
Mentors: Stephanie Masta, Janelle Grant

241 *Erika Wheeler*
Mentors: Jennifer Foray

242 *Arden Woodall, Samantha Murphy*
Mentors: Dino Felluga

243 *Chaeyoung Yoo*
Mentors: Hayagreeve Keri, Hyein Park,
Scott Pluta

244 *Rachel Young, Amanda Shie*
Mentors: Swati Srivastava

245 *Wendi Yuan*
Mentors: Sa Liu, Jung Hyun Lee

246 *Katherine Zhang*
Mentors: Jennifer Hall

AFTERNOON POSTER SESSION | 1:00PM-3:30PM

300 *Landon Abboud*
Mentors: Casey Gawen

301 *Hadi Ahmed*
Mentors: Sarang Pramod, Mark Johnson

302 *MarySara Albert, Zhujin Xia, Logan Hamilton,
Ben Goncher*
Mentors: Lauren Novak, Kari Clase

303 *Brandon Allen*
Mentors: Vetria Byrd

304 *Brianna Arinze*
Mentors: Chris Rochet,
Chandnee Chandrasekaran

305 *Deha Ay, Douglas Andrew Hermo*
Mentors: Sogand Hasanzadeh,
Shiva Pooladvand

306 *Anna Bajszar*
Mentors: Cankui Zhang

307 *Kyler Bartol*
Mentors: Zahra Tehrani

308 *Joseph Bignotti, Kamryn Arnold*
Mentors: Garam Kim

309 *Anthony Bovenschen, Nicholas Pecoraro*
Mentors: Jae Park, Li Liao

310 *Garrett Brewster*
Mentors: Margaret Phillips, Heather Howard

311 *Jared Buls*
Mentors: Austin Toombs

312 *Leonard Cahya*
Mentors: Julie Liu, Carly Battistoni

313 *Daniel Ceglio, Alexis Lowe, Monique Watson*
Mentors: Caitlin Proctor

314 *Perapa Chotiprasidhi*
Mentors: Daniel Suter

315 *Niamh Christie*
Mentors: Molly Maloney, Christopher Eckhardt,
Daniel Oesterle

316 *Payton Clapper*
Mentors: Zahra Tehrani

317 *Stephanie Clark*
Mentors: Mackenzie Chapman,
Andrew Mesecar

318 *Melanie Clayton*
Mentors: Zahra Tehrani

319 *Tyler Collins, Ryan Jensen, Jinrae Kim,
Vishnu Langdu, Pranav Singh*
Mentors: Nichole Ramirez, Prabhpreet Dhir

320 *Maggie Craig, Kathryn Malerbi, Gianna Thornton*
Mentors: Yumary Ruiz, Carlyn Kimiecik, Natalia Rodriguez, Jason Ware

321 *William Crytzer, Tanay Athreya, Rasesh Ramadesikan*
Mentors: Priscilla Ding, Ryan Lunn, Emily Wu

322 *Reese Curtis*
Mentors: Andrew Flachs

323 *Soumalya Das*
Mentors: Alessandro Selvitella

324 ‡ *Erika Denker, Hunter Velasquez*
Mentors: Erik Otarola-Castillo, Trevor Keevil, Melissa Torquato

325 *Alicia Denton, Alton Holstine*
Mentors: Kara Stewart

326 *Alyssa Easton*
Mentors: Zahra Tehrani

327 ‡ *Peyton Edelbrock*
Mentors: Ian Lindsay

328 *Zachary Ellis, Brian Colananni*
Mentors: Mark Johnson, Mustafa Ali

329 *Jacob Eyster*
Mentors: Zahra Tehrani

330 *Joshua Fechtman*
Mentors: Vetria Byrd

331 *Daniella Ferrante, Emily Gonzalez, Marco Rivero, Melanie Sperrazza, Stella Yao*
Mentors: Spencer Headworth, David McElhattan

332 *Abigail Fisher*
Mentors: Aaron Thompson

333 *Sophia Flores, Alexis Proudman*
Mentors: Elizabeth Flaherty, Stacy Lindshield

334 *Aedan Frazier, Rufat Imanov, Dhruv Gupta, Mitch Arndt*
Mentors: Mark Johnson, Sarang Pramod, Cole Nelson

335 *Aedan Frazier, Dhruv Gupta, Rufat Imanov*
Mentors: Mark Johnson, Sarang Pramod, Cole Nelson, Mitch Arndt

336 ‡ *Summer Funkhouser, Dakota Brandenburg, Kelly Haddow*
Mentors: Yumary Ruiz, Carlyn Kimiecik, Natalia Rodriguez, Jason Ware

337 *Kylee Gall*
Mentors: Lisa Hilliard

338 *Andrea Garcia Duran, Matthew Spinazze, Trevor King*
Mentors: Aaron Gin

339 *Alyssa George, Lukas Dolidze, Kevin Ryu*
Mentors: Seema Mattoo, Ali Camara

340 *Mason Giacchetti, Mitchel Craven, Sean Flanary*
Mentors: AJ Wildridge, Andreas Jung

341 *Michael Goldberg, Andy Ding, Frances O'Leary*
Mentors: Caroline Blanchard

342 *Abigail Hamilton*
Mentors: Brandon Keehn

343 *Cassidy Hardin*
Mentors: Mackenzie Chapman, Andrew Mesecar

344 *Sarah Hauser*
Mentors: Zahara Tehrani

345 *Hailey Hedrick*
Mentors: Kara Stewart

346 *Amanda Herbert*
Mentors: Patrick Zollner, Marian Wahl, Landon Jones, Grant Burcham

347 *Brandon Herr*
Mentors: Jonathan Delph

348 *Belle Hinshaw*
Mentors: Ellen Wells, Kenneth Burnell, Johnathan Klicker-Wiechmann

349 *Danny Hristov*
Mentors: Hugo Samayoa-Oviedo, Julia Laskin

350 *Xinzhu Huang*
Mentors: Chelsea Davis

351 *Avery Hurst*
Mentors: Qin Xu

352 ‡ *Aidan Jennewein, Christine Mayo*
Mentors: Alina Alexeenko, Andrew Strongrich, Jennifer Gray

353 *Zoe Johnson, Nadia Crace*
Mentors: Jennifer Smith, Jasmine Begeske

354 *Shannon Kang, Nathan Miller,*
Kaitlyn Petratos, Madeline Yang
Mentors: Swati Srivastava

355 *Isheeta Khurana*
Mentors: Alfred López

356 *Jaden King*
Mentors: Michael Mickelbart

357 *Sam King*
Mentors: Emily Dykhuizen, Surbhi Sood

358 *Carley Knosp*
Mentors: Stephen Hooser

359 *Sydney Kohn*
Mentors: Brooke Max

360 *Jamie Lam, Gabriel Alminauskas,*
Alexander Fink
Mentors: Lucas Cohen

361 *Seoyoung Lee, Chun Lee, Sohan Zaveri,*
Heath Lovell, Aditya Agrawal, Louis Liu,
Sunwoo Park, Sudhanva Donakonda,
Laula Huang
Mentors: Aly El Gamal, Shreya Ghosh

362 *Elizabeth Lenart*
Mentors: Yumary Ruiz, Carlyn Kimiecik

363 *Jiaxiang Li*
Mentors: Vetria Byrd

364 *Erica Long*
Mentors: Eunice Centeno, Johnnie Cheng,
Timothy Johnson

365 *Xavier Lopez*
Mentors: Stephen Elliott

366 *Alexis Lowe*
Mentors: Caitlin Proctor

367 *Isaac Martinez, Max Lee, Akshay Godhani,*
Dan Spillane, Jasper Hochbaum, Ian Quan
Mentors: Shreya Ghosh

368 *Kelly Mathis, Faith Anthony, Allison Eisenhut*
Mentors: Lisa Hamrick, Bridgette Kelleher

369 *Maxwell Michalec*
Mentors: Sarang Pramod

370 ‡ *Elise Miller*
Mentors: Marguerite O'Haire, Leanne Nieforth-Bomkamp

371 *Stephanie Moga*
Mentors: Giulia Murbach De Oliveira,
David Thompson

372 *Margaret Morse, Zachary Cody*
Mentors: Aaron Thompson, Paul Siciliano

373 *Vishaak Narayan, Alex Marks, Shaan Luthra,*
Adrien Dubois, Anish Bhowmik, Guna Avula,
Aarohi Panzade, Jasper Koliba,
Aakanksha Shripal
Mentors: David Purpura

374 *Noelle Naughton*
Mentors: Mark Hall, Andrew DeMarco

375 *Conrad Otterbacher*
Mentors: Maria Olivero-Acosta, Yang Yang

376 *Mili Patel*
Mentors: Carolyn McCormick, Veronika
Peskova, Bridgette Kelleher

377 *Jackson Pechin*
Mentors: Sa Liu, Jung Hyun Lee, Marwan
Alajlouni, Thomas Wallace

378 *Nicholas Pecoraro, Anthony Bovenshen*
Mentors: Jae Park

379 *Nicole Perry, Jack Dorman*
Mentors: Catherine Searle, Giovanna Carpi,
Ilinca Ciubotariu

380 *Pattiya Pibulchinda*
Mentors: Eduardo Barocio

381 *Holly Pickett*
Mentors: Lisa Hilliard

382 *Hannah Pike*
Mentors: Peter Bermel, Allen Garner, Charles
Grey

383 *Dhanyasree Prem Sankar, Kevin Kang*
Mentors: Aly El Gamal, Shreya Ghosh

384 *Madeline Prospero*
Mentors: Yumary Ruiz, Zoe Taylor, Lucrecia
Mena Melendez

385 *Alexis Proudman, Sophia Flores*
Mentors: Elizabeth Flaherty, Stacy Lindshield

386 *Qingzhuo Qi*
Mentors: Keith Cherkauer, Bilal Abughali

387 *Alekya Raghavan*
Mentors: Dorothy Teegarden, Chaylen Andolino, Emily Hicks

388 *Shyam Ravichandran, Ryan Rushing*
Mentors: Abraham Koshy, Andreas Jung

389 ‡ *Katie Reich, Sage Thompson, Hannah Williams*
Mentors: Yumary Ruiz, Carly Kimiecik, Natalia Rodriguez

390 ‡ *Becca Reinecke, Dylan Huntoon, Katie Kneeland, Sikang Sun, Jon Tierney, William Whitsitt, Elliot Wong*
Mentors: Katherine Fowee Gasaway, Alina Alexeenko, Anthony Cofer

391 *Becca Reinecke, Brendan Klaas, Mark Kosmerl, Ishaan Rao, Samuel Smith*
Mentors: Katherine Fowee Gasaway, Alina Alexeenko, Anthony Cofer

392 *Emma Rekeweg, Karina Paone*
Mentors: Jason Harris, Shraddha Rane

393 *Caleb Remocaldo, Cameron Chevrier, Kyler Harrison, Eric Klueppelberg*
Mentors: Amanda Baxter, Rafael Lang

394 *Jaden Retter*
Mentors: Mindy Mallory

395 *Kathleen Reyna*
Mentors: Zahra Tehrani

396 *Grace Reynolds, Josie Bryant*
Mentors: Peristera Paschou, Apostolia Topaloudi

397 *Jacob Roach*
Mentors: Mark Ward

398 *Joseph Robinson*
Mentors: Gouri Prabhakar, Daniel Cziczo

399 *James Rooney*
Mentors: Tony Hazbun, Panyue Chen

400 *Carlos Rubin de Celis*
Mentors: Peristera Paschou, Pritesh Jain

401 *Diego Ruiz-Avila*
Mentors: Zhong-Yin Zhang, Frederick Nguele Meke

402 *Charlie Sale, Efe Barlas*
Mentors: Jamie Davis

403 *Kelly Sammons*
Mentors: Michael Mickelbart, Santiago Franco Lopez

404 *Katie Schmucker*
Mentors: Brad Kim, Derico Setyabrata

405 *Jack Schwartz*
Mentors: Kedric Milholland, Mark Hall

406 *Robert Sego, Santiago Guada, Preethi Goli, Rahul Ashok, Theodore Tsai*
Mentors: Carla Zoltowski, Edward Delp

407 *Nisha Sen-Gupta*
Mentors: Sydney Trask, Susan Sangha

408 *Leo Seo, Leng Lohanakakul, Rajeev Sashti, Jake Heimlich, Vishal Urs*
Mentors: Chih-Chun Wang, James Krogmeier, David Love

409 *Akul Seshadri, Ethan O'Banion*
Mentors: Kendra Erk, Ria Corder, Caitlin Adams

410 *Peyton Shafer*
Mentors: Kari Clase, Lauren Novak

411 ‡ *Xiaxin Shen, Corbin Newhard*
Mentors: Smriti Bhatt, Miad Faezipour

412 *Lauren Skadberg*
Mentors: Lisa Hilliard

413 *Kennedy Skipper*
Mentors: Arielle Borovsky

414 *Thomas St. Pere*
Mentors: Zahra Tehrani

415 *Jake Strachan*
Mentors: Thomas Redick

416 *Madeleine Strom*
Mentors: Aaron Bowman, Anke Tukker

417 *Anna Strong, Julia Suter*
Mentors: Carolyn McCormick, Bridgette Kelleher, Amy Schwichtenberg, Wei Siong Neo

418 ‡ *Drake Tackett, Roy Su*
Mentors: Garam Kim, Timothy Ropp

419 *Meghan Thai*
Mentors: Andrew Fix, David Warsinger, Hamid Fattahi Juybari, James Braun

420 *Eric Thompson*
Mentors: Tianyi Li, Chengcheng Tao, Tanmay Surve

421 *David Tilley*
Mentors: Garam Kim

422 *David Tilley*
Mentors: Garam Kim

423 ‡ *Hoang Tran, Anshul Kulkarni, Jessica Budde, Xilai Dai, Aaradhya Jajoo, Sohan Pramanik, Abhiram Saridena*
Mentors: Goufan Shao, Keith Woeste, Song Zhang

424 *Minh Tran, Matthew Kraynik, Raymond Ngo, Christopher Priebe, Chase Lacoursiere, Tomas Kolar, Chris Morrison*
Mentors: Christopher Chiminski, Mark Johnson, David Meyhew, Matthew Swabey

425 *Austin Trebley*
Mentors: Keith Stantz

426 *Alicia Trujillo*
Mentors: Theresa Casey, Kelsey Teeple

427 *Darin Tsai, Aloysius Rebeiro, Alan Zhang*
Mentors: Daniel Mejia, Gerhard Klimeck

428 *Jacob Valdez, Evan Rittner, Joseph Kawiecki*
Mentors: Katherine Fowee Gasaway, Steven Pugia, Alina Alexeenko, Anthony Cofer

429 *Kyle VandeWalle*
Mentors: Zahra Tehrani

430 ♦ *Brittney Vetter*
Mentors: Ellen Wells

431 *Lauren Voss*
Mentors: Elliot Friedman, Elizabeth Teas

432 *Ethan Wakal*
Mentors: Vetria Byrd

433 *Andrew Wanstall*
Mentors: Marty Frisbee

434 *Alexandra Ware*
Mentors: Ghazaleh Ashrafi

435 *Hannah Welp*
Mentors: Tauqeerunnisa Syeda, Jason Cannon

436 *Logan Williams, Daniela Alvarez, Samuel Spence*
Mentors: Kari Clase, Abigail Ekeigwe, Lauren Novak, Taylor Sorrell

437 *Mitchell Witt, Miranda Chai, Aidan Anastario, Hanna Ertel, Jack Knox, Jay Kee, Kaushik Karthik*
Mentors: Nan Kong, Nicole Adams

438 *Elliot Wong*
Mentors: Peter Bermel, Allen Garner

439 *Ming Yuan Adrian Wong, Ivan Yang, Gabriel Skowronek, Ricardo Xie*
Mentors: Abraham Koshy, Andreas Jung

440 *Courtney Woodruff*
Mentors: Kimberly Kinzig

441 *Zhengxiang Xie*
Mentors: Peter Bermel

442 *David Yi, Lunden Friberg*
Mentors: Aaron Bowman, Hyunjin Kim

VIRTUAL POSTER PRESENTATIONS | WATCH ON THE CONFERENCE WEBSITE

500 *Adhil Akbar, Rohan Joshi, Adam Piaseczny, Jingyuan Liu, Aarini Panzade, Jiarui Xie*
Mentors: Carla Zoltwoski, Edward Delp

501 *Fahad Aloufi, Alice Dragnea, Abigail Roy*
Mentors: Lucas Cohen, Andrew Weiner

502 *Lauren Anderson*
Mentors: Uma Aryal, Rodrigo Mohallem

503 *Brianna Arinze, Arya Shembekar, Rajesh Balasamy*
Mentors: Kari Clase

504 *Mae Artang, Dale Morris*
Mentors: Sarah Huber, Thom Gerrish, Tom St. Pere

505 *Maansi Asthana*
Mentors: Zahra Tehrani

506 *Jason Barahona Rosales, Lily Kabat, Rebecca Mold*
Mentors: Kari Clase, Taylor Sorrell

507 *Jennifer Beckman*
Mentors: Ramizah Mohd Sabri, Qing Deng

508 *Ranjan Behl, Leonard Jung, Sundhar Sangeetha*
Mentors: James Goppert, Riley Franklin, Arpit Amin

509 *Nicolas Berlier, Bazim Azeem, Joshua Koshy, Caitlin Heinowitz, Mason Burgess*
Mentors: Aly El Gamal, Shreya Ghosh

510 ♦ *Jaden Beveridge, Bora Kaya, Wesam Sidani, Dalton Webber, Chris Pontious*
Mentors: Prabhpreet Dhir

511 *Arka Bhattacharya, Rhutuja Patil, Joshua Grams*
Mentors: Lauren Novak

512 *Caitlin Birthright, Alyssa Klipsch, Halle Von Ah*
Mentors: Lauren Novak, Taylor Sorrell, Abigail Ekeigwe, Yemi Oduniyi

513 *Caitlin Birthright, Amanda Pawlecki, Benjamin Dierolf*
Mentors: Sarah Huber, Thomas Gerrish

514 *Maya Bjerke, Zilin Xianyu, Alessandro Paz Hernandez*
Mentors: Lauren Novak, Abigail Ekeigwe, Taylor Sorrell, Yemi Oduniyi

515 *Alec Booth*
Mentors: Laura Gonzalez, Krishna Jayant

516 *Grace Bowling*
Mentors: Ian Lindsay

517 *Josie Bryant, Grace Reynolds*
Mentors: Peristera Paschou, Apostolia Topaloudi

518 *John Bullock, Pume Tuchinda, Karsten Hilgarth, Anthony Pei, Aryan Jain*
Mentors: Carla Zoltowski, Edward Delp

519 *Mason Burgess, Harsh Ranawat, Wenhui Yang, Siddharth Singh, Joseph Huang, Tanon Chokkhanchitchai*
Mentors: Edward Delp, Carla Zoltowski

520 *Bethany Buro*
Mentors: Peter Bermel, Allen Garner, Charles Grey

521 *Aneesh Chakravarthula, Brooklynn Cox, Neha Priyadarshini, Cecilia Jiang*
Mentors: Aravind Machiry, Akhil Guntur, Daniyaal Rasheed

522 ‡ *Sarah Coon*
Mentors: Michele Buzon, Michele Buzon, Daniel Cooperman, Randal Loder, Kristin Yu, Raghav Badrinath, William McLaughlin

523 *Herbert Alexander de Bruyn*
Mentors: Song Zhang

524 ‡ *Asher Denny*
Mentors: Melissa Roberson

525 *James Derloshon, Crystal Jiang, Mallory Motz*
Mentors: Kari Clase, Lauren Novak, Yemi Oduniyi, Abigail Ekeigwe

526 *Mehul Dhillon, Austin Jewett, Tyler Cole, Alice Dinh*
Mentors: Prabhpreet Dhir

527 *Brittany Drevalas, Mezna Alhabshi, Luke Mercer*
Mentors: Lauren Novak

528 *Nicole Dubish*
Mentors: Zahra Tehrani

529 *Alyssa Easton*
Mentors: Hana Hall

530 *Samuel Elkin, Matthew Waldren, YaLing Tsai*
Mentors: Mark Johnson, Sutton Hathorn

531 *Seth Feickert*
Mentors: Nichole Ramirez

532 *Aidan Fisher, Oliver Krefta, Adam Zurek*
Mentors: Mark Johnson, Cole Nelson

533 *Rishikesh Gadre, Hasnain Daudi, Erik Zabalegui Lopez, Eddie Kon, Evgeniia Vorozhbit*
Mentors: Alina Alexeenko, Petr Kazarin

534 *Neyven Garal*
Mentors: Cordelia Running, Lissa Davis

535 *Akanksha Garg, Lorraine Zaumu, Sherman Moser, Dhirodaatto Sarkar, Brian Dodd, Trevor Owens*
Mentors: Daniel Froid, Cynthia Wan

536 *Evan Gold*
Mentors: Jason Ware

537 *Connor Hall, Celine Maduwuba, Ben Kaplan, Alison Fung*
Mentors: Emily Staub, Thom Gerrish, Sarah Huber

538 *Jongkyu Hwang, Hansoo Kim, Samantha Dreussi*
Mentors: Mark C Johnson, Raghuraman Kottaiyur

539 *Ishmam Iqbal*
Mentors: Mark Johnson, Sutton Hathorn

540 *Brad Jeon, Joseph Freck*
Mentors: Aly El Gamal, Shreya Ghosh

541 *Byeongchan Jeong, Youngjoo Moon, Juhyung Kim, Aaron Fritz*
Mentors: Xiaokang Qiu

542 *Adhiksit Kalra, Jerry Wang, Matthew Rines, Natalie Keefer, Niharika Narra, Nikita Ravi*
Mentors: Preet Dhir, Nichole Ramirez, Carla Zoltowski

543 *Scott Kenning*
Mentors: Andrew Weiner, Luke Cohen

544 *Mansoorah Kermani*
Mentors: Lindsay Weinberg

545 *Jagan Krishnasamy, Victor Le*
Mentors: Cole Nelson

546 *Ethan Labianca-Campbell, Rachel Koeiman, Aaron Boes, David Sixon, Erica Long, Philip Voronin, Suryatej Bhamidipati*
Mentors: Daniel Froid, Max Hellrun

547 *Iris Layadi*
Mentors: Denny Yu, Jing Yang, Jingkun Wang

548 ‡ *Marjorie Leblanc*
Mentors: Maggie O'Haire, Leanne Nieforth-Bomkamp

549 *Kenny Lee, Avery Dorsch, Kayla Hinton*
Mentors: Kari Clase, Yemi Oduniyi, Abigail Ekeigwe, Lauren Novak

550 *Eugene Lee, Sitong Chen, Kevin Davis*
Mentors: Denny Yu, Jingkun Wang

551 *Sangin Lee*
Mentors: Vetria Byrd

552 *Anna Lehman*
Mentors: Carlos Perez-Torres, Whitney Perez

553 *Alexis Lowe, Hannah Slabach, Morgan Gyger*
Mentors: Kari Clase, Taylor Sorrell, Allison Ayers

554 *Caio Mansur*
Mentors: Vetria Byrd

555 *Emily Martin*
Mentors: Catherine Searle, Spencer Siddons, Paradyse Blackwood

556 *Madeline Mills*
Mentors: Zoltan Nagy, Wei-Lee Wu

557 *Kathryn Moran, Charlotte Moss, Umar Mian, Austin Lu*
Mentors: Thomas Gerrish, Sarah Huber, Patrick Petersen

558 *Evelyn Nonamaker, Aditi Lohar, Hannah Reinbrecht*
Mentors: Kari Clase

559 *Myung Sun Park, Minjun Song*
Mentors: Mark Johnson, Sutton Hathorn, John Peterson

560 *Sophia Patel, Haley Sidorowicz*
Mentors: Andrea DeMaria, Nicole Noel

561 *Isaac Pricher, Evan Spellman, Andres Rojas Salazar, Nicky Gianchandani, Vijayeendra Ravindra, Drake Hagerman*
Mentors: Nichole Ramirez, Carla Zoltowski, Prabhpreet Dhir

562 *Caroline Puch*
Mentors: Aaron Bowman, Xueqi Tang

563 *Bailey Pyle*
Mentors: Dennis Minchella, Trevor Vannatta, Grace Schumacher

564 *Diana Quintero Bisono, Isabelle Adnson*
Mentors: Stacy Lindshield, Papa Ibnou Ndiaye

565 ‡ *Jack Reynolds*
Mentors: Danny Milisavljevic

566 ‡ *Samuel Richman, Sonya Kraft, Pavit Hooda, Frank Qiao*
Mentors: Mario Perez-Ahuatl

567 *Shye Robinson*
Mentors: Marcus Mann

568 *Gabrielle Rump*
Mentors: Sharleen Flowers,
Stephanie Gardner

569 *Saaniya Rupani*
Mentors: Kari Clase, Taylor Sorrell,
Garret Manquen

570 *Vishrant Saagar, Mason Burgess,
Ching Chia Huang*
Mentors: James Ogg, Aaron Ault

571 *Kian Schifferdecker, Nishka Awasthi,
Zhaoqi Wang*
Mentors: Thomas Gerrish, Sarah Huber

572 *Rishi Shah*
Mentors: Gerald DeHondt

573 *Elena Shen, Christine Zhou, Ya-Fei Lin*
Mentors: Matthew Lanham

574 *Jagroop Singh, Sebastian Wojcik, Alicia Zeh*
Mentors: Kari Clase, Taylor Sorrell,
Lauren Novak

575 *Shantanu Sinha*
Mentors: Davide Ziviani, Amin Maghareh,
Jaewon Park, Mahindra Rautela

576 *Lisette Skiba*
Mentors: R. Claudio Aguilar, Jennifer Lee

577 *Britney Smitley, Bram Rasmussen,
Anjana Narayanan*
Mentors: Kari Clase

578 *Nanditha Srinivasan*
Mentors: Fabrício d'Almeida

579 *Maya Steinhart*
Mentors: Mandy Rispoli

580 *Albert Sun, Grant Goldenberg*
Mentors: Mark Johnson, Cole Nelson

581 *Abigail Taylor*
Mentors: Spencer Headworth

582 *Tania Pliego Torres*
Mentors: Christine Kiracofe

583 *Arianna Uribe-Melchor*
Mentors: Kranthi Varala, Rajeev Ranjan

584 ‡ *Mia Utayde*
Mentors: Jason Cannon, Daniel Foti,
Shreesh Sammi

585 *Aletea vanVeldhuisen*
Mentors: Craig Goergen, Daniel Gramling,
Xinzeng Feng, Michael Sacks

586 *Stephen Verhoff, Milo Anderson,
Ian Ophaug-Johansen*
Mentors: Kari Clase, Taylor Sorrell,
Allison Ayers

587 *Erin Walker*
Mentors: Elizabeth Mercier

588 *Hyeonwoo Wang*
Mentors: Alex Ma

589 ♦ *Brandon Watson*
Mentors: Tara Grillos

590 ♦ *Elise Winn*
Mentors: David Nelson

591 *Taylor Wolt, Iman Mevaa, Bailey Czerkiewicz*
Mentors: Kari Clase, Lauren Novak

592 *Songhao Wu, Allison Mou*
Mentors: David Warsinger, James Braun,
Andrew Fix

593 *Sara York, Hunter Smith, Ari Atlas*
Mentors: Kari Clase, Lauren Novak

594 *Timothy Zhou, Benjamin Loshe, Joseph
Attardo, Kaiwen Shen, Ryan Boyd, Shiqi Wang*
Mentors: Mithuna Thottethodi

595 *George Ziavras, Tristan Brideweser,
Benjamin O'Brien, Shriansh Chari*
Mentors: Daniel Froid

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Honors College

De novo design a binder protein for SARS-CoV-2 RBD through the online game Foldit

Author(s):

SeArre Abebe, College of Science

Abstract:

SARS-CoV 2 is the virus that causes COVID-19, which infects human cells by binding its spike protein's receptor binding domain (RBD) to the human angiotensin converting enzyme 2 receptor (ACE2). Natural proteins, such as antibodies, can block RBD-ACE2 interaction but cannot be sprayed intranasally to treat early-infection due to their large size. Therefore synthetically designed small proteins that can block the ACE2 interaction, known as binder proteins, are currently being researched. Here, a novel small binder protein against the spike protein's RBD was designed using the online game Foldit. De novo design is difficult for researchers since current computer algorithms, like Rosetta, do not guarantee an accurate prediction of a protein's native conformation. Foldit however, provides a potential solution to this issue by incorporating human problem solving with Rosetta through a fun, interactive game designed for anyone to play. The proposed binder protein uses a three-helix bundle from the ACE2 receptor and incorporates hydrophobic packing at the RBD-binder protein interface. The designed binder protein is ninety two amino acids long, and has a Rosetta energy score of 13550.939, which is above the target score of 13000. This indicates a presence of stable interactions between spike protein RBD and our designed binder protein.

Mentor(s):

Zahra Tehrani, Honors College

Poster Presentation Abstract Number: 101 :: Social Sciences/Humanities/Education

College of Veterinary Medicine

Analyzing demographics of veterans with PTSD seeking a service dog

Author(s):

Shivangi Agarwal, College of Engineering

Elise Miller, College of Science

Abstract:

The purpose of this study was to analyze and understand the demographics of veterans who are seeking a service dog for PTSD.

A longitudinal clinical trial was conducted to quantify the therapeutic effects of service dogs on veterans with PTSD. The trial consisted of 2 groups: the service dog group who received their service dog during a 3-month study period, and the control group who received their service dog after that study period.

The data for this study was collected through baseline surveys to record the participants' demographics.

The total sample had an average age of 37.81 years, ranging between 19 to 67 years at baseline. The study surveyed 74% male and 26% female veterans. 68% of the participants were either married or were living with a significant other. Furthermore, 60% of the participants had one or more pets. All participants had at least some high school education, with 35% of them having some college education. With only 34% of the participants being employed, 42% of the unemployed participants were unable to work due to health or disability reasons. In order to participate in the study, participants had to be diagnosed with Posttraumatic Stress Disorder (100%). Participants also reported having panic attacks (93%), Major Depressive Disorder (31%), Anxiety Disorder (83%), Traumatic Brain Injury (89%), and Military Sexual Trauma (28%).

The data from this study provide a picture of the sociodemographic data of individuals seeking PTSD service dogs.

Mentor(s):

Marguerite O'Haire, Comparative Pathobiology, College of Veterinary Medicine

Leanne Nieforth, Purdue University

Clare Jensen, Purdue University

Sarah Leighton, Purdue University

Poster Presentation Abstract Number: 102 :: Life Sciences

College of Health and Human Sciences

Mood Symptoms in Welders Exposed to Manganese

Author(s):

Khunsha Ahmed, College of Health & Human Sciences

Abstract:

Manganese (Mn) is an essential trace element that is prevalent throughout the body. However, chronic occupational Mn exposure can cause psychiatric deficits with mood symptoms being reported as one of the earliest symptoms. This study investigated whether Mn exposure in welders is associated with mood changes and assessed the impact of any confounding variables. 40 welders and 25 control subjects were recruited from a local manufacturer. Personal air sampling and a work history questionnaire were used to collect data about their Mn exposure. A self-administered questionnaire called the Brief Symptom Inventory (BSI) was given to each subject to assess mood changes. The number of clinically significant subjects was determined by comparing the t-scores to normative values which were adult nonpatient males for this study. It was found that 52.5% of welders and 40% of controls had clinically significant mood symptoms. The subdomain interpersonal sensitivity was significantly associated with Mn exposure for the past three months (rho=0.356, p=0.024) and the past year in welders only (rho=0.320, p=0.044), while the subdomain somatization was significantly associated with Mn exposure for the past year in welders only (rho-0.330, p=0.037). Since controls also showed a high prevalence of mood symptoms, years of smoking and the number of alcoholic drinks consumed per week were tested as possible covariates. However, neither variable showed any correlation with either the Mn exposure variables or the mood symptom variables.

Mentor(s):

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

Roslyn Harold, Purdue University

Humberto Monsivais, Purdue University

Daniel Foti, Purdue University

Honors College

Designing a High-Affinity Binder Protein Against SARS-CoV-2 with the Game Foldit

Author(s):

Olohitare Dorinda Ahonsi, College of Health & Human Sciences

Abstract:

Understanding how SARS-CoV-2 infects human cells provides insight for potential therapeutic approaches. SARS-CoV-2 enters human cells through the binding of its surface protein to the human angiotensin-converting enzyme 2 (hACE2) receptor. To stop the interaction between the spike protein's receptor binding domain (RBD) and the hACE2, a binder protein with greater affinity to RBD than hACE2 can be utilized. A binder protein is a great method of inhibiting early infection as it directly targets the entry mechanism of SARS-CoV-2. Small synthetic proteins are an attractive option as opposed to natural proteins because they can be designed with higher stability and binding site densities. This project embarks on designing a high affinity binder protein that competes with hACE2 to bind to the SARS-CoV-2 RBD using the game; Foldit. A challenge to designing de novo proteins is the difficulty in predicting protein stability and the best route and substitution methods to increase binding affinity. Foldit is an online game for citizen scientists to design and fold new protein structures. Foldit, provides a better solution for protein design prediction compared to computational methods alone, such as Rosetta, as it allows for human rationalization and risky or unfavorable tactics to obtain the best protein structure. Here, a novel protein structure is presented with an energy score of 12108.229. The protein contains 1 loop, 4 beta sheets, and 2 helix secondary structures with 42 residues. The RBD-binder interface includes aspartate, glutamine, lysine, serine, and tyrosine residues. This novel structure is designed through Foldit against Sars-CoV-2.

Mentor(s):

Zahra Tehrani, Honors College

College of Engineering

VIP FEMTA Freeze Dryer Test

Author(s):

Olukunle Akinleye, College of Engineering

Gouri Bellad, College of Engineering

Hersh Thapar, College of Engineering

Abstract:

The Film Evaporation MEMS Tunable Array (FEMTA) is an experimental small satellite attitude control microthruster that evaporates liquid water to generate thrust. The vapor pressure driven pump has been designed to be the propellant management system for FEMTA. The FEMTA suborbital flight experiment is a payload for testing that propellant management system aboard Blue Origin's New Shepard vehicle in 2023. Environmental testing at relevant temperatures and pressures was required as part of the integration and testing of the system. One method employed was thermal vacuum testing with Purdue LyoHub's REVO RV85 freeze dryer with a Residual Gas Analyzer (RGA) to investigate outgassing properties of the Engineering Test Unit. Pressure and atomic mass unit data from two tests show an anomaly in expected behavior that indicates an air bubble or other trapped gas release from the hardware. To further investigate this anomaly, the testing procedure has been updated to remove the fill screw on the propellant tank and measure the pressure of its flexible diaphragm, which separates the propellant and propellant tank. This will lead to determining if the spike is due to diaphragm expansion in the thermal vacuum. The updated test will also be used to observe potential leaks in the experiment tubing system by running hard water throughout the system and observing any other variations of outgassing elements on the RGA.

Mentor(s):

Katherine Fowee Gasaway, Aeronautics & Astronautics, College of Engineering

Steven Pugia, Purdue University

Alina Alexeenko, Purdue University

Anthony Cofer, Purdue University

Poster Presentation Abstract Number: 105 :: Life Sciences

<div align="center">

College of Health and Human Sciences

Parentally Exposed Zebrafish Larvae Have Altered Craniofacial Measurements

</div>

Author(s):

Isabelle Akoro, College of Health & Human Sciences

Abstract:

Atrazine is a herbicide used throughout the Midwest US to prevent broadleaf weeds in crops. The US EPA has set the maximum contaminant level at 3 ppb (µg/L) in drinking water. Atrazine (ATZ) is an endocrine disrupter interfering with the function of hormones and disrupting normal physiology and homeostasis throughout development and the life course of an organism. The zebrafish model was used to test the hypothesis that an embryonic parental ATZ exposure will cause modifications in morphology in developing offspring. AB adult zebrafish were bred. Their embryos were collected and exposed to ATZ concentrations of 0 ppb, 0.3 ppb, 3 ppb, or 30 ppb from 1-72 hours post fertilization (hpf; the end of embryogenesis). ATZ exposure was ceased at 72 hpf and larvae were grown into adulthood in aquaria water (ATZ F0). ATZ F0 adult zebrafish were then bred within their treatment group, their embryos were collected, and placed in petri dishes in aquaria water until 120 hpf. At 120 hpf, larvae were collected for morphological analysis including general morphology measurements and co-staining with alcian blue and alizarin red for cartilage and skeletal assessments. Head length and ratio of head length to total length was significantly increased in the F1 of 0.3 and 30 ppb ATZ groups ($p<0.05$). Additional craniofacial morphology was completed with a decreased distance for cartilaginous structures, decreased surface area and distance between saccular otoliths, and a more posteriorly positioned notochord ($p< 0.05$). The posteriorly positioned notochord indicates delayed ossification and skeletal growth. These findings signify that a single embryonic parental exposure leads to changes in craniofacial development in their offspring.

Mentor(s):

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

Janiel Ahkin Chin Tai, Purdue University

Sydney Stradtman, Purdue University

College of Science

The Relationship Between Single- and Few-Electron Backgrounds and Liquid Xenon Purity in XENONnT

Author(s):

William Alford, College of Science

Jessie Lanzer, College of Science

Sagnik Ballabh, College of Science

Aniruddha Upreti, College of Science

Abstract:

XENONnT is an experiment designed to detect weakly interacting massive particles (WIMPs), hypothetical particles which may make up dark matter. It consists of a dual phase time projection chamber (TPC) filled with a purified liquid xenon scintillator, and is used to search for an excess of events over the known background. Currently, xenon dual-phase TPCs show a low-energy background that is not fully understood. After high energy events in the detector, this background manifests as single- and few-electron ionization signals. In this work we explore the relationship between this background and the purity of xenon in the TPC described by the electron lifetime. Improving our understanding of this background can help us characterize the backgrounds in XENONnT and will allow for mitigation in future TPCs.

Mentor(s):

Juehang Qin, Physics & Astronomy, College of Science

Rafael Lang, Purdue University

Purdue Polytechnic Institute

Investigation on Barriers to Lean Manufacturing Implementation

Author(s):

Keita Arakawa, Polytechnic Institute

Abstract:

Lean manufacturing focuses on minimizing waste while simultaneously increasing company value. Many barriers exist which prevent effective implementation of the lean methodology, including ineffective management, poor company culture, lack of incentives, limited employee training, and inefficient technology. Indiana is a major manufacturing region within the United States which makes the location a prime location for research. There is no current literature in this field in this area. This research aims to summarize findings from an Indiana-specific lean survey (sample size = 126), quantifying the influence of barriers on organizational decision-making towards implementation. The survey required participants to rank-order to what extent barriers prevent lean implementation. It specifically questions the barriers regarding financials and employees. Secondary data was also used to block companies to revenue generated and quantity of employees. The data analysis utilizes the Kruskal-Wallis test to compare ranked values according to the blocked demographics. The test shows that larger companies (≥20 employees) are more affected by a culture barrier in implementing lean manufacturing than smaller companies (≤20 employees). The test also shows that smaller firms have a larger financial barrier of technology compared to larger firms. The paper concludes by providing recommendations for overcoming lean implementation barriers and areas of future research.

Mentor(s):

Lisa Bosman, Technology, Leadership, & Innovation, Polytechnic Institute

College of Agriculture

Gene X, a putative phloem-specific gene is involved in responses to phosphate deficiency in Arabidopsis

Author(s):

Samantha Barker, College of Agriculture

Abstract:

Phosphorus is an essential macronutrient that plays a pivotal role in plant growth and development. However, inorganic phosphate (Pi) deficiency is one of the most limiting factors for crop productivity. When plants experience Pi deficient soil conditions, a series of adaptive responses and alterations happen, including enhanced expression of Pi transporter, prohibition of primary root, and induction of lateral root length, density and root hair. More specifically, the root architecture in response to Pi deficient soil becomes more branched with the development of axial roots in order to seek out Pi rich soil. The regulation of root system architecture has been claimed to be controlled by local signals generated in roots. In addition to local signaling, systemic signaling has also been found to be involve in Pi deficiency responses. A method called TRAP (translating ribosome affinity purification) was used to profile responsive genes in phloem under Pi deficiency, and a few new genes have been identified. In order to characterize the function of one of the new genes in Pi deficiency responses, some experiments have been done, including overexpression of this gene in Arabidopsis, hydroponic experiment to determine phenotype and Pi concentrations in overexpression plants, localization of this gene by GUS staining, and mutation of this gene by CRISPR method. This study is still in progress, and more results will be obtained.

Mentor(s):

Cankui Zhang, Agronomy, College of Agriculture

Jing Huang, Purdue University

College of Engineering

Studying Nurse Decision Making in COVID-19 Patient Care

Author(s):

Kalei Bass, College of Engineering

Abstract:

Nurse decision making for patient care situations is a complex process involving a variety of deciding factors in a typically stressful environment. Understanding how nurses make decisions will ultimately allow researchers to pinpoint areas where technology can improve training for nursing students and reduce the nurses' overall cognitive workload in the field. This project focuses on identifying what nurses visually attend to during clinical simulations to understand nurse decision making. Following institutional review board approval, a convenience sample of experienced nurses were recruited to participate in simulated patient care situations. These situations involved two male patients of different ages with Covid-like symptoms, the older of whom was in more critical condition. The nurses were tasked with assessing the patients and deciding the diagnosis of the more critical patient. A task analysis was conducted for each of seven recordings of nurses participating in the simulation to identify commonly performed behaviors. The most common events across all seven nurses included checking vitals, visiting the most critical patient first, and ordering labs. The elements identified in this analysis were critical to selecting the areas of interest (AOIs) for the eye-tracking analysis on the same seven videos based on the frequent fixation points between and during the common events. Though it is still in progress, the results gathered from this analysis will further the team's development of nursing student training methodology in the alternate reality (AR) checklist studies and hopefully serve as a cognitive aid to enhance decision making in simulations in the future.

Mentor(s):

Nicholas Anton, Industrial Engineering, College of Engineering

Denny Yu, Purdue University

College of Health and Human Sciences

Implications of FOXP3 and DLL1 in anti-angiogenic research

Author(s):

Molly Beatty, College of Health & Human Sciences

Nicole Stepp, College of Health & Human Sciences

Lucas Bottini, College of Health & Human Sciences

Abstract:

Due to recent research on angiogenic mechanics, restriction of blood vessel growth has emerged as a possible target of anti-tumor research. However, while purely removing the vasculature from the altered area may shrink the tumor in size, we question if overall survival will improve when analyzing effects on a cellular level. In an attempt to learn more about immunologic implications of inhibiting angiogenesis, our lab's objective is to understand the effects of certain anti-angiogenic drugs in relationship to two biological markers, DLL1 and FOXP3, in breast cancer. Through microscopic imaging and a subsequent computer analysis process, clusters of respective biomarker were counted after a uniform threshold was established. In response to a control (IgGA), an inhibitor of VEGF (which promotes neoangiogenesis), an inhibitor of Ang2 (which supports blood vessel maturation), and a combined therapy of DC101 + Ang2 inhibitor, FOXP3 peaked when treated with anti-VEGF and shared a commonality in the combined therapy group with DLL1 as lower expression was observed. Tumors stained for DLL1 expressed peak amounts of positive clusters when treated with anti-Ang2. While the expected optimal treatment was the combined drug affect but neither DLL1 or FOXP3 seemed to be associated with significant change in expression when treated with both anti-VEGF and anti-Ang2, our study proposes that inhibiting both the formation and maturation of blood vessels does not garner the most favorable result in either case, but instead, single anti-VEGF and anti-Ang2 therapies can be expected to elicit more significant immune responses (in FOXP3 and DLL1 respectively).

Mentor(s):

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

College of Engineering

In silico cytometry of Crohn's disease transcriptomics reveals novel cell-type-specific disease biology

Author(s):

Alexander Bergendorf, College of Engineering

Abstract:

The emergence of single-cell RNA sequencing (scRNAseq) technologies has allowed researchers to gain valuable insights into cell-type-specific disease biology. These technologies have not been widely adopted in large clinical studies due to their expensive costs and the time-intensive nature of processing their data. These issues have been addressed in part by the development of analytical tools such as CIBERSORTx to transfer information found from smaller scale scRNAseq datasets to large datasets where bulk gene expression is measured in pooled cell types. However, there is still a need to manipulate scRNAseq data for use with these tools.

Here, we develop a workflow to perform QC, assign cell types, and create a single-cell reference file from scRNAseq datasets for use with CIBERSORTx. From the algorithm created, CIBERSORTx can further be used to compare the cell-type proportions and cell-type-specific expression profiles of bulk gene expression data. We identified several inflammatory cell types with increased abundance in more aggressive stricturing Crohn's disease as well as marker genes associated with aggressive gene phenotypes. The results from the developed workflow provide valuable insights into the development of treatment pathways for different types of Crohn's disease and can be applied to other diseases.

Mentor(s):

Douglas Brubaker, Biomedical Engineering, College of Engineering

Javier Munoz, Purdue University

Mahmoud Rahal, Indiana University

Matthew Bohm, Indiana University

College of Engineering

Automatic Process Synthesis for Olefin Production from Shale Gas

Author(s):

Arsh Bhatia, College of Engineering

Abstract:

Shale gas is rich in natural gas liquid and is a good source for olefin production which is used in manufacturing plastic, rubber etc. The current shale gas manufacturing processes use sequences of energy and cost intensive reactions and separations, and lead to flaring of waste. Recently, developments by Chen et al. [1][2], relying on researchers and practitioners' engineering intuition, have shown that other process sequence alternatives can be more efficient. This method may lead to suboptimal process configurations. In this study we investigate the automation of process synthesis procedure using mathematical programming to identify new flowsheets for a small-scale liquid production plant from natural gas liquid in shale gas consisting of a dehydrogenation reactor and an oligomerization reactor. The algorithm, written in MATLAB, creates a reaction-separation network which can enumerate all the configurations of possible flowsheets. Our current work has shown us that there are 58 configurations possible for this case. Work needs to be done to consider recycle streams to be able to identify new and unique flowsheets.

References

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[2]   Z. Chen, Y. Li, W. P. Oladipupo, E. A. Rodriguez Gil, G. Sawyer, and R. Agrawal, "Alternative ordering of process hierarchy for more efficient and cost-effective valorization of shale resources," Cell Reports Phys. Sci., p. 100581, 2021, doi: 10.1016/j.xcrp.2021.100581.

Mentor(s):

Rakesh Agrawal, Chemical Engineering, College of Engineering

Zewei Chen, Purdue University, Chemical Engineering

Poster Presentation Abstract Number: 113 :: Life Sciences

College of Health and Human Sciences

Inhalation Toxicology in Male and Female Mice Following Cured-in-Place Pipe-Related Emissions Exposure

Author(s):

Katelyn Biggs, College of Health & Human Sciences

Abstract:

There is a decline in infrastructure, specifically in underground water pipes. The repair methods include cured-in-place pipe (CIPP) where uncured resin is polymerized using a steam-based method. The visible emissions produced create concern due to evidence of negative short-term health effects and minimal information regarding emission characterization. This research study investigates if CIPP-related emissions and toxicity are dependent on resin material: styrene or non-styrene resin. By understanding this factor, the potential public health impacts of the CIPP procedure can be reduced. This study exposed male and female mice to styrene, non-styrene, and control resins and necropsied after 1-day and 7-days post-exposure, collecting bronchoalveolar lavage fluid (BALF) and lung tissue. RT real-time-PCR measured gene expression of inflammatory markers, followed by an evaluation of protein expression level. IL6 identifies present pathogens. IL6 emission data indicated significant inflammation in male and female mice 1-day post-exposure with a recovery 7-days post-exposure. CXCL2 marks immune response and showed significant differences between the resin groups in male and female mice 1-day post-exposure. 7-day post-exposure females indicated a recovery while males did not show a recovery. The protein expression levels were consistent with the IL6 and CXCL2 gene expression data. In conclusion, CIPP emission exposures expressed evidence of lung damage inflammation, and toxicity which was influenced by differences in the resin material as well as sex and time post-exposure. This preliminary data demonstrates emissions produced during CIPP installations can result in pulmonary toxicity which is modifiable due to alterations in CIPP procedures such as resin material selection.

Mentor(s):

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

Li Xia, Purdue University

College of Science

Vibration of ASTERiX Dark Matter TPC and Observations of Liquid Xenon Purity Following Paused Recirculation

Author(s):

Amelia Binau, College of Science

Caden Glenn, College of Science

Ben Hartings, College of Science

Justina Riffell, College of Science

Abstract:

The Purdue University Dark Matters Lab, run by Dr. Rafael Lang of Purdue Physics and Astronomy, harbors a liquid xenon dark matter time projection chamber (TPC) modeled after the XENON collaboration's detector (XENON1T, XENONnT) housed at Gran Sasso National Laboratory in Italy. Our recent investigation of anomalous electron-training events during vibration of the TPC using a massage gun and transducer has yielded intriguing results illuminating the complex particle interactions inside the tank, as well as the mechanics of the detector itself. Furthermore, the team recently paused recirculation/purification of the liquid xenon within the tank, yet continued to take data. We found that despite the lack of external purification, the lifetime of signals from electron recoil events suggest the xenon purity has not much changed. We suspect this is due to having the tank's liquid xenon evacuated during the COVID-19 pandemic. The TPC was placed under a vacuum that caused the tank's internal Teflon lining to outgas most of its impurities that would normally contaminate the liquid xenon. This discovery, if affirmed by continued analyses, could be communicated to the XENON collaboration for implementation in future noble gas dark matter detectors.

Mentor(s):

Rafael Lang, Physics & Astronomy, College of Science

Amanda Depoian, Purdue University

College of Agriculture

Identifying oxidized cysteine residues on proteins in Drosophila melanogaster

Author(s):

Hannah Blum, College of Agriculture

Abstract:

Oxidative stress, which is caused by an imbalance of reactive oxygen species (ROS) is thought to play a role in aging and disease. These ROS are one of the major reasons for the oxidation of proteins, acting as both inducers of oxidative damage and mediators of aging. ROS act through the oxidation of cysteine residues. To identify proteins with cysteine oxidation a redox proteomics method, stable isotope cysteine labeling with iodoacetamide (IAM) (SICyLIA), was used. Before using this approach, concentration of the oxidizing species (H_2O_2) and treatment time that are most effective for demonstrating the effects of oxidative stress had to be determined. The effects of varying concentrations of H_2O_2 on Drosophila melanogaster S2 cell count, viability, and intracellular metabolite ratios for NAD+, NADP+ and GSH were analyzed. Here, we show that 20 mM H_2O_2, which showed signs of cellular arrest and a decrease in viability, and a 15-minute treatment time are appropriate conditions for observing the effects of oxidative stress in Drosophila S2 cells. Using SICyLIA, 332 peptides were identified that were oxidized on cysteine residues. Further studies performed using a TMTsixplex approach identified 6,060 peptides corresponding to 2,084 proteins, and 127 proteins were found to be significantly oxidized after normalization. Future studies will further analyze the effects of oxidative stress on cysteine residues in Drosophila to better characterize the redox proteome.

Mentor(s):

Vikki Weake, Biochemistry, College of Agriculture

Sarah Stanhope, Purdue University

Poster Presentation Abstract Number: 116 :: Life Sciences

College of Engineering

Spatial Variability of Carbon Quality, Denitrification, and Methanogenesis in Agricultural Wetlands

Author(s):

Jackson Brady, College of Engineering

Abstract:

Wetlands amplify transformations of excess nitrogen which is deleterious to aquatic ecosystems. Wetlands also produce the greenhouse gases nitrous oxide and methane. Wetland restoration and creation should balance water quality enhancement and climate impacts, however, water quality varies spatially and temporally in wetlands and understanding the environmental drivers of wetland processes is critical to restoration success. The objective of this research is to understand how nutrient concentrations and carbon quality change through wetlands to better control the tradeoff between water quality and greenhouse gas release. Samples were collected from overlying water in 3 wetlands at Purdue Wildlife Area and Agronomy Center for Research Education to investigate the spatial variability of carbon quality, denitrification, and methanogenesis. We analyzed water samples for organic matter quality and dissolved gases (namely dinitrogen and methane). We characterized the quality of organic carbon using simultaneous measurement of absorbance, transmission, and florescence excitation and emission (A-TEEM) on Horiba Aqualog. Dissolved gasses were characterized through gas chromatography and Membrane Inlet Mass Spectroscopy (MIMS). While data analysis is ongoing, we expect to see that denitrification happens at greater rates near areas with periodic flooding, methanogenesis in areas of continuous inundation, and carbon quality to be significantly different across areas of differing water depth. Promoting denitrification and mitigating greenhouse gas release are essential for making wetlands a viable option to process nitrogen pollution. Understanding the impact of carbon quality and hydrology on soil will allow wetland restoration design and placement of restoration projects to be better optimized.

Mentor(s):

Sara McMillan, Agricultural & Biological Engineering, College of Agriculture

Jacob Hosen, Purdue University

Meghan Ciupak, Purdue University

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

College of Science

Accuracy of Polls in U.S. Elections

Author(s):

Ryan Branstetter, College of Science

Manas Paranjape, College of Science

Abstract:

Elections are the lifeblood of democracies and forecasting them is an important problem in politics. We aim to improve previous mathematical models for forecasting U.S. elections by better understanding polling data. However, the data involved with forecasting elections is often complex and challenging to interpret. Different pollsters provide data in different formats which adds further difficulty and necessitates data cleaning. Another major issue with the data is that the historical accuracy of every pollster is not equal. Working with polls for gubernatorial, senatorial, and presidential elections from 2004 up until 2020, we are developing a method to categorize these pollsters based on their accuracy in past elections. To do this, we investigated a list of over 500 pollsters and analyzed the average errors that each pollster made in previous elections. As 2022 midterm polls become available, we will use the profiles that we are building for each polling organization to improve mathematical models for election forecasting.

Mentor(s):

Alexandria Volkening, Mathematics, College of Science

Purdue Polytechnic Institute

Digital Literacy Skills in Construction Trades Training

Author(s):

Luke Buscemi, Polytechnic Institute

Abstract:

The goal of this exploratory study was to gain a better understanding of how construction trades training programs within the state of Indiana implement digital literacy skills in their curricula. This study was conducted by utilizing a survey-based approach sent to each training body, which answered various questions regarding demographics, types of technology being implemented within each program, and factors that hinder their ability to adopt and incorporate new technologies into the program. Responses to the survey highlighted the lack of hands-on application to emerging technologies being discussed within the program. Moreover, respondents listed 'slightly effective' as to how effective the training is to educate students on emerging technologies in construction. Similarly, student perception of usefulness related to learning emerging technologies was only 'slightly useful'. Training programs should look to provide more information (and hands-on interaction) on the types of emerging technologies within the construction industry in their programs to better equip their students with a better understanding of these technologies before entering the workforce.

Mentor(s):

Luciana Debs, Construction Management Technology, Polytechnic Institute

College of Engineering

Structural, Phylogenetic, and Mutational Analysis of a Penicillin-binding Protein in Novel Phage PhiRho

Author(s):

Reagan Bushok, College of Engineering

Logan Cook, College of Engineering

Fi Goode, College of Engineering

Abby Simpson, College of Science

Abstract:

Mycobacteriophage are viruses that infect Mycobacterium, a bacterial genus which includes the causative agent of tuberculosis. These phages may be used to treat antibiotic resistant bacterial infections. Novel phage PhiRho is a lytic mycobacteriophage whose genome is currently undergoing annotation. PhiRho gene 176 is a d-ala-d-ala carboxypeptidase, also known as penicillin-binding protein (PBP). PBPs are involved in synthesis of the bacterial cell wall and are the target of the antibiotic penicillin. The utility of a PBP to phage was of interest, so PhiRho 176 was selected for further analysis using protein structural prediction, mutational analysis, and phylogenetic methods. Protein structure was predicted using Phyre2, confirming structural similarity to archeal and bacterial PBPs. Phylogenetic analysis using phyML, MEGA, and SplitsTree demonstrated conservation across many phage clusters. Mutational analysis using Python located specific mutations within the DNA sequence of Gene 176. PhiRho gene 176 showed very high similarity to genes in other phages, indicating gene 176's structure and function are being maintained due to strong selection pressure. Together, these results imply that PhiRho 176 and PBPs play an important role in the survival and fitness of phage. Future treatment of bacterial infections may include mixtures of phage and antibiotics, so the effect of penicillin on the PBPs of mycobacteriophage represent an important area of future research. In order to use phage for medical applications, a more complete understanding of phage gene function is required in order to maximize treatment efficacy while minimizing unwanted effects.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Taylor Sorrell, Purdue

Honors College

Designing Stable Binder Protein for Inhibition of SARS-CoV-2 using Foldit Software

Author(s):

Leonard Cahya, College of Engineering

Abstract:

In December of 2019, the emergence of COVID-19 caused by the SARS-CoV-2 virus marked the beginning of a global pandemic. The SARS-CoV-2 virus infected millions of people; the virus enters human cells through the binding of its spike protein's RBD with the human ACE2 receptor. To prevent cell entry of the virus, binder proteins that strongly interact with the RBD have shown promise as a therapeutic strategy of competing with ACE2 binding. De novo binder proteins have shown an advantage compared to monoclonal antibodies because of their smaller size and larger range of possibilities of design. To better understand the design elements of a binder protein with a stronger affinity for the RBD receptors, I used Foldit to design a novel binder protein. Foldit is an online puzzle game that engages players to challenge protein prediction problems. The current design consists of 93 amino acid residues with three main alpha-helices comprised of 32, 27, 21 residues respectively. Each of these alpha-helices is separated by a 2-3 amino acid residue loop. At the outer surfaces of the structure are residues such as glutamate and lysine which are hydrophilic in nature and buries hydrophobic residues like phenylalanine in the center of the structure. The current energy score is 13438 which achieves the target stability score of greater than 13000. While developing de novo proteins is challenging because of the vast number of possible conformations, Foldit allows users to combine human creativity with computer algorithms to explore these designs more easily.

Mentor(s):

Zahra Tehrani, Honors College

College of Agriculture

Grassy Creek Corridor Framework Plan

Author(s):

Shangzhe Cai, College of Agriculture

Abstract:

The research project seeks to develop a framework plan for the Grassy Creek Corridor, an expansion of Grassy Creek Regional Park in the suburban area of Indianapolis. The study area consists of mostly cropland and the Grassy Creek. The overarching community goals are to recover the ecological system, provide recreational and educational opportunities, and establish community connections. The specific research question is: How to identify locations to develop ecological restoration, recreation areas, and educational facilities to achieve the goals?

Using spatial analysis methods in ArcGIS, the research is completed using a two-step procedure. The first step evaluates the Grassy Creek Corridor area using social system data, including race and ethnicity distribution, public school enrollment, household income level, educational attainment, and crime index. The evaluation helps determine spots to intervene and increase accessibility to parks for communities in need. The second step analyzes natural system data, including data of hydrology, land cover, current land use, soil types, and tree canopy cover. The result is used to identify potential locations for ecological restoration, agricultural use, recreation area, educational opportunities, and green infrastructures.

Layering maps with social and ecological data in ArcGIS produces a parcel-based overlay within the Grassy Creek Corridor. With the information, four parcels are identified as the potential locations for development, and a framework plan is developed. Based on the framework plan, the next step is to develop a site design and estimate the project outcomes.

Mentor(s):

Aaron Thompson, Horticulture & Landscape Architecture, College of Agriculture

College of Health and Human Sciences

Expression of Copper Chaperone for Cytochrome C Oxidase (COX17) in the Blood-CSF Barrier in the Choroid Plexus: Impact of Lead Exposure and Brain Copper Homeostasis

Author(s):

Vincent Calhoun, College of Health & Human Sciences

Abstract:

Copper (Cu) is an essential metal to brain health. Regulation of Cu homeostasis in the cerebrospinal fluid (CSF) takes place mainly in the blood-CSF barrier in the choroid plexus (CP). Cu chaperones are part of the Cu-transporting proteins responsible for the delivery of Cu ions to intracellular compartments. Notably, cytochrome c oxidase copper chaperone (COX17) is a critical Cu chaperone that delivers Cu to mitochondria for synthesis of cytochrome c oxidase. However, the questions as to whether this specific Cu chaperone is present in the CP and how environmental exposure to lead (Pb), which accumulates in the CP upon overexposure, may interact with COX17 to cause Cu dyshomeostasis remained unanswered. This study was designed to test the hypothesis that COX17 expressed in the CP and Pb exposure altered its expression in the CP, leading to distorted Cu levels in the CSF. We used the immunohistochemical (IHC) approach on mouse brain slices to approve and characterize the expression of COX17 in the CP tissue. In addition, we used an immortalized choroidal epithelial Z310 cell line to investigate how Pb exposure changed COX17 expression by using immunofluorescence (IF) analysis. Our IHC data on mouse brain slices clearly demonstrated an abundant expression of COX17 in CP tissues. Compared to adjacent brain regions by quantifying fluorescent intensity, our data revealed that the expression of COX17 was 70.3% , 52.3%, and 68.3% higher in the CP than those expressed in striatum, subventricular zone, and prefrontal cortex, respectively (p < 0.0001, n=4). In cultured Z310 cells treated with Pb in culture media for 24 hrs, our immunofluorescent data revealed that Pb treatment caused a dose-dependent increase in the expression of COX17, i.e., 79.9%, 112.8%, and 155.6% increases, as compared to the controls, by Pb exposure at 2.5 µM, 5.0 µM, and 10.0 µM, respectively (p < 0.0001, n=10). These observations demonstrate that COX17 is highly expressed in the choroid plexus, a critical tissue in regulating Cu transport between the blood and the CSF. Moreover, our data reveal that Pb exposure is capable of altering the expression of COX17, which may lead to brain Cu dyshomeostasis in numerous neurodegenerative diseases. Further investigations are in progress to understand the mechanism by which Pb alters COX17 and the consequences of Pb-COX17 interaction in the context of Pb-induced neurotoxicity.

Mentor(s):

Wei Zheng, Health Sciences, College of Health & Human Sciences

Luqing Liu, Purdue University

College of Science

Assessing How Data Broker Reporting Can Affect Modeling of Astrophysical Transients

Author(s):

Robin Carpenter, College of Science

Michael Agrillo, College of Science

Conor Costello, College of Engineering

Erin Smith, College of Science

Manny Gil, College of Science

Jack Reynolds, College of Science

Abstract:

The Zwicky Transient Facility (ZTF) surveys the night sky multiple times a night to alert on astrophysical transient events. At 1 million alerts per night, it is less than 10% of what the upcoming Vera C. Rubin Observatory (LSST) will be streaming, which will usher in a new era for sky surveys. Raw alerts from these observatories are ingested by data brokers that filter by quality cuts and add contextual information so that users downstream may efficiently follow up on discoveries with complementary multiwavelength and multi-messenger observations. The primary ZTF brokers include ALeRCE, Antares, MARS, and FINK. Our project seeks to assess the reliability of these brokers, and determine whether differences in data broker reporting may affect follow-up decisions and the ability to estimate physical parameters with theoretical models. We analyzed a sample of 500 transients and found that brokers are discrepant in their reports. In some cases, significant data loss with the potential to skew conclusions is observed. The broker ALeRCE was most reliable with only 11 missed points in the sample. FINK, however, is the least reliable, missing 715 alerts and dropping 13145 due to quality cuts. Addressing the origins of these discrepancies will be critical for astronomers acting on LSST discoveries. Future plans for this work will investigate the scientific impact of the unreported information via the use of a random selection of Type Ia supernovae modeled using MOSFIT, a package that fits and estimates transient parameters.

Mentor(s):

Danny Milisavljevic, Physics & Astronomy, College of Science

College of Pharmacy

The impact of tau isoforms on pathological tau aggregation formation

Author(s):

Raul Castro, College of Science

Abstract:

A key characteristic of Alzheimer's disease (AD) is the presence of protein aggregates consisting of hyperphosphorylated tau isoforms in the post-mortem brains of AD patients. These aggregates, known as neurofibrillary tangles, have been highlighted in previous research as the product of pathological tau species, but the process by which these tangles spread from neuron to neuron across brain regions is not fully understood. This research project focuses on isolating pathological species made of different tau isoforms and characterizing these species in terms of their relative efficiency of cell-to-cell transmission. The methodology includes utilizing an E. coli bacterial expression system to produce different tau protein isoforms, converting the monomeric protein to amyloid-like fibrils, and assessing the fibrils' pathological activity in an HEK-tau biosensor cell line that is widely used to assess the propagation ability of tau seeds. The expectations of the study are to (i) understand the aggregation propensity of different tau isoforms in a cell-free system, and the efficiencies of propagation of tau pathology in cellular models; and (ii) establish a foundation for medical therapies targeting pathological tau in neurodegenerative diseases.

Mentor(s):

Chris Rochet, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Sehong Min, Purdue University

Purdue Polytechnic Institute

INSERR: A Novel Search and Rescue ROV Design for Flooded Indoor Environments

Author(s):

Pou Hei Chan, College of Engineering

Pou Ut Chan,

Wai Teng Sin,

Chon Weng Lei,

Abstract:

With the ever-increasing flood risk due to urbanization, low spots in indoor environments such as basements and underground garages can turn into death traps [1]. Search and rescue efforts often struggle to locate persons at risk within the critical time due to the hazardous environment or lack of manpower. This research introduces a novel remotely operated vehicle (ROV) system, called Indoor Navigating Survivor Emergency Response ROV (INSERR), to address these problems. INSERR is designed with a compact form factor to fit through common choke points such as doors and windows. 6 thrusters with 6 degree-of-freedom allow for precise maneuver for submerged navigation through such entryways. A scanning imaging sonar enables the pilot to locate submerged doorways or other entryways even in murky waters as floods often are zero-visibility waters. Lidar scans above the water surface in any air pockets. Cameras and audio systems allow for a line of communication once a victim has been located. The onboard payload bay can provide first-aid or other survival supplies. This research proposes the ROV as a comprehensive package for search and rescue for quick response, enhanced identification, and provides means of life support during a flood emergency.

Mentor(s):

Byung-Cheol Min, Computer Information, Polytechnic Institute

College of Engineering

Modeling Energy Efficiency of Solar Thermal Powered Batch Reverse Osmosis

Author(s):

Lahiri Chitturi, College of Engineering

Abstract:

Batch reverse osmosis is the most energy efficient water desalination method and when powered by renewable energy, suggests promise for a cost-effective, low-carbon solution. One abundant energy source on Earth is solar energy which can be implemented using solar panels which have an established maximum efficiency of 25%, or solar thermal engines which can outperform solar photovoltaic systems by achieving higher efficiencies between 20% and 40% according to market research. Here, an approach to model and quantify the energy efficiency of a direct-drive solar thermal powered batch reverse osmosis system is presented to indicate the feasibility of pursuing this technology. One contribution of the modeling work presented is the inclusion of system dynamics since batch reverse osmosis is a transient process. The pressure needed to drive the reverse osmosis system dictates the required torque output of the solar thermal engine, affecting energy flows to the high-pressure pump and the circulation pump. The hydraulic devices consume the most energy in the batch reverse osmosis process and are therefore the most critical for energy efficiency modeling. The energy input from the sun and the efficiency of conversion by the solar thermal engine into mechanical work are also considered. Currently, from experimental work, the batch reverse osmosis process consumes about 2 kW/m3 water produced. This process is the first thermally driven batch reverse osmosis process and could potentially be the most efficient thermally driven desalination process overall with high impact especially in regions near the equator where solar resources are prevalent.

Mentor(s):

David Warsinger, Mechanical Engineering, College of Engineering

Antonio Puentes, Purdue University

Akshay Rao, Purdue University

Abhimanyu Das, Purdue University

College of Agriculture

East Arm Little Calumet River Master Plan

Author(s):

Nicholas Cook, College of Agriculture

Abstract:

Opportunities are abundant for implementing green infrastructure solutions that will help mitigate the long-term effects of climate change and water levels rising in the Lake Michigan watershed of Northwest Indiana. This project focuses on the areas around Burns Harbor, Indiana Dunes National Park, and the East Arm Little Calumet River due to extensive risks associated with changing hydrological conditions. These ecologically sensitive areas, especially around the periphery of Burns Harbor, are at most risk due to ecological vulnerability and risk of erosion. The research methods used to guide this project include site inventory and analysis, evaluation models assessing social and ecological conditions in ArcGIS, and community input. To successfully function as a greenway the East Arm Little Calumet River Blueway system would need to incorporate different points of access, between the Indiana Dunes Heron Rookery and the connection to the Portage Lakeshore and Riverwalk. Methods to assess both proposed and modifying existing locations, opportunities for sub-areas along the River and small, pilot projects along the 10-mile stretch include the use of GIS data to take inventory of wetlands, slope, hydrology, habitat corridors, green infrastructure suitability, and land cover uses to determine the best location for an integrated master planning effort. Community analysis of population, neighborhoods and economic centers was included to determine where community members would benefit most from new trail connections, kayak launches, and access to public green spaces.

Mentor(s):

Aaron Thompson, Horticulture & Landscape Architecture, College of Agriculture

Megan Hedges, Purdue University

College of Science

Spin transport in disordered two-dimensional topological insulators

Author(s):

Justin Copenhaver, College of Science

Abstract:

The spin-polarized edge states of two-dimensional topological insulators (2D TIs) provide a direct mechanism for charge-to-spin conversion relevant for spintronics research. The spin conductance of these states is quantized in the presence of scalar perturbations that do not break the time-reversal and spin-rotational symmetries. Perturbations which break these symmetries, meanwhile, are expected to cause a deviation from the pristine-limit quantization. For this project, we introduce a low-energy effective model describing the edges of a 2D TI and analytically predict the effects of scalar and symmetry-breaking perturbations on the spin transport, identifying a key role played by spin torque in an out-of-equilibrium edge. We then utilize a tight-binding model of topological monolayer WTe_2 and scattering matrix formalism to numerically study spin transport in a four-terminal 2D TI device. In particular, we find the spin Hall conductance corresponding to edges in local equilibrium is surprisingly robust to symmetry-breaking perturbations.

Mentor(s):

Jukka Vayrynen, Physics & Astronomy, College of Science

Honors College

Designing a mini binder protein to SARS-CoV-2 spike protein using Foldit

Author(s):

Amanda Coy, College of Health & Human Sciences

Abstract:

SARS-CoV-2 infects human cells through the binding of its spike protein to the human angiotensin converting enzyme-2 (ACE-2) receptor. By designing a novel protein that can bind to the receptor binding domain (RBD) of the spike protein, it may be possible to treat early COVID-19 infection by blocking RBD-ACE2 interaction. Mini binders will be more effective than current antibody treatments because their small size and high stability makes them appropriate for nasal application and nebulization, providing a stronger immune response. Thus, what is the lowest energy conformation of a potential binder protein that can bind to the spike protein tighter than ACE-2? One challenge of this research is that there are an exponential number of possible ways of designing a protein backbone for a particular target, and there are millions of conformations a single polypeptide chain could possess. Current automated computational methods, such as Rosetta, do not have the capability to solve these design challenges alone. However, the online game Foldit provides a platform for combining human spatial skills and the Rosetta energy function for building new protein structures, contributing to accelerated drug discovery. Here, a novel binder protein design using foldit is presented. The proposed binder has an energy score of 13,075.953. It consists of 82 residues and 3 alpha helices interacting to form a hydrophobic core at one end of the protein. The helices are interacting with the RBD of Spike and each other, while additionally, each helice is separated by a loop. Clearly, complex thinking and Foldit's algorithm can be combined to create a favorable mini binder protein for SARS-CoV-2. My design provides possible candidates for future testing, and Foldit's creators are studying this design process of players to evaluate human-computer hybrid models for solving future scientific problems.

Mentor(s):

Zahra Tehrani, Honors College

College of Engineering

Investigating Selective Emitters for Thermophotovoltaic Conversion

Author(s):

Owen Crocker, College of Engineering

Abstract:

Emission-free renewable energy is a growing topic that has immense, but undiscovered, potential. However, as with most renewable energy sources, heat is frequently lost from the system, decreasing the overall efficiency. By recycling photons and utilizing this excess heat energy, thermophotovoltaics (TPVs) offer an intriguing approach to renewable energy, while opening a variety of opportunities for technological advancements. The primary complication of TPVs is the low efficiency of the system itself. The major component that affects the efficiency is the emitter, a semiconductor that preferentially emits in-band photons and suppresses out-of-band photons at varying wavelengths. These factors produce a desirable optical performance and are studied to prioritize efficiency. To evaluate the absorbance and transmission of photons in these structures, the Stanford Stratified Structure Solver (S4) is used. Because varying the material and geometry of an emitter significantly alters the absorption and transmission of photons at specified ranges of wavelengths, this tool is solely used to simulate the optical behaviors of emitters. A series of 1-D photonic crystals will be examined and compared to determine the ultimate favorability of said materials. Results are to be presented and future applications suggested, with the intention to further develop use of TPVs in day-to-day operations. With further advancements of TPV systems, emission-free renewable energy is a much more attainable goal for the future.

Mentor(s):

Peter Bermel, Electrical & Computer Engineering, College of Engineering

Jie Zhu, Purdue University

College of Health and Human Sciences

Impact of Adolescent Social Isolation on Adult, Binge-Like Ethanol Consumption and Plasma Corticosterone in High-Alcohol-Preferring Mice

Author(s):

Eva Cullins, College of Health & Human Sciences

Abstract:

Adolescent stress exposure increases the likelihood of alcohol misuse and Alcohol Use Disorder (AUD) in adulthood; however, it is not clear how genetic and environmental factors interact to increase risk. This study examined how adolescent social isolation affects adult binge-like ethanol drinking and levels of the stress hormone, corticosterone, in male and female mice with a genetic predisposition toward high alcohol preference (HAP). 28 HAP mice were separated into group-housed (GH) and socially-isolated (SI) conditions (n = 13, 13). Binge drinking was assessed using a drinking-in-the-dark (DID) procedure, which promotes high levels of alcohol consumption during the dark cycle when nocturnal rodents consume most of their fluids. Blood samples were taken before DID and after the 4th (last) day of DID. Intake across the 4 days indicated that SI males drank more than GH males during the first hour of the consumption period. There was no significant effect of housing or sex for the second hour across days. On the 4th day, when mice were given access to alcohol for an additional 2 hours, both SI males and females consumed more than GH males and females during the last 2 hours of the 4-hour period. Analysis of plasma corticosterone samples are ongoing. These findings demonstrate that adolescent social isolation promotes binge-like drinking in both male and female adult mice with a genetic predisposition for high alcohol preference; however, this relationship is time-dependent, and males may be more sensitive than females to social isolation stress.

Mentor(s):

Julia Chester, Psychological Sciences, College of Health & Human Sciences

Arbaaz Mukadam, Purdue University

Soyol Enkh-Amgalan, Purdue University

College of Health and Human Sciences

Parkinson's Disease Risk and Occupation - A review of recent literature

Author(s):

Perry Curtis, College of Health & Human Sciences

Abstract:

Redacted.

Mentor(s):

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

College of Science

Assessing the Effect of Bd Reservoir Species on the Geographic Range and Climatic Niche of Robber Frogs in Costa Rica

Author(s):

Jasmina Davis, College of Science

Abstract:

One of the deadliest pathogens for amphibians is the fungus Batrachochytrium dendrobatidis (Bd). However, some amphibian species are highly tolerant to Bd infection and able to carry and transmit Bd to other species (i.e., Bd-reservoir species), potentially driving susceptible populations to extinction. Here, I aimed to examine how Bd-reservoir species affect the distribution of susceptible species in Costa Rica. I hypothesized that the spread of two Bd-reservoir species caused the contraction of the geographic range and climatic niche of two species of robber frogs across their historical range. For this, I quantified 1) the current disease prevalence and infection intensity in amphibian communities across the historical distribution of both robber frog species and 2) the historical prevalence by sampling Bd on museum specimens collected between 1960-2018. I also compared shedding rate in Bd-reservoir and non-reservoir species and quantified Bd in water samples from both streams where robber species declined and streams where they persist. My preliminary findings suggest that amphibian communities where robber frogs went extinct are dominated by Bd-reservoir species and exhibit higher prevalence than communities where robber frogs persist. The results of this study can be used to propose conservation actions for endangered species.

Mentor(s):

Hector Zumbado-Ulate, Graduate Student, Purdue University

Catherine Searle, Purdue University

Poster Presentation Abstract Number: 134 :: Social Sciences/Humanities/Education

<div align="center">

College of Health and Human Sciences

Secure Base Relationships Across Two Cultures

</div>

Author(s):

Shreya Desai, College of Science

Abstract:

The quality of child-mother attachment relationships is hypothesized to play a key role in development. Research conducted with infants indicates that the quality of those relationships is linked to cognitive, academic, and social competence outcomes. Less is known about child-mother attachment during the preschool years. Attachment is hypothesized as common to all children (Bowlby, 1982). Yet, research on different cultures is scant and its generalizability to other cultural groups is contested.

I studied child-mother attachment relationships during preschool years in samples from US and Colombia; specifically, whether the quality of maternal caregiving (secure-base support) is related to child security (attachment behavior), and whether that association exists across cultures. Secure-base support refers to the ability to provide a child with a "haven of safety," if needed (when upset or sick), and promote and assist a child when exploring their environment. Security refers to a child's trust in a caregiver's availability and response, inferred from the child's behavior when interacting with a caregiver.

The research design was cross-sectional and used observational methodology. Eighty-six US and 85 Colombian dyads were observed at home and playgrounds for 5 hours. Q-methodology was employed: the Maternal Behavior with Preschoolers Q-Set and Child Attachment Behavior Q-set. Results show that maternal secure-base support is significantly associated with children's secure-base behavior in both samples. Findings imply that the quality of caregiving during the preschool years plays an important role for attachment security outcomes. Findings support the notion that attachment relationships are common in different groups.

Mentor(s):

German Posada, Human Development & Family Studies, College of Health & Human Sciences

Geurim Kim, Purdue University

Muqing Liu, Purdue University

Poster Presentation Abstract Number: 135 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Biomedical Drone for Narcan Delivery

Author(s):

Brandon Dimitri,

Jeremy Frederick,

Nathan Arnold,

Aditya Kini,

Drew Lundin,

Saron Bhoopathy,

David Huang,

Matthew Murday, College of Engineering

Abstract:

Opioid overdose has rapidly evolved into a public health epidemic. Fortunately, Narcan is a drug that is capable of reversing the effects of an overdose. However, permanent brain damage may result in as little as 6 minutes after the overdose, so rapid delivery of Narcan is crucial to saving the lives of overdose victims. In rural communities, it is often difficult for EMS personnel to reach an overdose victim in this short time. With the advances in unmanned aerial vehicle (UAV) technology, aerial delivery of Narcan via drones is a solution with much promise to offer rapid response to overdoses. The goal of this project is twofold. First, to develop a drone capable of autonomously delivering Narcan and instructing bystanders to administer the treatment, and second, to evaluate the human response to drone delivery of Narcan.

The current state of the project has focused on the design and manufacturing of the prototype UAV. To enhance communication with the bystander to receive the Narcan at the site, a video screen has been added onto the UAV which will provide instructions for Narcan administration. Successful simulation and physical demonstration of vehicle flight while carrying the Narcan payload has been demonstrated over a short-range so far. To reach a greater range, the prototype will next be integrated into the 4G network. Achieving this level of connectivity will also enable live video streaming from a webcam onboard the vehicle which will allow a dispatcher and paramedics to monitor the progress of the UAV.

Mentor(s):

James Goppert, Aeronautics & Astronautics, College of Engineering

Nan Kong, Purdue University, College of Engineering

Nicole Adams, Purdue University, College of Nursing

Riley Franklin, Purdue University, College of Engineering

College of Agriculture

Identify behavioral differences given gene expression and splicing changes in the brain of adult Drosophila expressing honey bee MRJPs

Author(s):

Anna Donnelly, College of Agriculture

Abstract:

The ability to adapt behavioral responses to external or internal cues, referred to as behavioral plasticity, is a critical capability to the survival of social organisms. Honey bee workers transition between nursing and forager roles within the hive as they age. This transition is plastic: nurses can transition to foraging precociously and foragers can revert back to nursing. The proximate mechanisms underpinning this behavioral transition remain elusive. One class of protein, the major royal jelly proteins (MRJPs), have been implicated in leading to a 'nurse-like' brain state and help establish the behavioral differences between nursing and foraging honey bees. However, the role the MRJPs play in driving changes in behavior is largely unknown as there are few genetic tools available in the honey bee. The model organism Drosophila melanogaster has a wide variety of tools to investigate possible correlations between gene expression and behaviors. Many behavioral genes are highly conserved between the two species, allowing us to leverage the genetic tools in Drosophila to study the role of MRJPs in the honey bee. Using the GAL4/UAS system, MRJP2 was expressed in the mushroom bodies of Drosophila. Flies were then subjected to a phototaxis assay to investigate if MRJP2 plays any role in the phototaxis behaviors seen in nurse honey bees. During this assay, we would expect to find that 'nurse-like' flies would show a greater affinity for light during these experiments since their role in the hive is mostly done in the dark.

Mentor(s):

Brock Harpur, Entomology, College of Agriculture

Stephanie Hathaway, Purdue University

College of Health and Human Sciences

The association between the late-positive potential (LPP) and lifetime history of depression (MDD)

Author(s):

Luke Dubec, College of Health & Human Sciences

Emily Khoo, College of Health & Human Sciences

Abstract:

Late Positive Potential (LPP) is an ERP component which is characterized by engagement in motivationally salient stimuli. Decreased LPP amplitude has been frequently linked with Major Depressive Disorder (MDD). As a part of a broader study examining romantic relationships with EEG, 37 participants viewed a series of images that contained pleasant, unpleasant, and neutral stimuli to elicit the LPP. Drawing from prior research, it is hypothesized that the LPP will be blunted across stimuli for participants with lifetime MDD. The Structured Clinical Interview for DSM Disorders (SCID), a diagnostic interview, was used to assess lifetime MDD. Contrary to the hypothesis, the LPP was not significantly blunted in individuals with lifetime MDD compared to those without. However, results were in the expected direction, such that participants with lifetime MDD exhibited a reduced LPP across stimuli. Future research should further examine how current symptoms of MDD affect the LPP and potential carry over effects across blocks.

Mentor(s):

Daniel Foti, Psychological Sciences, College of Health & Human Sciences

Kim Galvez, Purdue University

Wei-Siong Neo, Purdue University

Purdue Polytechnic Institute

How Different Forms of Advertising Affect Product Reach

Author(s):

Sarah Dunn, Polytechnic Institute

Abstract:

The advancement of technology has introduced new ways to market goods to consumers, from radio commercials to targeted online ads. Marketing teams dedicate time, energy, and resources when trying to find the best way to market products. There is still more to explore when it comes to how different forms of advertising, such as social media, print ads, and commercials, can affect the success of a product. By analyzing different forms of marketing and how successful the advertised product is, while categorizing by age groups, this research aims to inform best practices for best advertising depending on the target audience. Data from various reports, such as the "2022 Marketing Statistics, Trends, and Data" report and "Most trusted advertising forms for purchasing decisions in the US", will be examined to assess what types of platforms are used when marketing products. Understanding the relationship between these different variables can help marketers find the best form of media to reach their target audience and help the overall success of their product. Excel and Tableau software will be used to organize and visualize the data. The results of this research will inform how various methods of advertising affect the reach of a product to different age groups.

Mentor(s):

Vetria Byrd, Computer Graphics Technology, Polytechnic Institute

College of Science

Electromagnetic-based System for High Yield Production of Magnetic Microrobots

Author(s):

Allison Earnhardt, College of Science

Abstract:

This project is attempting to find a high yield method of creating substrates of aligned magnetic material to use for tumbling microrobots. The better aligned the substrate, the more usable microrobots can be created. The problem with historical attempts is that only the center of the substrate would be properly aligned, which resulted in low yield rates; another previous method used expensive equipment to realign the magnetic material in the substrates after setting. This project will attempt to create Helmholtz coils which will create a uniform magnetic field over the entire substrate, creating uniform alignment and therefore a higher yield of functioning microrobots with less expense. This project will be creating its own Helmholtz coil design and a system which will apply them while creating substrates in order to align the magnetic field while the substrate material is setting. This is a method of creating substrates with aligned magnetic material to create microrobots which could both reduce waste/cost/time for creating functioning microrobots. The purpose of this project is to learn whether this new method of aligning the magnetic material will be more successful and less wasteful/higher yielding than the previous methods implemented. The adequacy of this system will be determined by the yield of the substrate, and will be tested for different field strengths and application lengths.

Mentor(s):

David Cappelleri, Mechanical Engineering, College of Engineering

Francis Robicheaux, Purdue University

Poster Presentation Abstract Number: 140 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Impact of temperature on the sustainability of cementitious composites containing bagasse biomass ash

Author(s):

Husam Elgaali, College of Engineering

Erika Micolta, College of Engineering

Abstract:

Redacted.

Mentor(s):

Mirian Velay-Lizancos, Civil Engineering, College of Engineering

Vito Francioso, Purdue University

College of Agriculture

Abundance of Mycoplasma bovis and Bovine Respiratory Disease

Author(s):

Audrey Ellis, College of Agriculture

Abstract:

A major economic problem for the beef and dairy cattle industry is Bovine Respiratory Disease (BRD). An estimated $800-900 million is lost every year due to the cattle death caused by BRD. The combination of multiple factors (predisposing, environmental and epidemiological) make an animal susceptible to BRD. The epidemiological factor consists mainly of four bacterial pathobionts, Pasteurella multocida, Mannheimia haemolytica, Histophilus somni, and Mycoplasma bovis, and have been associated with BRD mortalities. Currently, producers do not have an accurate and efficient test to diagnose an animal with BRD and rely on visual clinical signs . Therefore, the objective of this study is to quantify the abundance of Mycoplasma bovis in the nasal cavity from animals with BRD clinical signs compared to visually healthy animals. Nasal swabs were collected from four farms in the US including from Indiana, Texas, Colorado and Idaho. DNA was extracted from the nasal swabs to perform qPCR targeting Mycoplasma bovis. We will quantify the abundance of Mycoplasma bovis in each animal and then determine an abundance threshold of Mycoplasma bovis abundance that could be used for BRD identification.

Mentor(s):

Timothy Johnson, Animal Sciences, College of Agriculture

Junior Cheng, Purdue University

Eunice Centeno Martinez, Purdue University

College of Science

Short Chain Fatty Acids Regulate Cytotoxicity of EL4 mouse T-Cells

Author(s):

Jamie Emerson, College of Science

Abstract:

In normal settings, T-cell-derived granzymes enter target cells through pores that are created by another T-cell-derived effector protein called perforin. Interestingly, intestinal T-cells only produce granzymes and little to no perforin, suggesting that some gut-specific factor may suppress perforin expression, thereby limiting cytotoxicity in T-cells. Given the proximity of granzyme-producing T-cells to microbes in the intestines, we reasoned that microbe-derived factors may contribute to a limited capacity of perforin production. As short chain fatty acids (SCFAs) are at high ($\square$M) concentrations within the intestinal tract and have been previously shown to alter T-cell cytokine production, we hypothesized that they may also contribute to suppression of perforin by gut T-cells. Using an in vitro culture of an EL4 mouse T-cell line and a Jurkat human T-cell line, I treated cell samples with variable SCFAs (acetate, propionate, and butyrate) in increasing concentrations, measured their perforin production via flow cytometry, and measured their gene expression via real-time polymerase chain reaction (qPCR). I determined that propionate and butyrate transcriptionally suppress perforin mRNA (Pfr1) in EL4 mouse T-cells and that all three SCFAs suppressed perforin protein production in a dose-dependent manner. Mechanistically, I showed that SCFAs likely limit perforin expression by inhibiting histone deacetylase (HDAC) activity as known HDAC inhibitors mimicked the SCFA effect. No perforin was produced under any condition in the human Jurkat T cells. Further experimentation using in vivo mice experiments and alternate human T cell lines are needed to confirm these results in human biology. However, our data suggests that SCFAs may be applied therapeutically to reduce the cytotoxicity of pathologic T cells and may be used in a therapeutic capacity to limit inflammatory bowel disease.

Mentor(s):

Matthew Olson, Biological Sciences, College of Science

Sungtae Park, Purdue University

College of Agriculture

Thermodynamic studies of protein structural changes during cold extrusion

Author(s):

Sarah Ettestad, College of Engineering

Abstract:

Plant based meat alternatives have been a growing trend in the food industry, and pea protein is a popular choice due to its nutritional value and health benefits along with being widely available at low costs. A technique to change the pea protein's native structure and functionality is to induce protein unfolding through cold denaturation, a phenomenon that can be coupled with cold extrusion. In this work, the cold denaturation temperature of pea protein of various pH levels and salt concentrations were calculated using thermal parameters found through differential scanning calorimetry to model the protein's free energy using the modified Gibbs-Helmholtz equation. It was found that pea protein in a solution of pH 3 cold denatured at a temperature of 3.85°C, which would be the maximum temperature for cold extrusion. Pea protein that was tempered to two different moisture contents (55% and 37% dry basis) at three different pH levels (2, 4.5, and 8) were then cold extruded where the extrudate was then expected to have unique structural properties characterized through FTIR, zeta potential, SDS-PAGE, ANS-probes, and texture parameter analysis. There were more changes in secondary structure in the acidic extrudate, but zeta potential showed minimal difference between treatments. Overall, the impacts of cold temperature with shear forces among different pH and moisture treatments of pea protein have been observed, which may lead to new processing techniques of pea protein in plant-based food products that can serve as fat memetics.

Mentor(s):

Jozef Kokini, Faculty, Purdue University

Harrison Helmick, Purdue University

College of Health and Human Sciences

Metal Recycling: Threats to Human Heatlh

Author(s):

Rebecca Eyrick, College of Health & Human Sciences

Abstract:

Metal recycling plants release metal contaminants into the air and soil that can result in detrimental health impacts for the communities by which they are surrounded. The objective of this literature review was to observe the correlation between metal contaminants from metal recycling plants and human health impacts in order to apply it to further research in the field. The literature review was conducted using resources such as Google Scholar and PubMed. Articles were found using search terms "metal recycling," "health," and "contaminants." Articles included quantitatively examined metal contaminants found near different types of recycling plants, detailed measurement methods, and human health impacts. 11 articles were used, with 3 studies looking at e-waste recycling plants, 6 at metal recycling plants, and 2 at other locations. Lead was found in every study. The percent of studies reporting other metals was: cadmium (73%); nickel (64%); chromium (64%); copper (55%); zinc(55%); arsenic (37%); manganese (37%); iron (28%); cobalt (28%); and barium (28%) was found in 18% of studies. Four studies used soil samples, four studies used air samples, one used a combination of the two, and two were not specified. The main health effects were increased carcinogenic risk, irritation to respiratory system, and pain upon ingestion such as through food. These studies concluded that metal recycling plants release contaminants into the air and soil that result in detrimental effects for human health. More research should be conducted to observe these effects and take action against contaminants released by recycling plants.

Mentor(s):

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

College of Agriculture

Impact of methimazole-induced hypothyroidism on the porcine liver

Author(s):

James Fazioli, College of Science

Margaret Mulligan, College of Agriculture

Abstract:

Endogenous production of thyroid hormones can be suppressed by anti-thyroid medications including methimazole (MMI), which prevents iodination of their thyroglobulin precursor. Previous research indicates that MMI may contribute to liver toxicity and development of nonalcoholic fatty liver disease (NAFLD). Therefore, the objective of this study was to evaluate effect of MMI on liver function in swine. Twelve weaned pigs were randomly allocated for daily treatment with either 10mg/kg MMI (TRT) or sham control (CON). Blood samples were collected on days 0,4,7,11,25, and 28 to assess circulating thyroxin (T4). Animals were euthanized on day 28, and liver and thyroid weights determined as a percentage of body weight. Liver samples were snap-frozen and thyroid glands formalin-fixed for histological assessment. Liver RNA was extracted and the expression of genes associated with apoptosis (CDKN1A,P53,SIVA1, and PERP) and thyroid metabolism (DIO1,DIO2, and DIO3) evaluated by qPCR. No significant difference in T4 was detected between treatment at day 0; however, T4 levels were significantly decreased ($P<0.001$) thereafter in TRT. Thyroid tissue weight was significantly ($P<0.001$) increased in TRT ($\bar{x}$ 0.051%) relative to CON ($\bar{x}$ 0.015%). Thyroid tissue from TRT animals showed varying degrees of abnormality, including reduced eosinophilic colloid and disorganized columnar epithelium. Liver weight showed no significant difference between groups, and no significant differences in expression of apoptotic or thyroid metabolism genes were observed. A dose of 10mg/kg MMI is sufficient to significantly suppress thyroid hormone production and create goitrous pathology in swine. However, gene expression analysis shows no evidence of liver toxicity or NAFLD.

Mentor(s):

Jonathan Pasternak, Animal Sciences, College of Agriculture

Erin Ison, Purdue University

Ryan Cabot, Purdue University

College of Science

Synthesis of atomically precise iron sulfide clusters and their mass spectrometric analysis

Author(s):

Dylan Forbes, College of Science

Abstract:

Nanoclusters consist of a core of atoms that are usually protected with surface ligands, intermediate in size between single atoms and nanoparticles. Their high surface to volume ratio, unique electronic structure, and tunability makes them a great candidate as a model system for fundamental studies and application in catalysis, energy storage, and molecular electronics. In this study, we designed nanoclusters using atom-by-atom substitution to replace one of the Fe atoms in the core of $[Fe_6S_8L_6]^{+/2+}$ cluster with other transition metals. Because the core determines the overall properties of the nanocluster, this is an effective method for tuning the electronic and magnetic properties of the cluster. We synthesized nanoclusters based on the iron sulfide and nickel sulfide cluster protected with triethylphosphine ligand (PEt_3) and analyzed them using high resolution mass spectrometry. Mass spectrometric analysis showed that when $FeCl_2$ is used as a metal precursor in the synthesis singly and doubly charged cationic species are formed $[Fe_6S_8L_6]^{+/2+}(L=PEt_3)$. Meanwhile, using $NiCl_2$ as a metal precursor generates singly charged $[Ni_3S_3HL_5]^+$ cluster with the same synthetic procedure. We examined the substitution of Ni atom to the core of $[Fe_6S_8L_6]^{+/2+}$ clusters by using 1:1 molar ratio of $NiCl_2$ and $FeCl_2$. Mass spectrometric analysis revealed signals corresponding to $[Fe_5NiS_8L_6]^+$, $[Fe_4Ni_2S_8L_6]^+$, $[Fe_5NiS_8L_5]^{2+}$, and $[Fe_4Ni_2S_8L_5]^{2+}$ species indicating that $[Fe_6S_8L_6]^{+/2+}$ cluster undergoes atom-by-atom substitution. The core of the $[Ni_3S_3HL_5]^+$ cluster does not undergo substitution with Fe atoms. This work increases the range of atomically precise alloy nanoclusters that have potential applications in molecular electronics, spintronics, quantum computing, and energy storage.

Mentor(s):

Habib Gholipour-Ranjbar, Chemistry, College of Science

Julia Laskin, Purdue University

College of Engineering

Modeling High Efficiency Thermophotovoltaic Systems

Author(s):

Mariam Ghoneima, College of Engineering

Abstract:

A thermophotovoltaic (TPV) system converts heat into electricity, contributing to green energy generation. A thermal emitter is a critical part of the TPV system which emanates light in a specific range of wavelengths that can be utilized by the photovoltaic (PV) cell. High-performance TPV systems are difficult to create due to their inherently challenging components and their need to coordinate several different subsystems. The purpose of this study is to find an optical structure that can be used to ensure an efficient thermophotovoltaic emitter.

The specific emitter that was researched in this study is a 2-D array of nanowires. This is a manmade metamaterial that has optical properties not otherwise found in natural materials. A 2-D array of nanowires embedded in the substrate material may have good optical performance because of its narrow-band emission in which only the photons with energy above the bandgap of the PV cell are emitted. This emitter can also be scaled to large areas and has stability at high temperatures. In this study, S4, a numerical solver calculating the reflection and transmission of light in layered media, is used to investigate the optical property of a 2-D array of nanowires. The effect of material properties on the optical performance is also researched. The study will analyze the reflection and transmission spectra of such an emitter, calculate the overall TPV efficiency, and compare it with other TPV systems.

Mentor(s):

Jie Zhu, Electrical & Computer Engineering, College of Engineering

Peter Bermel, Purdue University

Poster Presentation Abstract Number: 148 :: Life Sciences

College of Science

Characterizing the Mycobiome of Common Crop Seeds

Author(s):

Brenna Giese, College of Science

Abstract:

The fungi associated with seeds of common crop plants are generally unknown despite the rapidly growing field of microbiome research. Academic studies and industrial screenings are largely focused on a few organisms of interest, leaving fungi with potentially consequential properties – such as pathogenicity or symbiotic relationship with the seed – uncharacterized. This work sought to identify the fungi in commercial seeds from fifteen fruit, vegetable, and herb seeds from two companies. First, to identify fungi present on the surface of commercial seeds, seeds from packets were plated on Potato Dextrose Agar and resulting fungal growth was isolated into axenic culture. Cultures were subsequently identified by Sanger sequencing of the internal transcribed spacer (ITS) region of the rDNA repeat. Second, to identify unculturable or endophytic fungi in the same samples, Next Generation Sequencing (NGS) was used, again using the ITS region as a marker gene. Surface fungi were isolated in 14 of the 15 varieties plated, belonging to 11 different genera including the plant pathogenic genera Alternaria and Cladosporium. These results indicate that current fungicidal seed treatments and screenings are insufficient for removing surface fungi and may inadvertently serve as a source for inoculum.

Mentor(s):

Catherine Aime, Botany & Plant Pathology, College of Agriculture

College of Science

The Effect Of Antibiotic Use On Tumor Development In A Sporadic Colon Cancer Model

Author(s):

Molly Gillig, College of Science

Abstract:

Colorectal cancer (CRC) is a leading cause of cancer death. The gut microbiota has been recognized to play key roles in CRC. Recent epidemiological data suggest that antibiotic use may be associated with an increased risk of CRC. However, the potential causal link between antibiotic use and CRC development has not been established. We hypothesized antibiotic use in those with high-risk colon cancer may promote cancer development via disruption of gut microbiota. To test this hypothesis, we conducted an animal experiment using an innovative mouse model in Apc+/580S, Kras+/LSL, CAC+ (AKC) AKC mice. The AKC model resembles human sporadic CRC because the AKC mice bear two genetic mutations, APC and KRAS, which are commonly found in CRC patients. Like CRC patients, the AKC mice develop aggressive adenomas in the large intestine. In our study, the AKC mice were given "normal" water for the control group or antibiotics water for the experimental group. At the conclusion of the animal study, the mice were euthanized, and the colon was analyzed for tumor growth. We found the lifespan of the experimental group was reduced as compared to the control group, although antibiotic use did not significantly affect tumor multiplicity or size. PCR analyses targeting the gut microbiota revealed antibiotic treatment eliminated most of the bacteria, causing intestinal dysbiosis. These results indicate that antibiotic treatment impacts survivorship and gut microbiota in the AKC mice, and further studies are needed to evaluate the role of antibiotic use in colon cancer development in different colon cancer models.

Mentor(s):

Qing Jiang, Faculty, Purdue University

Cindy Nakatsu, Purdue University

Suji Im, Purdue University

Yiying Zhao, Purdue University

Purdue Polytechnic Institute

Understanding Non-Speech Human Sounds

Author(s):

Bethany Grace,

Katherine Xiong,

Abstract:

Redacted.

Mentor(s):

Sudip Vhaduri, Faculty, Computer and Information Technology

College of Science

Approximating Projections by Quantum Operations

Author(s):

Colton Griffin, College of Science

Aneesh Khilnani, College of Engineering

Abstract:

Using techniques from semidefinite programming, we study the problem of finding a closest quantum channel to the projection onto a matricial subsystem. We derive two invariants of matricial subsystems which are related to the quantum Lovász theta function of Duan, Severini, and Winter.

Mentor(s):

Thomas Sinclair, Mathematics, College of Science

College of Health and Human Sciences

Alcohol, Stress, and Emotions: Interactions Between Prior History of Stress and Alcohol on Discriminative Conditioning and PKC-δ Expression

Author(s):

Abigail Hackleman, College of Health & Human Sciences

Muhja Ibrahim, College of Health & Human Sciences

Abstract:

Generalized anxiety to non-threatening stimuli is a common symptom of post-traumatic stress disorder (PTSD). The high comorbidity between PTSD and addiction disorders suggests maladaptive interactions between neural circuits of fear and reward learning. To investigate these learning processes more closely, male and female rats (n = 36) had access to ethanol for 5 weeks prior to stress and discriminative conditioning, as well as during the 3 weeks of conditioning. Experimental rats were exposed to a stressor (i.e., 15 unsignaled footshocks) while control rats received no stress (i.e., exposure to the chamber without the footshocks). Rats were then trained to discriminate between a fear cue paired with footshock, a reward cue paired with sucrose, and an explicit safety cue with no reinforcements delivered. Finally, a portion of brains (n = 9) were sectioned and stained for PKC-δ, an enzyme located in the amygdala implicated in fear regulation. Stress resulted in increased freezing behavior during and after the fear and reward cues. The no stress group displayed more reward seeking behavior than stress animals. While males who experienced stress exhibited increased PKC-δ expression in the central amygdala relative to their no stress counterparts, this effect was only marginal in female rats. These findings suggest that interactions between prior history of alcohol and trauma can significantly impact behaviors associated with both fear and reward as well as function in brain regions important for emotional expression.

Mentor(s):

Susan Sangha, ,

Sydney Trask, Purdue University

Kevin Shim, Purdue University

College of Agriculture

Small differences in ratings when asking sensory questions verbally compared to digitally

Author(s):

Madeline Harper, College of Agriculture

Abstract:

Method bias in sensory testing is an important issue that can influence research findings. In some situations, it may not be possible to use only one method due to the circumstances of collecting data from human subjects; for example, some individuals may need to hear questions versus reading them on a screen. In our research, we sought to assess how flavor intensity and liking ratings could differ based on whether questions were asked aloud compared to via an iPad. Due to some prior, accidental work that required this, we hypothesized that there would be a significant difference between methods. Participants (n = 51, 20 males, range 18–49 years) were asked to evaluate seven samples in a randomized order for flavor intensity (0–100 scale) and liking (-100–100 scale) and were randomly assigned to either the verbal or digital condition. Samples included deionized water, flat tonic water, flat lemon-lime soda, and solutions of sodium chloride, monosodium glutamate, potassium chloride, and sucrose. No significance was found for liking, but significant differences were noted for flavor intensity. Flavor of flat lemon-lime soda, sodium chloride, monosodium glutamate, and sucrose were rated as more intense when rating verbally compared to digitally ($p < 0.05$). These findings indicate that caution is warranted when mixed verbal/digital methods are used and that researchers may need to shift to whichever method best accommodates all participants.

Mentor(s):

Cordelia Running, Nutrition Science, College of Health & Human Sciences

College of Agriculture

Understanding How Protein Structures Impacts its Function and Effect of Cold Denaturation on Protein Gelation

Author(s):

Christabel J. Hartanto, College of Agriculture

Abstract:

Food scientists have recently begun with more sustainable ideas to save the world from global warming by utilizing plant-based protein. Ingredient designers look for proteins that can form gels that trap water or lipids, and then tweak the protein's original structure through thermal, chemical, and physical changes to replicate textures in these goods. Low temperatures are one pre-treatment that has gotten little attention, despite the fact that at temperatures below -20°C, protein conformational entropy overtakes enthalpy, resulting in cold denaturation. The structure of untreated pea protein isolate is modified using a combination of ethanol, shear forces, and low temperatures, and the effects of these treatments on gelation are investigated. It is found that a combination of treatment at -10°C in ethanol with applied shear forces led to gels with the lowest tan δ values during temperature ramps and frequency sweeps. Further characterization was also done by measuring surface hydrophobicity through fluorescent probe. The results also showed that cold denatured protein has more surface hydrophobicity that contributes on gel network. This may indicate that these structures are most suitable for replacing fattier and creamy textures. Together, this work suggests that this cold denatured protein would form complexes with lipids in ways that would further promote these textures.

Mentor(s):

Jozef Kokini, Faculty, Purdue University

Honors College

Making Simulated Patterns Look Real: Image-Processing for Zebrafish

Author(s):

Caroline Henson, College of Engineering

Abstract:

Zebrafish are small striped fish that develop different patterns, and understanding zebrafish patterns has important biomedical applications. Due to the small size of these fish (less than an inch in length), understanding how cells interact and develop to form patterns is a challenging endeavor. While there are mathematical models that replicate zebrafish patterns, these simulations do not achieve the variety in cell size or color seen in real fish images. By viewing a large number of zebrafish images, I am analyzing cell colors and shapes. The goal of my research is to develop post-processing software for simulated zebrafish, in order to make them appear similar to real fish.

Mentor(s):

Alexandria Volkening, Mathematics, College of Science

College of Science

Iterative Quantum Algorithm for Linear Systems of Equations on the Honeywell H1 Quantum Computer

Author(s):

Adrik Herbert, College of Science

Eric Reinhardt, College of Science

Abstract:

The quantum algorithm for linear systems of equations (HHL algorithm) provides an efficient tool for finding solutions to systems of functions with a large number of variables and low sensitivity to changes in inputs (i.e. low error rates). For complex problems, such as matrix inversion, HHL requires exponentially less computational time as compared with classical computation methods. HHL can be adapted to current quantum computing systems with limited numbers of qubits (quantum computation bits) but a high reusability rate such as the Honeywell H1 quantum computer. HHL implementation can be further improved for use on the low-qubit-count Honeywell H1 by adapting the algorithm to use an iterative structure as opposed to a parallelized structure for the computational circuit. Iterative algorithms have been developed by IBM in the high-level quantum computer language, Qiskit. One example of this is the iterative quantum phase estimation algorithm which can be adapted to minimize the number of qubits required for HHL. A component of our work has been to develop documentation which instructs on the conversion of quantum computing code written in Qiskit to the lower-level language OpenQASM used by the Honeywell H1. Here we present the HHL algorithm as well as a general methodology for creating iterative algorithms in the OpenQASM language for use on the Honeywell H1 and similar systems.

Mentor(s):

Andreas Jung, Physics & Astronomy, College of Science

Andrew James Wildridge, Purdue University

Honors College

Neutralizing the SARS-CoV-2 Spike Protein with a Mini-Binder Protein

Author(s):

Rhenn Holliday, College of Health & Human Sciences

Abstract:

SARS-CoV-2, a virus stemming from Wuhan, China, has gained the attention of scientists as they attempt to design a protein able to neutralize this virus. SARS-CoV-2 infects cells via binding its spike glycoprotein to the human enzyme, angiotensin-converting enzyme (ACE2), which is found on the surface of lung and other human cells. A mini-binder protein could attach to the spike glycoprotein to neutralize the virus, however, the ideal backbone structure, side chains, secondary structures, and other structural components needed to create a stable protein is unclear. This study aims to design a potential mini-binder protein with the purpose of blocking the spike protein from binding to ACE2, while having a stable structure and higher binding affinity than ACE2. De novo protein design is a promising option for creating a synthetic mini protein; however, computational software, such as Rosetta, are unable to design proteins without the guidance of human intuition and visual problem-solving skills. Here, a potential binder protein was designed through Foldit, an online gaming software for protein design that incorporates both human creativity and the Rosetta energy calculating algorithm. From Foldit, a mini-binder protein structured with two large alpha helices, hydrogen bonds, and specific side chains has been contoured in a way to have a higher binding affinity than ACE2. Most sidechains on the outer surfaces the protein where hydrophilic as they interacted heavily with the surrounding environment. Side chains on the exterior of the protein mostly consisted of arginine, lysine, and glutamate, while the interior contained more hydrophobic side chains. With a score over 13000, this mini-binder protein could be a steppingstone for finding a viable mini-binder protein leading to experimental testing by the creators of the Foldit game at the Institute for Protein Design.

Mentor(s):

Zahra Tehrani, Honors College

College of Engineering

Antitumor Efficacy of Chimeric Antigen Receptor Neutrophils Targeting Solid Cancer Tumors

Author(s):

Sydney Hummel, College of Engineering

Abstract:

Neutrophils, the most abundant white blood cells in the circulation, are closely related to cancer development and progression. Primary neutrophils from healthy donors present potent cytotoxicity against different human cancer cell lines through direct contact and via the generation of reactive oxygen species (ROS). However, due to their short half-life and resistance to genetic modification, neutrophils have not yet been engineered with widely used chimeric antigen receptors (CARs) to enhance their anti-tumor cytotoxicity for targeted immunotherapy. Here, we genetically engineered human pluripotent stem cells with anti-FITC CAR and successfully differentiated them into functional neutrophils by implementing an innovative chemically-defined differentiation platform. The resulting CAR-neutrophils bridged with FITC-folate presented superior and specific cytotoxicity against tumor cells under the hypoxic tumor microenvironment. Collectively, we established a new platform for the production of CAR-neutrophils, paving the way to myeloid cell-based therapeutic strategies that would complement and boost current cancer treatment approaches.

Mentor(s):

Xiaoping Bao, Chemical Engineering, College of Engineering

Yun Chang, Purdue University

College of Science

Expression and purification the wild type Fic1-Fic2-YopT domains of Pasteurella multocida PfhB2-toxin for structural analysis

Author(s):

Elissa Jaensson, College of Science

Abstract:

The respiratory pathogen Pasteurella multocida secretes PfhB2, a multidomain toxin implicated in virulence. Little is known about PfhB2-YopT, which is homologous to the Yersinia YopT-like cysteine proteases and requires a Cys-His-Asp (CHD) catalytic triad for activity. Previously, we solved the crystal structure of PfhB2-YopTC3733S, a catalytically inactive mutant, which exists as a head-to-tail dimer formed by domain-swapping and assembles two CHD catalytic triads. However, we could not crystallize the WT PfhB2-YopT domain, and multi-angle light scattering (MALS) data suggests that it exists as a monomer. Since the wild type domain doesn't form stable dimers alone, including the two upstream Fic domains from the PfhB2-YopT domain may facilitate dimerization. Here, we seek to determine the structure of PfhB2-YopT to uncover its enzymatic mechanism of action and to guide interrogation of its role in Pasteurella virulence.

To purify the WT Fic1-Fic2-YopT domain for analysis, we will amplify the region from P. multocida via PCR. The amplified domains will be inserted into pET-SUMO using restriction cloning. The pET-SUMO expression vector allows for our domains to be tagged with an N-terminal His6-SUMO peptide. After validation of the construct, pET-SUMO-Fic1-Fic2-YopT will be expressed in BL21 cells and purified via size-exclusion chromatography. Finally, the purified domain will be analyzed by MALS and crystallography, given successful crystallization screening.

Obtaining a crystal structure for the Fic1-Fic2-YopT domain could provide insight into the active and biologically relevant form of the YopT protease domain. Future studies seek to identify the target substrate(s) and physiological role of PfhB2-YopT.

Mentor(s):

Seema Mattoo, Biological Sciences, College of Science

Jill Cornell, Purdue University

College of Science

Targeting profibrotic macrophages for therapy of pulmonary fibrosis

Author(s):

Rina Jiang, College of Science

Abstract:

Idiopathic pulmonary fibrosis is a progressive, fibrotic disease of high mortality with a median survival rate ranging from 2-5 years [1]. Though current therapies –nintedanib and pirfenidone have been proven to slow disease progression, IPF remains non-curative as neither can provide a total resolution of established fibrosis. At a molecular level, the activation of macrophages results in the release of profibrotic cytokines, which further stimulate extracellular matrix deposition. Despite the role of TLR7 agonists in preventing the release of profibrotic cytokines, systemic delivery has been largely restricted due to unwarranted toxicities and adverse effects. To counteract this problem, our study aims to reverse profibrotic pathways in alveolar macrophages by using a folate-targeting TLR7 agonist to reprogram macrophage phenotypes (M2-like to M1-like). Quantitative measurements via hydroxyproline assays and histological examinations were utilized to assess the programming status in the bleomycin (BLM)-induced lung fibrosis murine model. Results revealed decreased hydroxyproline content and collagen deposition. Thus, these findings suggest a new therapeutic strategy in treating fibrosis without significant toxicity.

Mentor(s):

Philip Low, Chemistry, College of Science

Fenghua Zhang,

College of Agriculture

Absence of INO80 reveals a role for the CHD chromatin remodeler PICKLE in response to double-strand breaks in Arabidopsis

Author(s):

Emily Johnson, College of Agriculture

Abstract:

Redacted.

Mentor(s):

Joseph Ogas, Biochemistry, College of Agriculture

Jiaxin Long, Purdue University

College of Science

A Novel Approach to Examining the Role of Epstein Barr Virus in Nasopharyngeal Cancer

Author(s):

Simran Kadadi, College of Science

Zhonghao Zhang, College of Engineering

Abstract:

In 2020, over 19.3 million new cancer cases were diagnosed worldwide and approximately 15 percent of all human cancers worldwide were attributed to viruses. The Epstein Barr Virus (EBV) infects approximately 95 percent of all adults and causes ~ 1% of all cancers.

This project pioneers the examination of the role of EBV in nasopharyngeal cancer using single-cell RNA sequencing (scRNA-seq).

Cancer stem cells (CSC) are a heterogenous subpopulation within tumors that have self-renewal and differentiation properties potentially causing tumor initiation and relapses. CSCs are crucial for novel anti-cancer drug discovery.

In order to investigate the cellular response to EBV infection at the single-cell level in nasopharyngeal cancer (NPC) patients, I sourced a dataset containing tumor and peripheral blood mononuclear cell (PBMC) samples. To visualize the high dimensional data in a 2D map, we used the uniform manifold approximation and projection algorithm (UMAP), a neighbor graph-based approach to identify the cell identities.

After checking the expression of all EBV genes, we identified LMP-1 as the sole EBV gene detected. We identified major pathways associated with human cancer malignancy, hallmark TNFA signaling via NFKB pathway, hypoxia pathway, and hallmark p53 pathway. Based on our analysis, we observed that the SOX9 gene and CD44 gene were more expressed in LMP-1 high cells versus low cells. These cancer stem cell genes were overrepresented in high LMP-1 cells than the control. By targeting LMP-1 expressing stem-like cancer cells, this research has the potential to lead to an improved outcome when combined with other treatments.

Mentor(s):

Majid Kazemian, Biochemistry, College of Agriculture

Krannert School of Management

Understanding Academic Integrity Through the lens of Purdue Faculty

Author(s):

Kenneth Kanwischer, School of Management

Abstract:

The current status quo regarding academic integrity has reached a crossroads. The turn to remote learning has caused universities across the United States to take new approaches to curbing academic dishonesty. As new companies develop technologies to create an environment for students to be able to be educated remotely, a debate has erupted as to how professors can guarantee that students are using technology to effectively learn the given content similarly to an in-person setting. Websites such as Chegg, Course Hero, and Slader have provided mediums for students to learn content and get help, but there have been numerous students that have taken advantage of this to cheat. The COVID-19 pandemic has caused most academic institutions to turn to online remote learning with mixed results. In this report, data voluntarily collected from 39 faculty members at the Krannert School of Management at Purdue University portray the approaches taken by multiple departments in the attempt to curb academic dishonesty. In addition to how professors deal with academic integrity, we also collected data on how professors have adjusted their curriculum due to the COVID-19 pandemic. Findings show that the Purdue Honor Pledge is average/ineffective at discouraging academic integrity, professors are very mixed in their procedures towards addressing academic integrity, and that faculty members on average do not expect much of their course content to be found online. Addressing these policies on a school level can have positive effects towards encouraging students to uphold values that will assist them in their future careers.

Mentor(s):

Cara Putman, Business Law, School of Management

College of Health and Human Sciences

Relationship of starchy diet with salivary amylase activity measured via the "Pudding assay"

Author(s):

Neha Kapur, College of Health & Human Sciences

Abstract:

People vary dramatically in their salivary amylase, which alters the oral texture of chewing requirements, and liking for starchy foods. Salivary amylase might also influence how quickly glucose is released early in the small intestines. Our larger research study is investigating whether dietary intake of starch causes changes in salivary amylase activity. Here, we present the initial relationship between quantity of starchy foods in the diet and how quickly a person's saliva digests starch. To do this, we collected 3 days of dietary records from participants and analyzed them for quantity of starchy food in the diet. Then, participants picked up a saliva testing kit. The kit included a guide and survey link for the salivary amylase activity test—the "Pudding Assay." For this assay, participants chewed wax for 30s, collecting all saliva generated. Volume of saliva was measured, and then the saliva was added to a container of starch-thickened pudding. The viscosity of the pudding/saliva mixture was measured by observing its flow rate through a 10mL syringe, a technique adapted from the International Dysphagia Diet Standardization Initiative. Measurements of the pudding/saliva mixtures' viscosity were taken at 30s and 4min after adding saliva to the pudding. Thinner, less viscous pudding/saliva mixtures flow through the syringe more quickly and indicate higher salivary amylase activity. Here, we will present the initial findings from our first wave of participants, observing whether at the beginning of our study their habitual intake of starchy foods relates to their salivary amylase activity.

Mentor(s):

Cordelia Running, Nutrition Science, College of Health & Human Sciences

Kathryn Pacheco, Purdue University

College of Science

Granzyme A is a Critical Regulator of Small Intestine Antimicrobial Production

Author(s):

Navjot Kaur, College of Science

Abstract:

Immune cells that reside within the intestinal tract produce a number of inflammatory mediators (i.e. cytokines and granzymes) that promote optimal intestinal function. Cytokines like interleukin (IL)-17 and IL-22 act to enhance epithelial cell barrier function, while the role of immune-derived granzymes remains less clear. Therefore, the main goal of my research is to determine how granzymes contribute to intestinal function. I observed a direct correlation between the expression of the serine protease, granzyme A, and expression of the anti-microbial peptides Reg3b/Reg3g. Reg3b and Reg3g are produced by Paneth cells within the intestinal tract and are known to regulate gram-negative bacteria within the gut. Therefore, I hypothesize that granzyme A is required for intestinal Reg3b/Reg3g production and regulation of gram-negative bacteria in the gut. To test this hypothesis, I measured expression of Reg3b and Reg3g mRNA expression in the intestine of WT and Gzma-/- mice by real-time PCR and collected fecal material for 16S rRNA sequencing to assess changes in microbial communities. In these studies, I found that Gzma-/- mice have significantly reduced expression levels of Reg3b and Reg3g antimicrobial peptides as compared to WT controls. These data suggest that granzyme A may modulate the intestinal microbiota via regulating anti-microbial peptide production. My future work will focus on the mechanisms by which granzyme A induces anti-microbial peptide production and how this influences microbial communities within the gut.

Mentor(s):

Matthew Olson, Biological Sciences, College of Science

College of Engineering

Project Rekor

Author(s):

Vivek Khanolkar, College of Engineering

Alan Chung Ma, College of Engineering

Ashwin Senthilkumar, College of Engineering

Pranav Ahuja, College of Engineering

Sarah Clevenger, College of Engineering

Kshaunish Soni, College of Engineering

Shivansh -, College of Engineering

Abstract:

To combat Software Supply Chain attacks, the Project Rekor VIP Team is collaborating with the open source Sigstore community in their efforts to protect the open source software supply chain by cryptographically signing their software contributions. Software supply chain security is a rising area of focus for anyone involved in the development and release of software. Due to the large, and still growing, dependence on open source software, these dependencies have become targets to malicious attacks in order to compromise production software. To combat this, Sigstore is creating a software signing service that allows developers to cryptographically sign and contribute artifact meta-information. Through these, artifact trustworthiness can be viewed and verified by anyone through Rekor, a transparency log, . This gives way to the ability to continuously monitor the log for potentially suspicious behavior. The VIP Team is currently working towards creating a supply chain transparency monitor to continuously scan and audit transparency logs and display to user trends of sigstore. The certificate transparency monitor will be able to serve as a starting point for future renditions that may require further specialized capabilities. The team is currently building a website, the Rekor Monitor, that will install the transparency log into a local database, and periodically update it. The local log will then be put through a data science pipeline that produces charts which will be displayed to users. This will not only allow individuals to view trends within sigstore, but also maintain a local copy of the Rekor transparency log.

Mentor(s):

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

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

<div align="center">

College of Health and Human Sciences

A comparison of in-person and telemedicine treatment modalities using the SpeechVive device

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Author(s):

Renee Kohlmeier, College of Health & Human Sciences

Abstract:

Telehealth is increasing in popularity as a treatment option for people with Parkinson disease. The SpeechVive device is a wearable device that plays multitalker babble in the ear of the wearer helping them to speak more loudly, slowly, and clearly. The purpose of this study was to examine the effectiveness of the device delivered over a telehealth modality as compared to in-person. 65 people with PD were enrolled with 34 choosing the in-person (IP) group and 31 in the telehealth group. Participants were assessed pre-treatment, 6 weeks in, and 12 weeks into treatment. Participants produced a monologue and reading passage both on and off the device at each stage of treatment. Sound pressure level (SPL), utterance length in syllables, pause frequency, and total pause duration were measured from the samples. For SPL, significant group by session ($p<.001$) and group by condition ($p<.001$) interactions were found. The IP group increased SPL when wearing the device but the telemedicine group did not. Changes from pre- to post-treatment were small for both groups. Both groups paused less often while wearing the device ($p=.01$). There were small increases in the length of utterances post-treatment for both groups ($p<.001$). The IP group showed similar treatment effects compared to previous studies. The device was not as effective in the telemedicine group as it was in the IP group. One limitation was data loss due to recording issues that impacted the telehealth group more than the IP.

Mentor(s):

Jessica Huber, Speech, Language, & Hearning Sciences, College of Health & Human Sciences

College of Science

Gaining Insights into Conformational Dynamics of Phospholipase Cβ

Author(s):

Thomas Komay, College of Science

Abstract:

Cardiovascular disease is the leading cause of death in the United States. Phospholipase Cs (PLCs) are a family of enzymes that hydrolyze the lipid phosphatidylinositol-4,5-bisphosphate (PIP2), producing second messengers that regulate calcium signaling in the heart. The PLC□ subfamily is required for normal cardiovascular function, and changes in its activity are known to cause cardiac hypertrophy. PLC□ is regulated through direct interactions with the heterotrimeric G protein subunit G□□, which is released when G protein-coupled receptors (GPCRs) are activated at the cell membrane. G□□ is proposed to bind to an internal site within PLC□, implying a conformational change must occur for its activation of PLC□. However, how this G protein regulates the PLC□ is still unknown, and the nature of the conformational changes required in PLC□ are also unclear. To investigate this, I generated a PLC□□variant that lacked solvent-exposed cysteines but contained a single cysteine substitution in the pleckstrin homology (PH) domain, which has been shown to be flexibly connected in solution. This allows site-specific labelling of the lipase without compromising its structure or function, as assessed differential scanning fluorimetry and enzyme activity assays. To monitor the conformational dynamics of the PH domain in PLC□, in solution and when bound to G□□ and/or liposomes, we are using an acrylodan-based fluorescence assay.

Mentor(s):

Igi Vilza, ,

Angeline Lyon, Purdue University

College of Health and Human Sciences

Neural mechanisms associated with context-dependent pain tolerance

Author(s):

Michael Kuczajda, College of Health & Human Sciences

Kathleen Reyna, College of Health & Human Sciences

Rachel Riley, College of Health & Human Sciences

Sydney Thrasher, College of Health & Human Sciences

Abstract:

Previous work demonstrated using a within-subject procedure that a context, or environment, that has been associated with administration of a painful stimulus can result in the development of a context-specific pain tolerance in that environment. The present experiment was designed to replicate this finding using a between-subjects procedure in order to probe the neural mechanisms associated with this context dependent reduction in pain sensitivity. We found, using expression of the immediate early gene zif268 as a proxy for neural activity, that pain tolerance was associated with decreases in activity in prelimbic cortex, the anterior cingulate cortex, the posterior retrosplenial cortex, and the dorsolateral periaqueductal gray. Further, activity in these regions (but not regions that had no learning-dependent reductions in activity) was highly correlated suggesting synchronized activity between these regions. Together, these results suggest that pain tolerance is associated with decreased neural activity in a distributed neural circuit that might support acquisition of a context-dependent pain response.

Mentor(s):

Sydney Trask, ,

Poster Presentation Abstract Number: 170 :: Life Sciences

<div align="center">

College of Health and Human Sciences

Quantification of Exposure to Tetrachloroethylene among Children in Martinsville, Indiana by Testing their Exhaled Breath

</div>

Author(s):

Ian Kurz, College of Health & Human Sciences

Abstract:

The purpose of this study was to measure concentrations of volatile organic compounds (VOCs) in Martinsville, IN, which contains an EPA Superfund site for a perchloroethylene (PCE) groundwater contamination plume. People are exposed to PCE, as well as other VOCs, through evaporation into buildings from the water table after these chemicals were improperly disposed of. This overall project aims to better understand the effect of long term, low concentration exposure of PCE on the health and development of children. The scope of this poster is limited to exposure data, other groups are evaluating health outcomes. We used Proton Transfer Reaction - Mass Spectrometry (PTR-MS) to test the breath of the participants for PCE, which is an innovative use of the technology. The breath of each child was tested twice by breathing into the PTR-MS on two different days. Concentrations of PCE along with other VOCs in exhaled breath were quantified using standard curves. For this study we collected data from 41 participants between the ages of 6 and 11 years old. One-third of these participants appeared to have detectable levels of PCE in their breath, and among these participants the mean concentration of PCE in breath was 0.20 ppb. Data analysis is still in progress. These results demonstrate that children living in the Martinsville area are exposed to PCE, with the precise exposure level and sources to be determined. This paves the way for further research into the mental and physical health outcomes of these children due to this exposure.

Mentor(s):

Sa Liu, Health Sciences, College of Health & Human Sciences

Jung Hyun Lee, Purdue University

Marwan Alajlouni, Purdue University

Antonios Tasoglou, RJ Lee Group

College of Engineering

Component Redesign for the FEMTA Suborbital Flight Experiment

Author(s):

Max Lantz, College of Engineering

Carly McKean, College of Engineering

Ankit Mondal, College of Engineering

Abhirama Rachabattuni, College of Engineering

Yashoheet Sethi, College of Engineering

Ata Toraman, College of Engineering

Abstract:

FEMTA (Film Evaporation MEMS Tunable Array) is a micropropulsion system designed for small satellite attitude control using ultrapure deionized water as propellant. This system requires zero-G environmental testing for its propellant management system, which is the objective of the FEMTA Suborbital Flight Experiment. This propellant management unit is a vapor pressure driven pump using hydrofluoroether to expand a diaphragm and increase pressure, ensuring constant propellant flow. An engineering test unit is complete and testing has revealed areas where updates are necessary; these iterations will be compiled into a second pre-flight test unit targeted for completion this spring. The experiment's suborbital flight provider redefined payload sizing requirements at the beginning of this semester, influencing form changes to electronics and flow loop components and allowing the implementation of wire harnessing features. An in-progress flow hardware rework, motivated by repeated propellant leakage, aims to replace all-purpose pipe fittings and solenoids with microfluidics to reduce mass, clutter, and failure risk. In parallel, this update will add a simple, vacuum-compatible propellant loading and drainage system to simplify the integration and test processes. Due to redundancy with currently installed flow sensors, infrared sensors for air pocket detection were removed. Potential points of failure are hardwired to LEDs on an in-house printed circuit board monitored by cameras as a failsafe for recorded telemetry. These system design changes complement the setup currently in place to form an efficient and reliable testbed for the FEMTA micropropulsion unit.

Mentor(s):

Kate Fowee Gasaway, Aeronautics & Astronautics, College of Engineering

Alina Alexeenko, Purdue University

Anthony Cofer, Purdue University

Steven Pugia, Purdue University

Poster Presentation Abstract Number: 172 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Strength of Threaded Inserts in Carbon Fiber Reinforced Plate

Author(s):

Harry Lee, College of Engineering

Abstract:

The common methods of assembling composite parts are adhesive bonding, mechanical fastening, or a combination of both. However, there are situations where only mechanical fastenings are desired due to the ease of assembly and disassembly that makes routine inspections and part replacements possible. There are many types of composite mechanical fastenings, but the ones we focused on are threaded M4 inserts with five-millimeter-thick carbon fiber reinforced laminate. The lay-up process for the laminate consisted of 20 plies of AS4 NB321 plain weave, and the holes for the inserts were drilled after curing. As comparison, one group of specimens is drilling and tapping directly on the carbon fiber laminate. The other inserts tested were barbed inserts, self-tap inserts, self-tap inserts with adhesive, pressed fit inserts, embedded inserts, and embedded metal. Embedded metal specimens were created by embedding a small piece of aluminum before curing, then drilling and tapping afterward. A tensile pullout test and a fatigue test were conducted by applying loads on the M4 bolts screwed into the samples. The embedded insert has the highest ultimate strength but would not be practical because of the lack of alignment accuracy during manufacturing. Self-tap insert with adhesive has relatively high ultimate strength as performs well during fatigue, so it is concluded to be the best option insert type mechanical fastenings for composite assembly.

Mentor(s):

Garam Kim, Aviation & Transportation Technology, Polytechnic Institute

College of Engineering

Analysis of different single loop surface coil geometries for MRI

Author(s):

Hyunseo Lee, College of Engineering

Abstract:

Radiofrequency (RF) coil is a critical imaging component of magnetic resonance imaging (MRI). RF coils can function as a transmitter, receiver, or both. It transmits the transverse magnetic field (B1) required to excite protons and other molecules and detects the subsequent MRI signal. The sensitivity of RF Coils also plays a role in the MRI images' spatial and temporal resolution. However, RF coils are rigid and uncomfortable for patients. Therefore, enhancing patient safety, comfort and scan experience through novel RF coil designs is current research of interest. The aim of this project is to analyze different flexible receive coil geometries as a function of image quality, Q-factor, and signal-to-noise ratio (SNR). Rectangular and circular single loops are the most common RF single loop coils. Conventional copper wire coils require greater time and effort to be molded into non-standard polygons when compared to flexible PCBs. Initially, the bench measurements of loaded and unloaded Q factor between flexible PCB geometries will be studied and compared with the conventional loop coil. Then, in-scanner phantom SNR studies of the different flexible PCB-based geometries at 3T (128MHz) will be analyzed. This study intends to show the significance of the simple geometric shapes of the flex PCB single loop RF coils on the quality of the MRI images. For future work, analysis of SNR of phased arrays belonging to different shapes of flexible PCB loops can be performed.

Mentor(s):

Joseph Rispoli, Biomedical Engineering, College of Engineering

Folk Narongrit, Purdue University

Thejas Ramesh, Purdue University

College of Science

Mapping the Residual Interface Responsible for Proto-Oncoprotein Inhibition

Author(s):

Kyu Been Lee, College of Science

Abstract:

The NF-κB transcription factor plays a significant role in the activation, proliferation, and survivability of B and T lymphocytes. Due to this, different lymphoma diseases have developed methods to upregulate the NF-κB signaling pathway for its own benefits in proliferating and surviving such as by overexpressing mucosa-associated lymphoid tissue lymphoma translocation 1 (MALT1). MALT1 is a proto-oncoprotein which forms a trimeric CBM complex with CARMA1 and BCL10 in order to upregulate the NF-κB signaling pathway by two roles. It serves both as a protease, cleaving negative regulators, and as a scaffolder, recruiting proteins which positively regulate the signaling pathway. The G protein-coupled receptor kinase 2 (GRK2) has been identified in counteracting this protease by interacting and inhibiting the MALT1 function. Inhibition of MALT1 presents toxic effects to tumor cells relying on the CBM activity, making MALT1 a potential therapeutic target. To investigate the GRK2-mediated inhibition of MALT1, the interacting domains, the Death domain (DD) of MALT1 and the αN/RH domain of GRK2, have been purified via affinity and size exclusion chromatography. To map and predict the binding interface, successful protein-protein crosslinking products were purified for the following crosslinking mass spectrometry analysis. The results from crosslinking experiments and binding interface predictions allowed us to identify possible residues involved with the binding and, potentially, inhibition of MALT1. This finding may ultimately serve as a future stepping stone for improved therapeutics against lymphoma diseases relying heavily on the NF-κB signaling pathway.

Mentor(s):

John Tesmer, Biological Sciences, College of Science

Chun-Liang Chen, Purdue University

College of Engineering

Challenges of Reimplementing Deep Learning Models: Mesh R-CNN

Author(s):

David Li, College of Engineering

Allen Liu, College of Engineering

John Zylstra, College of Science

Abstract:

Machine learning (ML) and it's wide range of applications has dramatically impacted many aspects of modern society. However, the swift advancement of ML technology has led to the emergence of a reproducibility crisis. With new ML models being rapidly developed, it has become apparent that verification of these models and their proposed accuracies is an issue for reuse. One common challenge that arises in the task of reproducing ML models is the lack of standardized software engineering practices among academic prototypes. The TensorFlow Model Garden is a proposed solution to the reproducibility crisis by providing a curated collection of exemplar state-of-the-art ML models that demonstrate the standard of software engineering practices needed for reproducible and easily reusable ML models. Our team collaborates with Google to reproduce deep learning computer vision models for the TensorFlow Model Garden. One of our recent projects is the implementation and integration of a novel state-of-the-art 3D shape-prediction model called Mesh R-CNN into the TensorFlow Model Garden. We will discuss the findings of our re-engineering experience, including the key challenges that we faced and the strategies we employed to overcome them. We also propose techniques and tools for the ML reproduction process such as agile software engineering methodology practices, differential testing, and designing for hardware accelerator constraints. Our hope is that these learnings will inform future machine learning reproduction endeavors and raise the standards for implementation and documentation in ML development.

Mentor(s):

James Davis, Electrical & Computer Engineering, College of Engineering

College of Engineering

Biofilm Detachment During Flow

Author(s):

Alexis Lowe, College of Engineering

Daniel Ceglio, College of Engineering

Abstract:

Redacted.

Mentor(s):

Caitlin Proctor, Enviromental & Ecological Engineering, College of Engineering

College of Engineering

Designing a Self-Regulating and Portable Heating Device for a Microfluidic Based Biosensor

Author(s):

Riya Mahajan,

Abstract:

Redacted.

Mentor(s):

Mohit Verma, Agricultural & Biological Engineering, College of Agriculture

Mohsen Ranjbaran, Purdue University

College of Science

Child Automated Speech to Text Machine Learning Model

Author(s):

Alex Marks, College of Engineering

Shaan Luthra, College of Science

Adrien Dubois, College of Engineering

Vishaak Narayan, College of Science

Guna Avula, College of Science

Aarohi Panzade, College of Science

Jasper Koliba, College of Engineering

Aakanksha Shripal, College of Engineering

Anish Bhowmik, College of Science

Abstract:

In the last decade, the field of Automatic Speech Recognition (ASR) has rapidly transformed. However, current ASR systems are trained primarily with adult speech and do not accurately transcribe young children's speech. Over the course of the last 2 years, the CAST team has been working on an automatic speech recognition solution that will accurately transcribe child speech (for children 3 to 5 years old) and fill this gap in the field. Our goal is to create a program that can be used in a wide range of early development applications.

This year, the team has worked on data preparation and model building. The data preparation portion consisted of aligning our audio files with their given transcripts and generating feature matrix representations of the data. The team also began to build the transcription algorithm. The algorithm is a combination of a Recurrent Neural Network (RNN) and a Hidden Markov Model (HMM). RNNs are commonly used for prediction in time series applications like audio signals. The team has completed one iteration of the deep learning model and is continuing to tune model layers and parameters to increase transcription accuracy. Hidden Markov Models are also used in time series problems and use conditional probability to encode context into the prediction of each word. Currently, the team is building the first iteration of the HMM. We expect to have multiple iterations of both completed by the end of the semester and will evaluate how the two models work in tandem.

Mentor(s):

David Purpura, ,

Poster Presentation Abstract Number: 179 :: Life Sciences

College of Agriculture

Studying the Role of Histone Modifications in Fruit Fly Vision Neurons

Author(s):

Makayla Marlin,

Abstract:

Histone modifications, like methylation, occur post-translationally in histone proteins. These modifications can impact the expression of genes in all species, including the Drosophila melanogaster, commonly referred to as the fruit fly, by altering chromatin structure in the protein. These proteins package DNA, but the disruption by modification can damage the DNA. With previous studies in the Weake lab we have been able to see what genes are important to the survival of vision neurons, specifically in aging fruit flies. These genes that have been identified are now being studying by extracting histones from genetically modified flies in order to optimize method to detect the changes that can be seen in histone modifications using antibodies. By optimizing these antibody-based methods, we have the ability to identify how disruption of mechanisms associated with aging lead to change in histone modifications, such as methylation, which is what my study aims to do. By using H3 as a control antibody and H3K36me3 to study the disruption that may occur in fruit fly photoreceptor neurons, we will be able to see how aging may disrupt the processes of cellular regulation in the flies, which can eventually be translated to human studies.

Keywords:

Drosophila melanogaster, aging, antibodies, histone modifications, methylation, neurons

Mentor(s):

Juan Jauregui, Biochemistry, College of Agriculture

Vikki Weake, College of Agriculture

College of Health and Human Sciences

The role of anxiety sensitivity in prescription drug use/misuse among college students

Author(s):

Abigail McDonald, College of Health & Human Sciences

Abstract:

Background: The purpose of the current study is to understand the associations between anxiety sensitivity and various forms of legal and illicit substance use. We seek to investigate the role of anxiety sensitivity in alcohol, cannabis, and prescription drug use/misuse among college students. It is hypothesized that consistent with previous research, those with higher anxiety sensitivity will report more anxiolytic drug use. We will also test a novel hypothesis that higher anxiety sensitivity will be associated with greater medically sanctioned stimulant use in college students. Method: The sample consisted of 658 college-age students from a midwestern university. Data was collected via an online survey available to an introductory psychology experiment pool. Results: If the hypothesis is supported, findings would suggest that anxiety sensitivity is positively related to the use of sedative/tranquilizers, opioids, alcohol, and medically sanctioned stimulant use. Furthermore, anxiety sensitivity would be negatively related to stimulant misuse and marijuana use. Conclusion: These findings would support that anxiety sensitivity is associated with anxiolytic substance misuse and may be a viable transdiagnostic mechanism to target in substance use treatments.

Keywords: anxiety sensitivity, substance use, alcohol, marijuana, stimulants, college students

Mentor(s):

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

College of Science

Bounds on Quantum Chromatic Numbers for Lexicographic Products of Graphs

Author(s):

A. Meenakshi McNamara, College of Science

Abstract:

We provide a brief introduction to quantum graphs and the quantum chromatic number of graphs, which is closely tied to quantum error-checking problems. Quantum colorings are defined in terms of random strategies for non-local games with entanglement. We discuss existing bounds on quantum chromatic numbers and our work to expand upon these bounds. In particular, we define the lexicographic product of quantum graphs and investigate bounds on the resulting quantum chromatic number of these graph products. We demonstrate an upper bound for the quantum chromatic number of the lexicographic product of classical Hadamard graphs and expand to a discussion of our work on showing this bound for general quantum graphs. Additionally, we discuss our work on developing lower bounds for the lexicographic product of quantum graphs which are analogous to those in the classical case using fractional quantum chromatic numbers.

Mentor(s):

Rolando de Santiago, Mathematics, College of Science

Honors College

Binder protein design using FoldIt to block the interaction between SARS-CoV-2's spike protein and human ACE2 cells for possible therapeutic use

Author(s):

Alexander McQuade, College of Pharmacy

Abstract:

The three-fold receptor binding domain of the spike protein (RBD) on SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) effectively binds to human ACE2 (Angiotensin-converting enzyme 2) receptors on the surface of cells in the body. Disrupting this interaction is a possible therapeutic approach to the virus. Binder proteins have shown great promise in previous studies of viruses, but an effective and cost-efficient binder protein to SARS-CoV-2 is still needed. A binder protein competitively inhibits SARS-CoV-2 from binding to ACE2. In this project, the energy score of a human-designed protein that can bind to SARS-CoV-2's RBD was determined in an effort to identify a possible antiviral drug. To complete this, the FoldIt game was used which allows players to create de novo proteins on an energy scale point system. De novo protein designs allow for humans to be involved in every step of design, from primary to tertiary structure in order to make proteins that could inhibit viruses. Algorithms like Rosetta have been used in the past to generate energy-efficient proteins for issues like this, but studies have shown that humans are able to generate more favorable designs than algorithms. The structure outlined in this poster is a proposed protein that could hydrogen bond to the spike protein and inhibit its binding to ACE2. On FoldIt's inversely measured energy-efficient scale, it has a score above 13,000, meaning it has a low energy state. It is a protein containing three alpha-helices and a hydrophobic core. At its interface, the longest alpha helix resides. It binds to a less commonly examined set of residues on the spike protein. The energy efficiency of this design shows the ability of human creative approaches to design therapeutic protein approaches to SARS-CoV-2 that outperform antibodies and algorithm-generated proteins.

Mentor(s):

Zahra Tehrani, Honors College

College of Health and Human Sciences

Spatial Modification in Pulmonary Lipids Following Nanoparticle Exposure

Author(s):

Nicolas Medel, College of Health & Human Sciences

Abstract:

This study uses DESI-MS-Imaging to illustrate the inflammation and immune response to silver nanoparticle (AgNp) inhalation exposure in the lungs. This will be achieved by tracking the concentrations of lipids in the pulmonary system. Lipids are a good representative of the lung's immune and inflammation responses as they are a critical component in the initiation and resolution of both processes. AgNp inhalation toxicity is an unreviewed area of study due to its emergence in biomedical and commercial fields. However, it is known that consistent exposure to AgNps can lead to various pulmonary diseases such as fibrosis by causing the immune system to attack healthy tissue. Thus, the goal of this pilot study is to establish better imaging modalities of the immune response caused by silver nanoparticles. This imaging will allow medical professionals to better understand and treat the damaged areas caused by this phenomenon. In this study, mice were exposed to 50μg of AgNp via oropharyngeal inhalation. After 3 days, the 6 mice (3 control and 3 exposed) were necropsied. The right lung was frozen, BALF (Bronchoalveolar Lavage Fluid) was collected from the right lung, and the left lung was fixed in carboxymethylcellulose to later be put on slides for DESI-MS imaging. Following collection, immune cells, inflammatory genes, and inflammatory proteins all increased in the exposed mice. The DESI-MS results are currently being interpreted using different ionization modes. The goal is to achieve the highest specificity possible to decipher which lipids have increased or decreased in certain regions of interest.

Mentor(s):

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

Saeed Alqahtani, Purdue University

College of Engineering

Algorithm to Detect Inducible Laryngeal Obstruction from Vocal Fold Vibrations

Author(s):

Noah Mehringer, College of Engineering

Abstract:

Inducible laryngeal obstruction (ILO) is a condition wherein the vocal folds close abruptly during inhalation. The diagnostic gold standard is visual inspection via nasolaryngoscopy while the patient runs on a treadmill to induce an episode. This procedure is uncomfortable, requires a clinical visit, and an episode cannot always be successfully induced at the appointment. Alternatively, our group is developing a wearable sensor to detect ILO episodes from biosignals around the throat during a patient's daily activities. We also aim to develop a software algorithm that accurately distinguishes ILO episodes from other motion artifacts. A healthy subject was trained by a speech-language pathologist to simulate ILO episodes. Our prototype device was adhered to the subject's throat, and the subject simulated labored breathing with sporadic ILO events. The sensors collected bioelectric signals, audio, and skin vibrations to record vocal fold activity. Custom processing software digitally filtered out low frequency body motions and segmented the data into time windows containing ground truth labels for ILO. Each window also contained 45 data features calculated from the frequency and time domains which were used to train a logistic classification machine learning model. In this initial study, the prototype device and model demonstrated 75% accuracy at distinguishing ILO episodes from other motion artifacts. Future works include continued efforts to (1) increase the fidelity of the model with alternative features and algorithms; and (2) conduct preclinical studies with participants at Indiana University School of Medicine, where clinicians can begin building a database of authentic ILO episodes.

Mentor(s):

Chi Lee, Biomedical Engineering, College of Engineering

Taewoong Park, Purdue University

College of Engineering

Alternative Energy Grid Integration and Systems (AEGIS): Modeling Distributed Energy Resource Integration with GridLAB-D

Author(s):

Kenneth Meng, College of Engineering

Elizabeth Thomas, College of Engineering

Matthew Tsortanidis, College of Engineering

Abstract:

The integration of distributed energy resources (DERs) in the power grid has been increasing in recent years and this trend is expected to continue in the future. Due to the intermittent behavior of renewable energy technologies and the complexity of the grid, many research projects have been focused on understanding what settings allow for the most reliable and resilient system. This project investigates the impact of DER integration on power distribution systems using GridLAB-D, a distribution system simulation software. Scenarios under hot and cold weather conditions are studied to analyze the effects of such stresses on the system.

Most DERs are interfaced with the grid using power electronic inverters. In accordance with Section 5.3 of the IEEE 1547 standard, these inverters must be capable of operating in a variety of control modes (e.g. constant PF, VOLT-VAR) (IEEE Standard 1547-2018). The impacts of these modes of operation on the distribution system are evaluated in this project. To do this, performance metrics such as real and reactive power generation from DERs and voltage profile at select locations are established. The impacts of various load profiles and inverter control modes on these performance metrics are studied through numerical simulations of a realistic feeder model.

Mentor(s):

Dionysios Aliprantis, Electrical & Computer Engineering, College of Engineering

Loraine Navarro Estrada, Purdue University

Dakota Hamilton, Purdue University

Honors College

Characterization of In-Vivo Rat Microelectrode Insertion

Author(s):

Isaac Meng, College of Engineering

Abstract:

This study looks to characterize different aspects of microelectrodes in relation to their insertion into in-vivo rat animal models. In particular, this study examines how differences in probe diameter, tip geometry, and insertion speed of 90:10 Platinum Iridium (PtIr) microelectrodes affect insertion forces and their self-penetration length (a metric defined as maximum length of a given electrode that will always result in successful insertion). Along with those three dimensions, force vs. insertion distance is examined for its differences from ex-vivo insertions. The self-penetration length data provides a framework for choosing optimal designs for long term chronic brain microelectrode data collection that results in minimal harm and maximum longevity. The examination of force vs. insertion distance provides further strong evidence as to why ex-vivo studies of microelectrodes are not translatable to in-vivo applications, as well as a useful look into what proper insertions will look like from a force perspective. The analysis of the three microelectrode aspects vs. force provides individual empirical data that elucidates their impact on brain insertion as a whole.

Mentor(s):

Muhammad Abdullah Arafat, Electrical & Computer Engineering, College of Engineering

College of Science

Heterogeneous Nucleation on the Ancient Moon

Author(s):

Katherine Meves, College of Science

Abstract:

Recent studies have shown that the ancient Moon may have been home to a conventional collisional atmosphere (Needham and Kring, 2017). If this were the case, the possibility of clouds and furthermore, a water cycle on the ancient moon arises. With current predictions, not all of the ice present on the lunar surface is accounted for, and introducing the presence of ice clouds along with a transient atmosphere could address a solution.

To study the potential nucleation properties of water ice clouds on the moon we have created a droplet freezing array (Budke and Koop, 2015). Runs conducted with droplets of 3-5 microliters have portrayed freezing properties of pure, deionized water droplets. The process was then repeated for water droplets containing a small fraction of JSC-1A Lunar simulant to emulate potential lunar heterogeneous nucleation.

I have hypothesized that the presence of latent heat, released from the freezing of molecules, along with a proposed slightly thicker lunar atmosphere, will increase the temperature compared to what has been previously predicted by the ROCKE-3D model (Aleinov et al, 2019). If the presence of clouds on the ancient moon is plausible, the transportation of water in the atmosphere could lead to the emplacement of water in permanently shadowed regions, creating polar ice caps on the lunar surface.

Mentor(s):

Alexandria Johnson, Earth, Atmospheric, and Planetary Sciences, College of Science

College of Agriculture

Impact of Oncometabolites on Transcription-Related Phenotypes Linked to Histone Methylation

Author(s):

Allison Milicia, College of Science

Abstract:

Redacted.

Mentor(s):

Ann Kirchmaier, Biochemistry, College of Agriculture

Ronard Kwizera,

College of Agriculture

Sensitivity of Total Phenolic Compounds of Potato Peels Under Various Conditions

Author(s):

Heather Milliron, College of Agriculture

Abstract:

Potatoes (Solanum tuberosim L.) are considered to be a popular crop, stable food source, and the most processed food globally. They provide various nutrients to the human diet like minerals, vitamins, and amino acids. Before potatoes are processed, the majority of them are peeled thus increasing the amount of food waste in the United States. Potato peels (PP) contain valuable phenolic compounds that can be extracted with various methods. In this study, the efficiency of different extraction methods was evaluated for recovering phenolic compounds in PP. These methods included direct ultrasound-assisted extraction (DUAE) and convectional shaking extraction (CSE). Some parameters that affected the extraction of TPC are extracting time, drying temperature, and stability of various conditions were evaluated. The experimental results showed that DUAE was more effective in extracting TPC compared to CSE and that the extraction time and particle contamination strongly impacted the total phenolic compounds of the PP extract. The antioxidant activity of the extract shows that increased extraction time should have a strong antioxidant capacity. Those results also suggest that DUAE has the chance to transfer PPs from food waste to a valuable compound. Further studies that should be done are profiling and kinetic modeling for more understanding of the efficacy of the ultrasound-assisted extraction of TPC from PP waste.

Keywords: Potato peels, total phenolic compounds, direct ultrasound-assisted, convectional shaking, antioxidant activity

Mentor(s):

Qin Xu, Food Science, College of Agriculture

College of Health and Human Sciences

Experiences of youth with autism spectrum disorder when starting up in 4-H

Author(s):

Lillian Millspaugh, College of Health & Human Sciences

Abstract:

Organized extracurricular activities such as 4-H have numerous benefits for children with autism spectrum disorder (autism; Bonhert et al.) Despite the benefits of extracurriculars for those with neurodevelopmental disorders like autism, research shows that there is lower participation among neurodivergent individuals. The goal of the current study was to analyze the experiences youth with autism have when beginning in 4-H programs. Participants included six males with autism who had participated in 4-H programs, ages 13 to 19 years (M = 13, SD = 7.49). Participants were interviewed about their experiences participating in 4-H and included questions related to enrollment. Transcripts were analyzed using a thematic analysis approach (Braun & Clarke, 2006). An initial codebook was developed through reading interview transcripts. Two researchers then applied the codebook to each transcript and disagreements were resolve through full team consensus meetings. The final stages involved using a data-driven approach to identify sub-themes and define and name the themes. Analyses identified five sub-themes related to enrolling in 4-H programs: connections, autonomy, motivation, adjustment, and enrollment experience. Results suggest that youth with ASD are mainly informed about 4-H through a parent or other family connection, rarely through educators or peers. Results additionally suggest that specific interest areas are a primary motivator when youth choose to participate in activities and programs. The biggest barrier encountered by youth was lack of information. In future studies research should be expanded to analyze diverse perspectives, such as those with intersectional identities.

Mentor(s):

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

Rose Mason, Purdue University

Veronika Peskova, Purdue University

College of Science

A systematic review of the diverse strategies for host-seeking behavior in the Uranotaeniini tribe of mosquitoes

Author(s):

Sydney Moeller, College of Science

Abstract:

Blood-sucking insects use different strategies to detect, locate and feed on their hosts. Among mosquitoes, host feeding behavior and specificity ultimately modulate disease dynamics and have relevant ecological and evolutionary implications. Here we synthesize current knowledge on the diversity of host-seeking strategies and host interactions in an understudied tribe of mosquitoes, Uranotaeninii (Diptera: Culicidae). To do so, we performed a systematic review using two databases (Web of Science and Google Scholar) to identify studies of mosquito species in this group and bring together research published across a wide range of journals worldwide. Our findings reveal that this clade feeds on a wide diversity of hosts including invertebrates as well as ectothermic and endothermic vertebrates. In addition, some species in this genus are vectors of disease, transmitting, among others, Eastern Equine Encephalitis Virus and West Nile Virus to both non-human and human animals. We examine the diverse mechanisms behind host-seeking behavior in these mosquitoes to broaden our understanding of the different strategies used to detect, recognize, locate and feed on their hosts. By integrating key natural history information on Uranotaeninii, this work assembles for the first time our knowledge on this taxonomic group identifying fertile gaps for future research. Ultimately, this work provides valuable insights into the strategies used by mosquitoes to overcome the challenges associated with attacking a broad array of hosts. In addition to broadening our understanding of the ecology and evolution of this tribe, this information could lead to designing effective strategies to mitigate disease transmission.

Mentor(s):

Shilpi Singh, Biological Sciences, College of Science

Ximena Bernal, Purdue University

College of Health and Human Sciences

Human Subject Recruitment: Lessons Learned from a Parkinson's Study

Author(s):

Dilhara Moonesinghe, College of Health & Human Sciences

Abstract:

Human subject recruitment is often a challenge, and even more so among populations facing chronic, debilitating illnesses. In this presentation, we summarize common strategies for human subject recruitment, the pros, and cons of each, and discuss our strategies to recruit participants for a fully virtual Parkinson's Disease end-of-life study. The goal of the Parkinson's Disease study is to generate content for a Parkinson's Disease end-of-life decision-making tool. Participants completed a one-hour semi-structured interview on their medical and lifestyle decision making and provided feedback on an end-of-life resource draft. Health care providers, family caregivers, and patients with Parkinson's Disease participated. We began recruitment for a pilot (n=5) with health care providers and family caregivers of patients with Parkinson's Disease in the summer of 2021. We then recruited additional health care providers, caregivers, and patient with Parkinson's Disease (n=29) from October 2021 to January 2022. We used snowball sampling and convenience sampling through partnerships with local neurology clinics, Parkinson's support groups, Parkinson's exercise groups, and a Parkinson's community newsletter. Information from this presentation may assist other researchers in better recruiting human subjects for clinical studies and provide guidance on the use of different recruitment strategies.

Mentor(s):

Jiayun Xu, Nursing, College of Health & Human Sciences

Poster Presentation Abstract Number: 193 :: Life Sciences

College of Health and Human Sciences

Investigating Dopaminergic Pathway Perturbations Following Developmental Atrazine Exposure

Author(s):

Kaylin Moore, College of Health & Human Sciences

Abstract:

Atrazine is an herbicide used throughout United States agriculture to control broadleaf weeds. Atrazine moves from soil into drinking water sources. Currently the US EPA maximum contaminant level for atrazine in drinking water is 3 ppb (μg/L). Atrazine is a known endocrine disrupting chemical, impacting the neuroendocrine system (hypothalamus/pituitary) and downstream endocrine axes. The hypothalamus also functions in releasing dopamine, which plays a role in motor control. Previous studies have shown atrazine exposure decreases locomotion as well as disrupts dopaminergic neurons, but primarily focus on alterations in the substantia nigra. The goal of this study is to identify if an embryonic atrazine exposure alters expression of genes associated with dopaminergic pathways in the zebrafish larvae and to identify if dopaminergic pathway perturbations are specific to the hypothalamus, other brain regions where dopamine neurons are present, or multiple brain regions. First, zebrafish were bred and the embryos exposed at four different atrazine concentrations (0, 0.3, 3, or 30 ppb) through embryogenesis. Following exposure, larvae were collected for RNA isolation, cDNA synthesis, and analysis of gene expression via qPCR. Primers targeting dopamine receptor genes (drd1a, drd1b, drd2a, drd2b, drd2l, slc18a2) were designed and confirmed within the zebrafish genome. Different concentrations of cDNA were tested to determine the optimal amount to be used when running qPCR of each dopaminergic gene. qPCR analysis of each target gene is now being completed to determine if atrazine exposure alters gene expression. This will be followed by analyzing brain-region specificity using immunohistochemistry (IHC).

Mentor(s):

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

Sydney Stradtman, Purdue University

College of Engineering

Climate Justice in Engineering Education

Author(s):

Tyler Morgan, College of Engineering

Abstract:

The goal of this research is to design a learning module for Purdue first-year engineering (FYE) students to learn climate fundamentals, and the role of engineers in responding to climate justice challenges. There is a lack of climate material within these classes currently, leading to a lack of climate conscious engineers in the future. The project entailed reviewing and synthesizing a wide variety of previous research on climate change education in engineering, including key learning objectives and their assessment. Because one of the key foci of the first-year engineering sequence relates to data analysis and management, we focused our work on identifying climate data sets compatible with current curricular materials and application tools in the course. We designed a module to fit within the learning targets of ENGR 132, while also including new learning targets identified in previous research that could be easily implemented within the guidelines of ENGR 132. Climate data forms a useful example of the kinds of complex data management challenges engineers face now and in the future. In particular, the problem of climate change reveals structural inequities that engineers must address in their design of solutions. Climate change is one of the grand socio-technical challenges of our day, and thus has the potential to engage many FYE students in discovering how different disciplines of engineering (and disciplines beyond engineering) can contribute to climate solutions. The module will be delivered to a key faculty member in Engineering Education for further development and implementation in the course.

Mentor(s):

Donna Riley, Engineering Education, College of Engineering

Caroline Camfield, Purdue University

Poster Presentation Abstract Number: 195 :: Life Sciences

College of Agriculture

Identifying Bovine Respiratory Disease (BRD) through Nasal Microbiome

Author(s):

Kara Mosier, College of Agriculture

Abstract:

Bovine respiratory disease affects a copious amount of cattle. We know from studying BRD that there are four primary bacterial pathogens associated with animal mortalities, but there is no easy way to test for the presence of them on farms. We are determining the suitability of nasal swabs to determine the carriage of the BRD pathogens. The purpose of this study was to quantify the carriage and density of the bovine respiratory bacterial pathobiont Histophilus somni in healthy and infected beef cattle using qPCR. In the study, we investigated the carriage dynamics and density of this particular bacteria in the nasal passages of the healthy (N = 219) and infected (N = 224) cattle. We received nasal swabs from various farms that were then processed and extracted for DNA. The DNA was then plated onto various 96-well SyberWhite plates. The DNA was transferred from the "stock" 96-well plate to another 96-well plate to be run through qPCR. This was done three times to replicate the triplicate data we strived for. H. somni cultures were also used to create standard curves for the organism. These cultures were amplified using the same qPCR conditions as the nasal swab extracts. When data is completely collected from all the samples, we will compare samples with other research data on the other three pathobionts as well as overall compare the healthy versus sick cattle. We predict that we will see a higher level of all the pathobionts in the BRD infected cattle compared to the healthy cattle.

Mentor(s):

Timothy Johnson, Animal Sciences, College of Agriculture

Ruth Martinez, Purdue University

Johnnie Cheng, Purdue University

Poster Presentation Abstract Number: 196 :: Life Sciences

College of Agriculture

Multi-organ cell cycle suppression following fetal viral infection

Author(s):

Margaret Mulligan, College of Agriculture

Jocelyn Kleiman, College of Agriculture

Andrew Caldemeyer, College of Agriculture

Abstract:

Porcine reproductive and respiratory syndrome virus (PRRSV) infection in late gestation negatively impacts fetal development. The objective of this study was to identify which fetal organs are most severely impacted following infection and analyze the relationship between this response and previously established fetal phenotypes. RNA was extracted from fetal heart, liver, lung, thymus, kidney, spleen, and loin muscle, which were collected from late gestational gilts challenged with PRRSV. Initially, gene expression for three cell cycle promoters (CDK1,2 & 4) and one inhibitor (CDKN1A) were evaluated in the following phenotypic subsets: uninfected (UNIF), high-viral load viable (HV-VIA), and high-viral load meconium-stained (HV-MEC) fetuses from PRRSV infected gilts, and gestational age-matched controls (CON) from non-infected gilts. No differences between the CON and UNIF groups for any gene were found, signifying there was no impact of maternal infection alone. Relative to CON, HV-VIA and HV-MEC fetuses showed notable downregulation of at least one CDK gene across all the tissues except the liver. In contrast, CDKN1A was upregulated in all tissues except muscle. Further evaluation of additional genes known to be upregulated following the activation of P53 or TGFb/SMAD signaling cascades, indicated neither pathway was responsible for the observed upregulation in CDKN1A. Finally a second experiment using a larger unselected population of fetuses (N=96) identified higher correlation between cardiac and renal expression of CDKN1A and serum thyroxin and viral load. To conclude, these findings demonstrate the widespread suppression in cell division across all tissues in PRRSV infected fetuses and suggest a non-canonical regulatory mechanism.

Mentor(s):

Jonathan Pasternak, Animal Sciences, College of Agriculture

Purdue Polytechnic Institute

3D Printed Pressure Sensor

Author(s):

Mitesh Mylvaganan, Polytechnic Institute

Abstract:

Our research is focused on 3D printed ultra sensitive pressure sensors. The methods of making pressure sensors currently include slow or expensive methods. If we could 3D print them, it would allow for the sensors to be made in much higher quantities and for much cheaper.

A lot of processes can go into making a pressure sensor. They use either a mold and injection mold or use some sort of biological material. Our research focuses on flushing out the usage of 3D printers in this process to achieve optimal results for a fraction of the cost and time. We will be using the Elegoo Mars 3 for 3D prints with a resolution of up to 0.035 mm for high accuracy 3D prints. Our research also focuses on the shape of the pressure sensor. While there have been a few shapes already tested. We are experimenting with new shapes which may produce more accurate pressure readings. The design currently being tested has a mound shape with spikes on it, which has a large amount of surface area, while also providing a sharp point so there is a spike in pressure sensed when the sensor is pushed down. We will be testing the properties of certain designs and materials independently as control variables. This will allow us to find the combination of design aspects that work best. We hope to produce a fully functioning sensor that can be mass manufactured quickly and inexpensively.

Mentor(s):

Sunghwan Lee, Engineering Technology, Polytechnic Institute

College of Engineering

In situ characterization of atomic force microscopy tips damaged by compressive force

Author(s):

Siddharth Nathella, College of Engineering

Abstract:

Atomic Force Microscopy (AFM) uses a sharp cantilever mounted tip to measure surface structures down to the atomic level. Due to the central role tip material properties and geometry play in determining tip-sample interaction forces, the state of the tip has a strong influence on measurement results. In addition, changes in the tip during or between measurements can lead to poor repeatability. The lack of a convenient, fast, and reliable method of characterizing the state of the tip is a significant limiting factor in the broader and more productive use of AFM. In this work, we utilize AFM force-displacement curves to monitor tip properties. With this approach, the tip can be characterized quickly and without requiring equipment external to the AFM system. This enables the monitoring method to be implemented within many existing measurement workflows. We utilized this method to monitor changes in a set of silicon tips that were damaged by pressing them into a mica surface at progressively higher maximum forces. The resulting data showed two types of tip evolution which we hypothesize to be a fracture-dominated process and a plastic deformation-dominated process. The two processes can be identified through the trend in maximum tip-sample contact pressure during the damage process as a function of the force applied to the tip. Fracture-dominated processes have a strictly increasing contact pressure as a function of applied force. Plastic deformation-dominated processes increase to a peak pressure and then decrease with increasing applied force.

Mentor(s):

Ryan Wagner, Mechanical Engineering, College of Engineering

College of Liberal Arts

The Impact of Childhood Disadvantage on Cognitive and Physical Impairment in Older Adults – A Review

Author(s):

Sam Nemeth, College of Liberal Arts

Abstract:

With an aging population that is rapidly growing and continues to be at risk of cognitive and physical impairments, there is a need to better understand how social factors experienced in childhood and adulthood contribute to these impairments. We examine the current literature to see the impact of factors such as low childhood socioeconomic status, limited educational attainment, and relationship quality. We draw from cumulative inequality theory and stress process theory in order to better understand the connectivity of various studies and how the findings generate a larger picture of the impact of childhood disadvantage (CD) on later-life impairment. Examining this literature provides insight into the cognitive and physical limitations older adults experience and allows for the investigation of potential causes. The literature suggests several pathways that can influence cognitive and physical impairments in later life, one such pathway includes CD. In the papers reviewed, CD is found to be significant contributor to older adults experiencing cognitive and or physical limitations. This suggests the importance of interventions in early life to reduce the risk of impairment in later life.

Mentor(s):

Patricia Thomas, Sociology, College of Liberal Arts

Poster Presentation Abstract Number: 200 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Implementation and Assessment of Highway Work Zone Intrusion Alert Technologies

Author(s):

Bach Nguyen, College of Engineering

Abstract:

Highway construction work zones are too risky to manage due to the dynamic and complex nature of events and are frequently associated with high rates of worker accidents. Work Zone Intrusion Alert Technologies (WZIAT) are the type of safety systems used in roadway work zones that use sensors and alarms to detect intruding vehicles to alert field workers and secure time for them to move out of harm's way. Existing transportation studies show that these emerging technologies can improve work zone safety however, limited institutions have adopted WZIAT and there is no set of guidelines for such institutions to employ them. Thus, this research aims to assess the effectiveness of WZIAT in controlled off-road conditions, and active INDOT construction and maintenance work zones to understand their capabilities, concerns, and barriers and offer recommendations on their implementation. Additionally, the driving behavior of drivers is identified as the main contributor to fatal work zone crashes and is considered as a convoluted activity that comprises cognitive processes such as attention, hazard identification, situational awareness, and decision making under risk. The same applies to highway workers while reacting to the activated intrusion alarms by identifying the source and direction of hazard to vacate the work zone. Thus, it is crucial to investigate how the cognitive processes of drivers and workers are associated with WZIAT integration to advance various countermeasures to avoid work zone accidents. In this study, the emerging sensing technologies, Brite fNIRS, Empatica Wristband, and Tobii Pro Glasses 2 are applied to examine driver/worker-WZIAT teaming under risk.

Mentor(s):

Hrishikesh Pokharkar, Civil Engineering, College of Engineering

Sogand Hasanzadeh, purdue university

College of Pharmacy

Evaluation of the electrical activity of human-induced pluripotent stem cell-derived cortical spheroid neuronal networks carrying a Nav1.2-L1342P Epilepsy Genetic Variant using a multi-electrode array (MEA) recording system

Author(s):

TRANG NGUYEN, College of Pharmacy

C. MAXIMILLIA OTTERBACHER, College of Science

MUHAN WANG, College of Pharmacy

Abstract:

Voltage-gated sodium channels are essential in excitable cells such as neurons. They play a role in action potential generation and propagation. SCN2A gene encodes for Nav1.2, a transmembrane voltage-gated sodium channel expressed in the neurons. Mutations in this gene have been associated with benign infantile familial seizures (BIFS), epileptic encephalopathy, autism spectrum disorders (ASD), and developmental delays. Genetic variants resulting in Nav1.2 gain-of-function (GOF) are often associated with BIFS and epileptic encephalopathy, while variants resulting in Nav1.2 loss-of-function (LOF) are generally associated with ASD. Our project will explore two SCN2A disease-related variants, namely L1342P (GOF) and C959X (LOF), using human-induced pluripotent stem cells derived cortical spheroids. Cortical spheroids are in-vitro generated 3D aggregates that resemble the features of the brain. They possess a complex cellular composition and, when mature, can display electrical activity. They are valuable tools in neuroscience to understand disease mechanisms and test novel interventions in vitro [1]. In our experiments, spheroids carrying our mutations of interest are assessed via a multi-electrode array (MEA). The MEA system that we use in our lab array consists of 16 electrodes that can measure the electrical activity of the organoids non-invasively. Our goal is to observe the impact of the disease-causing L1342P mutation on the mature neuron functions. We will present several parameters, including mean firing rate [2], number of bursts, burst frequency, and burst duration. Our preliminary findings suggest that spheroids carrying the L1342P variant display hyperexcitability phenotypes. Our data support the use of stem-cell-derived platforms for studying SCN2A-channelopathies.

Mentor(s):

MARIA OLIVERO-ACOSTA, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

ZHEFU QUE, Purdue University

YANG YANG, Purdue University

Honors College

Abbreviated Fatigue Spectrum Analysis

Author(s):

Jacob Nylen, College of Engineering

Abstract:

One very common mode of failure for mechanical parts is fatigue failure, in which a part experiences cyclic loading until the repeated stresses cause deformations to the point of failure. Before implementing a new part onto an existing system that experiences cyclic loading, TTX company has the part undergo fatigue testing in order to characterize its performance throughout its lifetime. These tests can take a lot of time to perform and TTX only has access to one testing apparatus for a new part they wish to implement on their train cars. This creates bottle necks for the number of tests that can be run on specific iterations of the part. The task of this project was to develop a set of abbreviated test specification based on previous fatigue testing data in order to extrapolate the expected performance of a part in testing without running the test all the way until failure. In order to do this, I analyzed previous successful testing data to identify key performance parameters for predicting the success of a part. From here I consolidated all of the key parameters into a set of specification for grading parts during abbreviated tests. This allowed for more iterations of the part to be tested in a shorter time, leading to quicker feedback for design changes and verification in manufacturing methods.

Mentor(s):

Roshan Manibharathi, TTX

David Cannon, TTX

College of Engineering

Development of a Stereo DIC Measurement System to Characterize Electronic Package Component Displacement

Author(s):

Sean O'Sullivan, College of Engineering

Abstract:

An electronic, Heterogeneously Integrated (HI) package experiences a multitude of mechanical and thermal processes during manufacturing and over a product's lifecycle. These processes often lead to undesirable warpage of HI packages which can negatively impact assembly yield during fabrication and failure modes during use. To address the need to quantify warpage issues, many experimental methods have been developed. One method in particular is 3D Digital Image Correlation (DIC). 3D DIC is viewed as an attractive experimental measurement method due to its ability to characterize out-of-plane warpage in a non-invasive manner. Hence, the development and construction process of a stereo DIC experimental measurement system to perform measurements on real world electronics packaging components will be carried out. To accomplish the needs set forth, the following tasks will be conducted. 1: Review past literature to understand the current state-of-the-art DIC measurement techniques. 2: Identify and develop an image processing solution for use with captured DIC images. 3: Develop computer-aided (CAD) models of needed components for manufacture. 4: Fabricate the designed components. 5: Assemble the DIC system components. Lastly, the DIC system will be tested against a known solution to quantify its effectiveness with respect to warpage characterization.

Mentor(s):

David Halbrooks, Mechanical Engineering, College of Engineering

Mohit Goswami, Purdue University

College of Engineering

Multimode Four-Photon Correlation from a Room-Temperature Atomic Lattice

Author(s):

Hal Owens, College of Engineering

Abstract:

We report on experimental observation of four-photon correlations achieved by exciting Mollow triplet resonances in warm Rb atoms. We observe that in certain frequency ranges, a standing-wave pump can give rise to enhanced directional and correlated Raman scattering. A pair of Raman-scattered multimode beams are created in opposite directions with circularly symmetric (ring-shaped) patterns in the transverse direction. Using a single-photon-sensitive EMCCD camera, we observe intensity and spatial correlations between the co-propagating and counter-propagating spatial modes. We observe relative intensity noise reduction of about 20dB and intensity correlation between more than 200 spatial modes. We show that simple image processing can be used to extract higher correlations from the beams. A multimode photon source of this kind could pave the way for new applications in quantum communications and quantum imaging. Potentially opening the door to sub shot noise quantum imaging.

Mentor(s):

Hosseini Mahdi, Electrical & Computer Engineering, College of Engineering

Haechan An, Purdue University

College of Engineering

VIP IPA: Nuclei Segmentation and Counting on Microscopy Images

Author(s):

Tikhon Pachin, College of Engineering

Yu-Hsuan Lin, College of Engineering

Shang-Hsuan Lee, College of Engineering

Kotekar Annapoorna Prabhu, College of Engineering

William Stevens, College of Science

Abstract:

The Nuclei segmentation and counting team has managed to successfully implement filtering tools for image segmentation and counting preprocessing, which has been a crucial part of cancer research for over 10 years. This semester's work on the project covers the finalization of the Watershed segmentation logic, optimization of the current processes and construction of the cell classification neural networks.

Watershed segmentation is used to visualize a microscopy image as a topographical map and analyze the relief to place watersheds around the edges of the basins. Those edges represent cell borders on the original image. The preprocessing steps include the areas of interest detection algorithm, image to topographical map transformation, and basin minima detection algorithm. The Watershed segmentation logic involves image flooding, overflow protection and image analysis for watershed placement. Classification logic mostly includes feature extraction algorithms, loss function selection and construction of the convolutional neural networks.

Image preprocessing, such as areas of interest detection algorithm and topographical map extraction, can be found in the works of the team from the Fall 2021 semester. This semester's preprocessing work was focused on the K-means regional minima detection algorithm with the addition of the H-minima transform, partial image analysis utilizing a connected components algorithm, flooding and overflow protection for border detection, and construction of convolutional neural networks for cell classification.

The expected output of the current semester's work is a generalized algorithm to segment cells on any microscopy image as well as a classification algorithm to identify different types of cells with a potential anomaly detection feature.

Mentor(s):

Edward Delp, Electrical & Computer Engineering, College of Engineering

Carla Zoltowski, Purdue University

College of Engineering

Soluble Precursors for Chalcogenide Semiconductors Containing Alkaline Earth Metals

Author(s):

Isabel Panicker, College of Engineering

Abstract:

Chalcogenide Perovskites have emerged as an exciting class of materials for solar energy generation. The Chalcogenide Perovskites crystalline structure has a general formula of ABX_3 where A is a 2+ cation, B is a 4+ cation, and X is a chalcogen anion. Generally, the A cation is an alkaline earth metal, and the B cation is a group IV transition metal. These compounds are known to strongly absorb light, and unlike the Halide Perovskites, they are highly stable. We aim to synthesize Chalcogenide Perovskites ($BaZrS_3$, $SrZrS_3$, $CaZrS_3$) with a solution-based approach. However, there is very little work on soluble complexes that contain A-S bonding (A = Ba, Sr, Ca). Therefore, in this project we seek to develop soluble metal thiolates for these alkaline earth metals. We synthesized the soluble complexes and then verified their structure with proton NMR. Using these soluble complexes, we then decomposed them into the respective metal sulfides by drop coating them into films. Analyzing these films with XRD, we were able to verify that these soluble complexes decompose into the desired metal sulfides. This result is key to beginning the process of synthesizing chalcogenide perovskites using a solution-based approach which can then allow for the fabrication of Chalcogenide Perovskite solar cells.

Mentor(s):

Jonathan Turnley, Chemical Engineering, College of Engineering

Rakesh Agrawal, Purdue University

College of Engineering

The Affects of Outdoor Environmental Conditions on the Performance of HVAC Filters Operating on 100% Outdoor Air

Author(s):

Hajin Park, College of Engineering

Abstract:

People spend an average of 80-90% of their lives indoor. Filtration is the primary method to protect occupants from harmful particulate matter (PM) from the outdoor environmental air as well as the prevention of indoor pollutants from recirculating within the enclosure. However, little is known on the in-situ filter performance as many related studies test filter performances in controlled, laboratory settings. The effects of how outdoor environmental conditions impact the performance of the filters is not well understood.

This work provides the first usage of 100% outdoor air on HVAC filters over 1 year. The test rig compromises of 3 HVAC ducts under ASHRAE standards with Minimum Effective Rating Values (MERV) 8 (Pileated Filter), 13 (Bag Filter), and 14 (Box Filter) with a MERV 8 pre-filter in each duct. Two major performance factors were considered for this study: Relative Humidity (RH) and precipitation. These two variables were paired with Pressure Drop (PD). The major findings of this study shows that RH has a strong positive correlational trend with PD while rain and snow can cause different trends entirely.

Future analysis will scale the PD by the flowrate to normalize PD and excluding flowrate factors. The result of this study provides insight on how outdoor air affects the performance of HVAC air filters and to increase discussion on this topic. In addition, the study provides insight on how environmental factors impact the filter's PD which directly effects the energy cost of the HVAC system.

Mentor(s):

Brandon Boor, Civil Engineering, College of Engineering

Chunxu Huang, Purdue University

Poster Presentation Abstract Number: 208 :: Mathematical/Computation Sciences

College of Engineering

TensorFlow Model Garden

Author(s):

Feny Patel, College of Engineering

Abstract:

The goal of the TensorFlow Model Garden research team is to implement state-of-the-art object detection models in TensorFlow using open-source guidelines. This aim is further extrapolated to researching the challenges faced when implementing such models. Specifically, this study focuses on the challenges encountered when implementing YOLOX, an anchor-free object detection algorithm. Mainly, two types of obstacles are presented here. Firstly, it was found that there are discrepancies in the author's literary work and the official implementation of the model. Sometimes, it also relates to ambiguous/alluded information present in the paper. In YOLOX, we discovered that the research paper has little information on how the YOLOv3 baseline, a previous model of the YOLO family, is trained. Moreover, the implementation is not provided by the author as well. The second challenge discovered in implementing YOLOX is due to the difference between the two machine learning software libraries: PyTorch and TensorFlow. In the case of YOLOX, it was found that it is straightforward to implement the SimOTA, a label assignment strategy used in YOLOX, in Pytorch (author's implementation). However, accomplishing the same in TensorFlow is a challenge since TensorFlow does not support Variable-length tensors.

Mentor(s):

James Davis, Electrical & Computer Engineering, College of Engineering

College of Health and Human Sciences

Caregiver Outcome Priorities for the Angelman Syndrome Community

Author(s):

Mili Patel, College of Science

Abstract:

Redacted.

Mentor(s):

Carolyn McCormick, ,

Veronika Peskova, Purdue University

Bridgette Kelleher, Purdue University

College of Science

Dynamic Conformation of Phospholipase C-β is Important for Direct Gβγ Activation

Author(s):

Sanika Pelnekar, College of Science

Siddhi Shetty, College of Science

Abstract:

Phospholipase C (PLC) is vital regulatory enzyme in mammals, as they regulate calcium-based signaling pathways important for normal cardiovascular function. PLCβ hydrolyzes phosphatidylinositol 4,5-bisphospate (PIP2) to inositol 1,4,5-trisphosphate (IP3) and diacylglycerol (DAG) in response to stimulation of G-protein coupled receptors (GPCR). Previous research has shown that an aberrant PLCβ activation and/or expression is associated with cardiac hypertrophy and heart failure. The goal of this project is to use structural and functional studies of PLCβ in vitro to better understand its regulation, and ultimately help validate the enzyme as a drug target for cardiovascular disease. One outstanding question is how PLCβ is activated by the Gβγ heterodimer, which binds directly to the lipase to increase its activity in response to GPCR stimulation. Previous work from our lab and others suggests that Gβγ binds to a conformationally dynamic region of the lipase formed by its N-terminal pleckstrin homology (PH) domain and EF hands. We are using site-directed mutagenesis to introduce disulfide bonds within these domains to trap different conformational states. The mutant proteins are then purified under reducing or oxidizing conditions, stabilizing the conformation for functional assays, including thermal denaturation assays, and basal and Gβγ-dependent activation assays.

Mentor(s):

Igi Vilza, ,

Angeline Lyon, Purdue University

Purdue Polytechnic Institute

Cloud-native Application Performance Metrics for Resource Monitoring

Author(s):

Justin Petri, Polytechnic Institute

Abstract:

Like all software, cloud systems do not always perform predictably. It can be difficult to diagnose what is wrong with the application in question between crashes and sudden drops in speed. Developers can use Application Performance Metrics (APMs) to identify critical issues; however, there are no general frameworks that provide consistent performance metrics across many systems. We propose a unified framework to obtain, manage and employ application performance metrics for cloud-native environments. Cloud-native application deployments can take advantage of our proposed framework for resource management (i.e., scaling). Our framework can help identify issues faster, reduce development times and pinpoint specific areas of concern for application security teams.

Mentor(s):

Deepak Nadig Anantha, Computer Information, Polytechnic Institute

College of Education

Exploring Purdue Teacher Education Program: Focus on Diversity, Equity, and Social Justice

Author(s):

Julia Pirrello, College of Education

Abstract:

During this time of heightened awareness of social injustices via Black Lives Matter protests, the Me Too movement, and the COVID-19 pandemic, it is important to ensure that teacher preparation curriculum includes attention to knowledge and skills related to social justice issues in education. The purpose of this study was to investigate the ways in which social justice, diversity, and equity are addressed in the foundational courses of the Purdue Teacher Education Program (PTEP). McDonald (2005) proposed a framework in which social justice is integrated across all experiences (e.g., courses, activities) in a teacher education program. In an analysis of PTEP, we found that each required course referenced social justice, diversity, and/or equity, albeit to varying degrees, including practical applications of knowledge related to these ideas. In her framework, McDonald recommended conceptual and practical tools related to social justice. In PTEP, such tools (e.g., differentiation, Universal Design for Learning, culturally responsive teaching) are incorporated across multiple courses through readings and assignments. In this investigation, we used curricular analyses, faculty input, and student experiences to identify the nature of social justice references in the program curricula, and also highlight productive connections that begin in the foundations courses and could be continued into the methods courses later in the program. With a better understanding of the program curricula, personnel can both enhance opportunities in their own courses, as well as capitalize on experiences offered in other courses.

Mentor(s):

Jill Newton, Curriculum & Instruction, College of Education

College of Engineering

System on Chip Extension Technologies: Printed Circuit Board and Post-Silicon Team

Author(s):

Akshaj Prasannakumar, College of Engineering

Peter Spina, College of Engineering

Aidan Prendergast, College of Engineering

Abstract:

The AFTx05 Printed Circuit Board (PCB) Team works to design and fabricate a PCB targeted for enabling test and program execution routines of the AFTx05 (x05) System-on-Chip (SoC). The x05 SoC builds upon the capabilities of its predecessor, exhibiting new sparsity optimization, electromigration test structure, and polymorphic logic features. Additional improvements include pulse width modulation, timer structure, and external SRAM memory capacities. Previous semesters of research worked towards a PCB schematic and physical layout preparation. This previous design required an Intel Max10 FPGA as a central routing and SRAM module. This part was unavailable, resulting in necessary redesign around available parts.

There are four major working constraints of the x05 chip to contend with when designing a compatible PCB test system. These include a 1.2V core voltage, an accessible 50Mhz clock, a minimum 60 I/O pins for throughput, and sufficient logic to act as off-board SRAM. The FPGA most befitting of these requirements was determined to be the Xilinx Artix 7. Additional research work entails the synthesis of x05 diagramming and documentation as developed by previous researchers with the SoCET team. A full pinout of the x05's package is necessary for routing and layout work in addition to configuring data transfer from the x05 to the device peripherals. The FPGA Mezzanine Connector (FMC) was discovered as an effective protocol for communication between the Artix 7 and the x05 still functional at the 1.2V requirement.

Four future objectives are clear in order to complete PCB development. Additional information must be gathered about the x05 chip's more complex functionality, a layout must be designed for the board, parts must be sourced, and the board must be fabricated and tested. The team hopes to achieve as much as possible before the end of the semester to the benefit of the next x05 team.

Mentor(s):

Matthew Swabey, College of Engineering

Honors College

How a Puzzle Game can bring Creativity to Science

Author(s):

Mike Psimos, College of Science

Abstract:

Redacted.

Mentor(s):

Zahra Tehrani, Honors College

College of Health and Human Sciences

Audiovisual Phonological Representations in Siblings of Children with Developmental Language Disorder (DLD)

Author(s):

Rhiana Ragheb, College of Health & Human Sciences

Abstract:

Children with developmental language disorder (DLD) demonstrate linguistic deficits that extend into the visual modality, affecting the processing of visual speech cues, such as lip shape. DLD appears to run in families and likely has a genetic component. The current study used event-related potential (ERP) and behavioral measures to investigate whether siblings of children with DLD also show atypical processing of visual speech information. Eighteen children with DLD, 10 of their unaffected siblings, and 18 children with typical development (TD) participated in an audiovisual oddball task. Children saw images of a talker's face and heard the vowels [i] and [u], with one vowel occurring frequently and the other only occasionally. The talker's mouth was closed in the neutral condition, with visual cues playing no role in speech processing. In the audiovisual violation condition, the talker's mouth shape always matched the frequent vowel, leading to an audiovisual conflict whenever the rare vowel was played. Children pressed a button when they saw the talker's face assume a silly expression. In children with TD, rare vowels elicited a significant brain response in the audiovisual violation condition only. No brain response specific to rare vowels was observed in children with DLD in either condition. Siblings also showed no brain response to rare vowels in the audiovisual violation condition, but, unexpectedly, showed a response in the neutral condition. This suggests that siblings, like their DLD relatives, do not incorporate visual information into long-term memory representations of speech sounds the way children with TD do.

Mentor(s):

Natalya Kaganovich, Speech, Language, & Hearning Sciences, College of Health & Human Sciences

Jennifer Schumaker, Purdue University

College of Engineering

A Dynamic Computer vision approach for predicting the force in Pulling and Pushing

Author(s):

Sahana Rayan, College of Science

Abstract:

Overexertion due to excessive pushing and pulling are a leading cause of musculoskeletal disorders among industry workers. Preventing these injury risks would require early detection of force exertion levels which is challenging. Current methods of detecting pushing and pulling are intrusive, and thereby there is a need for an automated and non-intrusive method for assessing the force exertion levels during pulling and pushing. This study aims to develop a computer vision method for assessing the force exertion levels. To achieve this goal, a pulling and pushing experiment was conducted. 30 participants performed 15 pushing tasks (3 trials of 5 different exertion levels each) and 15 pulling tasks with two 3D cameras surrounding them. The proposed technique first extracted location coordinates on the face and the body for each timestamp in the video using the OpenFace and the OpenPose techniques, respectively. These coordinates were used to extract static features, like the average distance between feet, and dynamic features – average change in relative elbow location between timestamps. These features will be used to train a logistic regression model for classifying the force exertion levels (high or low). In addition, the features will be used to train a random forest model for classifying the pulling and pushing tasks. The future work of this study will be focused on collecting more data and discovering more representative features for developing a more accurate model.

Mentor(s):

Denny Yu, Industrial Engineering, College of Engineering

Guoyang Zhou, Purdue University

Poster Presentation Abstract Number: 217 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

Cold Eyes: Post-Mortem Iris Recognition Under Autopsy Procedures

Author(s):

Jordan Reining, College of Science

Abstract:

The purpose of this research project is to examine how autopsy procedures effect the quality of post-mortem iris recognition. Images of 73 eyes from 36 deceased individuals were collected using the Irishield 2120U iris scanner. Iris images were collected prior to autopsy procedures when the eyes are unaltered, after the vitreous humor was removed which resulted in the eyes deflating, and finally when saline was injected to reinflate the eye. The quality metrics of the images were compared between the three treatments. Quality score results suggested that adding saline to the eye during reinflation improves the initial image quality of the iris scan. In 27.7% of cases, there was an increase in saline quality of over 10 compared to that of the original quality. Additionally, Post Hoc (Games-Howell) tests revealed a significant difference between match scores of Original – Saline vs. Original – Deflated ($p < 0.01$) and Original – Saline vs. Deflated – Saline ($p < 0.01$). This result further supports our finding that reinflating the eye with saline improves quality and matching scores.

Mentor(s):

Kathryn Seigfried-Spellar, Computer Information, Polytechnic Institute

Stephen Elliott, Purdue University

College of Veterinary Medicine

The effect of transportation from commercial breeding kennels to a distributor on puppy welfare

Author(s):

Fiona Ridenour, College of Agriculture

Abstract:

Puppies from commercial breeding kennels (CBKs) are exposed to unpredictable environments when they are moved from their home kennels to a distributor. Novelty and unpredictability have been associated with increased levels of fear and stress in animals, which contribute to poor welfare. The aim of the current study was to assess the impact of transportation to a distributor on puppy welfare using behavioral metrics. Eight-week-old puppies (n= 249) from 12 CBKs were tested at their kennels of origin, and 3-4 days later after transportation to a distributor. At both time points, puppies were subjected to a one-minute social isolation test where their behavioral responses were continuously recorded. Wilcoxon-signed-rank tests indicated that puppies exhibited significantly less exploratory (Z= - 8.430, p< 0.001) and stationary (Z= -2.254, p= 0.024) behaviors and more locomotion (Z= -9.595, p< 0.001) and escape attempts (Z= -5.986, p< 0.001), body shake (Z= -3.390, p< 0.001) and elimination (Z= -3.695, p< 0.001) post-transportation than they did before transportation. This is the first study to assess the effect of transportation to a distributor on puppy welfare in CBKs and further research is needed to validate the tests and metrics used and to further explore puppies' responses to transport. However, these findings suggest that transported puppies experienced fear and distress that warrants intervention. Future research should explore the effects of different transport times and conditions on puppies and should examine the efficacies of interventions to mitigate or avoid transport stress entirely.

Mentor(s):

Candace Croney, Division of Diversity, Inclusion, and Belonging

Aynsley Romaniuk, Purdue University

Shanis Barnard, Purdue University

Alessia Diana, Purdue University

Poster Presentation Abstract Number: 219 :: Life Sciences

College of Science

Combining Chromatin Remodeling Complex Subunit Inhibitors and Enzalutamide for Prostate Cancer Treatment

Author(s):

Mallory Roach, College of Science

Abstract:

Currently, prostate cancer is the second leading cause of cancer death in American men. Enzalutamide, a second-generation small molecule inhibitor of the androgen receptor, is a common hormonal treatment option for prostate cancer. By inhibiting androgen receptor activity, this drug can effectively stop cancer cell growth that is fueled by androgen. Unfortunately, prostate cancer cells often begin to express resistance to enzalutamide. This leads to continual growth and metastasis making them more difficult to treat. Chromatin remodeling complexes (CRC's) are large protein complexes that interact with chromatin, a complex of DNA and proteins. Under certain circumstances, CRC's unwind chromatin and expose DNA. This process impacts the frequency of transcription of particular sequences. In certain types of cancer, specific chromatin remodeling complex subunits are frequently overexpressed aiding in cell growth. We hypothesized that treating with inhibitors to chromatin remodeling complex subunits may aid in the effectiveness of enzalutamide treatment. We investigated this hypothesis by treating prostate cancer cells, that are androgen-sensitive, with inhibitors to multiple chromatin remodeling complex subunits in addition to enzalutamide at varying concentrations. This allowed us to explore if chromatin remodeling complex subunit inhibitors are able to act synergistically with enzalutamide to induce cell death in prostate cancer cells. Once we identified a promising inhibitor, we explored the impact this epigenetic inhibitor has on genetic expression in prostate cancer cells and how this may impact enzalutamide resistance.

Mentor(s):

Emily Dykhuizen, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Sandra Ordonez-Rubiano, Purdue University

Surbhi Sood, Purdue University

College of Science

Elevation and wind direction controls on coastal Peruvian precipitation

Author(s):

Laura Rubio, College of Science

Abstract:

Arequipa, Peru, on the western coast of South America, experiences the impacts of water scarcity given it lies in the rain shadow of the Andes Mountains. Due to a persistent temperature inversion over the coastal Pacific Ocean, Arequipa receives most of its precipitation from humid air coming from the Amazon over the Andes. The influence of easterly winds leads to an elevation gradient where higher elevations receive higher amounts of precipitation. However, under less common conditions, there are cases where westerly winds can bring Pacific moisture to the region. During those times, lower elevations receive more precipitation. As sea-surface temperatures increase due to climate change, westerly influence may become more common, changing the spatial distribution of rainfall in the region. Water infrastructure is built to redirect high elevation precipitation to lower communities, so spatial changes in rainfall may increase water insecurity in some communities. In collaboration with the Arequipa Nexus Institute, we analyze precipitation data from the region. A regional network of collectors in Arequipa recorded daily rainfall, which were then used to plot precipitation against elevation. Using data from 17 stations active during 2020, the data showed a weak positive correlation between annual precipitation and elevation, with an R^2 of 0.26. The Peruvian government also publishes precipitation data on its SENAMHI server which showed a much stronger positive correlation between annual total precipitation and elevation, with an R^2 of 0.76. We will present results of daily precipitation gradients screened by dominant wind direction to identify potential Pacific moisture influence events.

Mentor(s):

Lisa Welp, Earth, Atmospheric, and Planetary Sciences, College of Science

Elizabeth Olson, Purdue University

Poster Presentation Abstract Number: 221 :: Life Sciences

Honors College

Developing a competitive inhibitor for SARS-CoV-2 using Foldit

Author(s):

Gracie Sanders, College of Science

Abstract:

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the pathogen that caused the COVID-19 pandemic. In human cells, the Angiotensin-converting enzyme 2 (ACE2) receptor binds the receptor binding domains (RBD) of the spike protein allowing for viral uptake of SARS-CoV-2. Binder proteins are a successful therapeutic because they have a large range of binding modes, can be delivered through the nasal cavity, and have many neutralizing sites. Using Foldit, an online program used to design potential binder proteins, we sought to design a stable protein that inhibits the interactions between ACE2 and the SARS-CoV-2-RBD. Foldit uses citizen scientists because people can engage the creative side of our minds whereas a computer must follow an algorithm. The proposed binder protein consists of 3 alpha helices and loops composed of 90 amino acids reaching a Rosetta energy score (relative protein stability) of 13,508.4. Alpha helices were determined to be the more stable secondary structure for inhibition. A total of 10 residues were added to the original template design. Binding was enhanced by filling voids and increasing Hydrogen bonds in the RBD interface to increase Van der Waals forces. The residues on the binding interface and between the strands are mostly hydrophobic in order to orient the protein via hydrophobic interactions. This research concluded that people can create successful binder proteins that could inhibit the relationship between SARS-CoV-2 and ACE2. If the protein design was created via peptide chemistry, it should have strong affinity to the RBD and cause competitive inhibition.

Mentor(s):

Zahra Tehrani, Honors College

Purdue Polytechnic Institute

Examining relationships between hormones, lupus severity and puberty via cross-feature visualization tool

Author(s):

Chintan Sawla, College of Science

Nathan Kanter, Polytechnic Institute

Abstract:

Systemic Lupus Erythematosus, more commonly known as lupus, is a chronic autoimmune disease that can target any organ in the body. Approximately 90% of all people with Lupus are women. This research aims to develop an interactive application that can aid in cross feature analysis of pre-pubescent Lupus data collected over a ten-year study. The cross-feature analysis incorporates a range of different variables for understanding the development of lupus and hormones amongst patients as they progress through puberty. In prior research done in the Byrd Visualization Lab, it was determined that symptom flares tend to worsen as an adolescent goes begins puberty. Building on our prior findings, this research explores whether multivariate data visualization can provide a new direction in examining relationships between specific hormones, lupus severity and puberty. The expected outcomes of this work are to: 1) visually represent the relationship between symptom flares and hormone development, and 2) determine what possible links there are between the measured hormones and Lupus symptom flares. Our analysis of the heatmap visualization, 4/6 of the puberty-based hormones,and all of the Lupus based hormones correlated with flares and Tanner, and none of the fat hormones (besides the puberty hormone Leptin) matched anything. The exceptions were two hormones that related to breast development (prolactin) and the menstrual cycle (progesterone). While these horomones will need to be explored in future work, the horomones that do have correlations support the prior discovery made that connects the start of puberty to increase severity in Lupus flares.

Mentor(s):

Vetria Byrd, Computer Graphics Technology, Polytechnic Institute

Oluwaseyi Jaiyeoba, Purdue University

Poster Presentation Abstract Number: 223 :: Life Sciences

College of Health and Human Sciences

Effects of Social Isolation on Strawberry Nesquik Consumption in High Alcohol Preferring Mice

Author(s):

Zainab Shaikh, College of Science

Abstract:

Alcohol use disorder (AUD) is a debilitating and prevalent public health concern linked to severe mental and physical health issues. An underlying characteristic that might help to better explain these differences, as well as differences in AUD susceptibility, is impulsivity, which has been shown to have a significant influence on drinking behavior. Prior research in the Chester laboratory found effects of social isolation on impulsive responding for reward (Strawberry Nesquik) in mice. The purpose of this study was to test a potential alternative interpretation of these prior results, specifically, whether social isolation alters general consummatory behavior for the Strawberry Nesquik reinforcer in a home-cage environment. The procedures and timelines of exposures to Strawberry Nesquik were matched to the previous experiment. Briefly, mice were food deprived for seven days and then given free-choice access to Strawberry Nesquik for 4 days. Then, mice in the social isolation group began social isolation for 28 days while the group-housed mice remained in their social housing groups. After this period, mice were again given access to Strawberry Nesquik for 4 days. Data analyses are currently in process.

Mentor(s):

Julia Chester, Psychological Sciences, College of Health & Human Sciences

Arbaaz Mukadam, Purdue University

College of Science

Agree to disagree? A national survey of biology researchers' and educators' conceptions of scientific hypotheses and predictions

Author(s):

Perion Sharp, College of Science

Mehul Shrivastava, College of Science

Abstract:

Guidelines for undergraduate biology education emphasize the evaluation of scientific hypotheses as a fundamental competency, but do not define their meaning and role in research. A widely accepted model of scientific inquiry posited by Popper (1959) established scientific hypotheses and associated predictions as two necessary components of causal explanations in science. However, there is a lack of consensus in modern literature regarding the concept and application of a scientific hypothesis, associated predictions, and the relationship between hypothesis and prediction. To address this gap, we conducted a national survey to characterize variation in contemporary conceptualization of hypotheses and predictions. We launched a survey across U.S. higher education institutions, targeting biology faculty and instructional staff. The survey included free-response questions regarding the definition of hypotheses and predictions and the relationship between them. Responses from 50 participants were analyzed using deductive and inductive thematic coding. In preliminary analysis of a subset of our data, we found that definitions included hypotheses as being explanatory and testable. However, other deductive codes were not present and additional ideas varied across participants. Most participants agreed that predictions are expectations related to an experiment, though other described attributes varied considerably. This trend of minimal agreement continued in participants' descriptions of the relationship between hypotheses and predictions. Contrary to Popper's ideas, some participants identified hypotheses and predictions as being equivalent. Our results indicate that contemporary ideas regarding the concepts of hypothesis and prediction are varied and have diverged from seemingly established ideas in the nature of science literature.

Mentor(s):

Anupriya Karippadath, Biological Sciences, College of Science

Stephanie Gardner, Purdue University

College of Liberal Arts

Assessing Global Governance Responses to Big Tech

Author(s):

Amanda Shie, College of Liberal Arts

Rachel Young, College of Liberal Arts

Abstract:

Big technology companies like Facebook and Google have amassed wealth by serving as gatekeepers of critical infrastructures of knowledge, connection, and desire. While such gatekeeping has resulted in a successful business model, it also has detrimental effects for privacy, information, speech, and monopoly. Moreover, Big Tech's virtual landscapes impact the entire global community. This research asks: how effectively has global governance responded to the evolving challenges of Big Tech power related to privacy, speech, and monopoly? To answer this question, this research draws from the Facebook Incidents Database, which uses news data (2004-2021) to track 4,316 Facebook incidents and over 900 Facebook-related regulatory scrutiny and lawsuits. The database is the first scholarly effort to organize Facebook's global incidents in issues ranging from speech, privacy, monopoly, fake news, and radicalization to place scandals like Cambridge Analytica into wider context. Specifically, we first use the database to catalog and evaluate formal (United Nations, Organization for Economic Cooperation and Development, World Bank) and informal (G7, G8, G20) global institutional responses to Big Tech's growing influence. Second, we present case studies on global institutional agenda-setting related to three major Facebook scandals: COVID-19 misinformation, terrorism, and the Rohingya genocide. We conclude by identifying which particular challenges of Big Tech power elicit the greatest responses on an international scale.

Mentor(s):

Swati Srivastava, Political Science, College of Liberal Arts

College of Science

Determining the Stability of Exoplanet Cloud Analogs in the Exoplanet ElectroDynamic Balance

Author(s):

Jasmine Singh, College of Science

Abstract:

Observations from the Kepler, Spitzer, and Hubble space telescopes have allowed us to study the atmospheres of planets orbiting other stars (exoplanets) located lightyears away. However, the characterization of these atmospheres is made difficult by the presence of clouds. One way to get around this is by studying the light scattering properties of exoplanet cloud analogs in the laboratory. This is achieved with the Exoplanet ElectroDynamic Balance (ExoEDB) in which single particles are suspended in an electromagnetic field and illuminated with a laser.

Prior to suspending and observing particles, they need to be generated. To this end we created an array of droplet generators capable of injecting a spray of charged droplets into the ExoEDB, which could then be trapped and stabilized. The electric field of the ExoEDB was also modeled in SIMION and particle stability determined through simulations varying the ExoEDB electric field through frequency and voltage. The ExoEDB particle simulations have allowed us to understand which frequencies and voltages yielded longer particle lifetimes and thus provide the most stable configurations. Current research and results from the droplet generators and modeling will be presented here.

This research is instrumental in understanding the light scattering properties of exoplanet cloud particles. Future goals for this work include successful trapping of particles at stable configurations as determined by modeling and the collection of complete scattering phase functions for exoplanet cloud analogs. All of which will allow us to better characterize and understand exoplanet atmospheres.

Mentor(s):

Alexandria Johnson, Earth, Atmospheric, and Planetary Sciences, College of Science

Kevin Walker, Purdue University

Poster Presentation Abstract Number: 227 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

"Our salary sucks": A cross-sectional study identifying predictors of CPS employee salary

Author(s):

Sidney Smith, College of Health & Human Sciences

Abstract:

United States' child protection systems (CPSs) are prone to high employee turnover rates due to low satisfaction levels. Salary is a major factor influencing satisfaction levels as it plays a significant role in why individuals seek and maintain employment. Because of the current organization of CPSs, salaries vary largely by agency contributing also to employees relocating to higher-paying agencies. The purpose of this paper is to identify predictors of CPS employee salary to further understand the driving forces of employee compensation. Publicly available salaries of CPS supervisors are collected on the county-level of 5 states: New Mexico, New York, South Carolina, and Mexico. These salaries are being compared with variables including county CPS administration type, political affiliation, child population, and year. Descriptive statistics and negative binomial regression models are used during analysis. By comparing CPS employee salaries across a collection of diverse counties and states, we can better understand the influences of salaries among this population. These results may be useful in developing and targeting interventions in overall efforts of lowering turnover and increasing system effectiveness.

Mentor(s):

Laura Schwab-Reese, Public Health, College of Health & Human Sciences

Poster Presentation Abstract Number: 228 :: Life Sciences

College of Health and Human Sciences

Comparison of the Half-Life of Methylmercury in In-Vitro vs In-Vivo Systems

Author(s):

Kiara Smith, College of Health & Human Sciences

Kristina Hobbib, College of Health & Human Sciences

Abstract:

Methylmercury is an environmental neurotoxin that bioaccumulates within aquatic systems, posing a risk of exposure to humans through seafood ingestion. High exposures damage the central nervous system, with the most serious effects seen with early developmental exposures. The half-life of methylmercury in human exposure is approximately 50 days. However, our data indicate the half-life in cell cultures is shorter, with preliminary data suggesting a range from one to three days. In these experiments we aim to elucidate the half-life of MeHg in human stem cell-derived glutamatergic neuronal cultures. The work builds on our prior MeHg toxicokinetic experiments. In the first experiment, human stem cell-derived neurons will be exposed to 0, 0.1, and 1 µM MeHg on two timelines, early + late (days 4-9 and 14-19) and late (days 14-19) within a 30-day period. Media samples will be taken daily following exposure to measure MeHg elimination, with cell samples collected intermittently. A second experiment will compare half-lives following the first and second exposure timelines. Neurons will be exposed to 1 uM MeHg on the early + late and the early timeline (just days 4-9), with similar media sampling. Cells will be harvested for analysis on day 28. While previous data suggest the half-life of MeHg following the first and second exposure timelines are 24 and 72 hours respectively, this experiment will confirm the difference between these. Although this project is preliminary, it may provide insight into the differences in MeHg kinetics affecting translation of cellular culture results to human contexts.

Mentor(s):

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

Anke Tukker, Purdue University

Poster Presentation Abstract Number: 229 :: Life Sciences

<div align="center">

College of Science

Visual Processing of Slow Luminance Changes in Zebrafish Tectum

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Author(s):

Thomas St. Pere, College of Science

Abstract:

The purpose of the study is to determine how the visual system encodes slow changes in luminance. We have previously shown that pyramidal neurons (PyrNs) of the zebrafish optic tectum respond strongly to luminance ramp stimuli with cycle times of 20 or 60s. PyrN ramp stimulus responses can be categorized into three distinct functional classes: ON, OFF and DUAL. Here we set out to 1) determine if PyrNs respond to cycle times longer than one minute and 2) determine if the PyrN functional classes encode luminance information across these larger time scales. Functional imaging during visual stimulus presentation was performed in 7 day old Tg(id2b:gal4,uas:gcamp6s) double transgenic larvae in which the genetically encoded calcium sensor GCaMP6s is expressed predominantly in PyrNs. GCaMP6s fluorescence was monitored in awake, immobilized larvae using two-photon microscopy. During initial trials we presented each larva with multiple luminance ramp stimuli with cycle times of 20 s, 1 min, 3 min, 9 min, and 18 min. Preliminary data suggest that a majority of PyrNs respond across all cycle times examined with the strongest response at 1 min ramps. Surprisingly, preliminary data also suggest that PyrN functional classifications can vary across timescales. Experiments are currently underway to test stimuli with cycle times as long as 100 min to determine if the observed trends continue to scale. These data will shed light on how the brain processes visual stimuli across time scales and guide future explorations of how these circuits influence visual behaviors.

Mentor(s):

Estuardo Robles, Biological Sciences, College of Science

Purdue Polytechnic Institute

How Sleep Effects Academic Performance Statistically

Author(s):

Ronald Steinbrook, Polytechnic Institute

Abstract:

Sleep is a constant factor in our lives, we spend almost a third of our living moments on this Earth doing it. This raises the question, how exactly does the amount of sleep effect our performance? Especially for those in school or in higher education? This research will examine three data sets provided by three institutions listing basic information such as the quantity of sleep, GPA, and gender. The goal of this research is to analyze this information in such a way to identify the optimum amount of sleep needed the betterment of school performance. This research will also assess which thresholds of sleep demonstrate diminishing returns when it comes to GPA if the two have a positive relationship at all. This research will also examine how much gender plays a role in sleep quantity and GPA. The outcome of this research will inform the impact of sleep on academic performance, and how we can successfully apply this information for the betterment of the average student.

Mentor(s):

Vetria Byrd, Computer Graphics Technology, Polytechnic Institute

Poster Presentation Abstract Number: 231 :: Life Sciences

<div align="center">

College of Health and Human Sciences

Variability of the Pallidal Index as a Marker of Brain Manganese Levels

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Author(s):

Lauren Stucky, College of Science

Grace Francis, College of Science

Abstract:

Excess exposure to manganese (Mn) leads to its accumulation in the human brain, which may cause neurotoxicity. MRI allows for estimation of brain Mn levels and is one of the diagnostic criteria for Mn intoxication. The pallidal index (PI), a ratio of T1-weighted signal intensities in the globus pallidus (GP) and frontal white matter (FWM), is a commonly used MRI marker of brain Mn accumulation. While the PI is a valid measure within one study, factors such as scanner type, sequences, and coils can change its numerical value greatly and limit its validity as a proportional measure of Mn concentration. This study investigated the variability of PI values across three different 3T MRI scanners (Siemens, General Electric (GE), and Philips), two coils and two age ranges to determine the "normal" range of PI values in non-Mn exposed individuals. The first comparison group included 10 subjects scanned on both Siemens and GE. We found that inter-individual variability in PI (CV=3%) was significantly smaller than the variability between scanners (CV=7.8%) with an average PI of 113.5 for Siemens and 97.3 for GE. A separate group of 28 controls on a GE scanner had an average PI of 89.7, and another group of 10 controls on Philips had an average PI of 111.7. Overall, the average PI on GE was significantly ($p < .001$) lower than that of Siemens and Philips. A preliminary comparison of PI values using two different coils on one subject showed no differences. Lastly, we compared the PI values across two different age ranges: 27-33 vs 64-68 years. The 60-year-old group had a significantly lower ($p=.0079$) average PI of 102.0 compared to the 30-year-old group's average PI of 111.7, an observation consistent with past literature since iron deposition in the globus pallidus increases with age (Harder et.al. 2008).

Mentor(s):

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

Humberto Monsivais, Purdue University

College of Liberal Arts

The Female Experience and its Evolution at Purdue University 1912-1924

Author(s):

Allison Sussman, College of Health & Human Sciences

Abstract:

The early twentieth century was characterized by the turbulence of the first world war and the Spanish Influenza pandemic. This purpose of this project is to discover and understand the female experience at Purdue University and its evolution during this time by reading the student newspaper, The Purdue Exponent. By reading student written newspaper articles I have identified several facets of female student life that underwent great change, such as women's athletics and representation in student government. The ultimate goal of this project is to summarize the developments that occurred in each facet of student life, detail critical moments in the history of Purdue women such as their efforts during WWI, and shed light on the opinions surrounding the female presence at Purdue.

Mentor(s):

Nancy Gabin, History, College of Liberal Arts

Poster Presentation Abstract Number: 233 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Do Parent-Mediated Interventions for Autism have a Positive Impact on Parent Well-Being? A Meta-Analysis

Author(s):

Jacqueline Talbot, College of Health & Human Sciences

Abstract:

Background: Parent-mediated interventions (PMI's) have emerged as an effective method for addressing the needs of children with autism spectrum disorder (ASD) (Brian et al., 2022). Studies across different PMI models have demonstrated positive impacts on child outcomes; however, fewer studies have focused on parental well-being outcomes. The goal of this study was to examine the impact of PMIs on experiences of parental stress.

Method: A search was conducted in PubMed, CINAHL, PsycINFO, and Child Development and Adolescent Studies, ProQuest Dissertations & Theses and World Cat Dissertations for a review of parent-mediated interventions. To be included in this meta-analysis, studies had to meet the following criteria: (1) randomized clinical trial, (2) parent-mediated intervention for autism, (3) autistic children between 0-5, (4) parental stress outcome measure. 22 articles fit this criterion; however, 4 were excluded due to unreported data, resulting in 18 articles.

Results: The results of the random-effects model indicated that, overall, PMIs reduce parental stress ($g = -0.23$, 95% CI [-0.44, -0.01}, $p = 0.04$). The between-study heterogeneity of variance was estimated at $\tau_2 = 0.12$, 95% CI [0.03, -0.01], which indicates some differences in the true effect sizes between studies.

Implication: Findings suggest that parent-mediated interventions indeed have a positive impact on parental stress. While the effects found were positive in some studies and negative in others, this could potentially be reflected by the high amount of variation among the samples. Further research could focus on identifying factors that may impact parents' perception of stress after PMI interventions.

Mentor(s):

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

Mehreen Hassan, Purdue University

College of Liberal Arts

A Deep Dive Into Bookplates

Author(s):

Chevelle Tallman, College of Liberal Arts

Abstract:

For two semesters, I have been helping to develop a more detailed inventory for a large collection of Early Modern European books dated from 1600 – 1799. Many of the books have rare and unusual bookplates. Bookplates were used to indicate ownership while showing information about the owner's background. They either indicate private ownership, with a single person's name, either first and last or just last name, or public ownership by an organization, usually a school or religious institution. Some of the bookplates are armorial or heraldic, revealing an owner's pedigree and family history as a point of pride and identity. Others are religious, often less ornate than familial ones, reflecting the owner's spiritual devotion or association with a religious group. Some of the bookplates have mottoes in Latin related to the family or organization. For my project, I selected 7 books dating from 1620-1785, each containing at least one bookplate. I then searched for information about the individuals and organizations that, at one time, owned these books. Where did these previous owners live? How near or far were they from the places in which the books were originally printed, if found? What might I find about the people and organizations who owned these books? What do the designs, motifs, and mottoes on the bookplates reveal about these people and organizations? Bookplates give researchers a unique look at the places and owners rare books have been with. They are an important avenue of exploration when researching Early Modern European print.

Mentor(s):

Elizabeth Mercier, Language & Culture, College of Liberal Arts

College of Agriculture

Twitch or Treat? How does restraint with a lip twitch affect horse welfare?

Author(s):

Haley Tate, College of Agriculture

Abstract:

Lip twitching is often used in horses for restraint during procedures. A twitch is a chain or rope leveraged with an attached stick that is twisted around the horse's upper lip. While twitched, the horse is subdued. Some studies suggest twitching causes an endorphin release similar to acupuncture (1). Others have documented horses displaying avoidance behaviors in response to the twitch (2). Therefore, this study aimed to determine whether twitching is aversive to horses. Fifteen horses were randomly assigned to three treatment groups: twitching alone (TA), twitching with praise (TP), and treats alone (TR). Treatment was applied daily for four days. Horses were given three minutes to acclimate in stocks, then three minutes of treatment. Behavior was "1-0" scored from video in 5-second intervals. Individual horses served as their own controls. Preliminary statistical results indicate TW horses experience a fearful affective state more frequently while TR horses tend to be more curious. TR horses demonstrated licking/chewing behavior at a higher rate but both TW and TP horses exhibited more behaviors associated with discomfort. These preliminary results represent a small portion of the sample size; however, if these trends continue, they could indicate an adverse effect of twitching on equine welfare.

1 Lagerweij et al., 1984

2 Hall et al., 2008

Mentor(s):

JoAnna Rogowski, Comparative Pathobiology, College of Veterinary Medicine

Poster Presentation Abstract Number: 236 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Assessing the Environmental Implications of Autonomous Vehicle Data Management

Author(s):

Oscar Teran, College of Engineering

Abstract:

Autonomous vehicles (AVs) are presented extensively in research literature as technology that could reduce greenhouse gas emissions through efficiency gains. However, AV data management is one area in which AVs will be adding energy use that previously did not exist for motor vehicles. Due attention to this aspect of AV operation has been neglected in many preeminent studies on AV environmental impact, so calculating an estimate better frames the role that AVs can play in addressing climate change. This research aims to establish initial upper and lower bounds of the data management emissions for AV operation, by calculating data requirements, energy consumption, and GHG emissions. Preliminary results show that the storage and transfer of data alone could result in about the same emissions as adding over 5 million vehicles in the U.S. by 2030, revealing that expanding the life cycle of AV assessment to include data management could help avoid unintended negative consequences.

Mentor(s):

Kendrick Hardaway, Enviromental & Ecological Engineering, College of Engineering

Hua Cai, Purdue University

College of Health and Human Sciences

Neurobehavioral Assessment of Purdue-Martinsville PCE Study

Author(s):

Brandon Tso, College of Health & Human Sciences

Abstract:

The Pike and Mulberry Streets of Martinsville, Indiana, is currently an EPA Superfund site with tetrachloroethylene (PCE) and tetrachloroethylene (TCE) groundwater contamination. PCE is a known neurotoxicant; high levels of exposure among industry workers have been linked with a specific set of neurological effects. Health effects of exposure in communities near hazardous waste sites are unclear, where community members' exposure is low-level but long-term and continuous. Of particular concern is that children may be more vulnerable to PCE exposure because of the developmental stages that they are in. To study the potential neurobehavioral effects due to PCE exposure, we enrolled 67 children (6-11 years old) from the Martinsville community and measured their exposure to PCE and other volatile organic compounds in exhaled breath samples. We currently have 57 fully completed assessments. Neurobehavioral performance was assessed with a set of iPad-based, validated age-appropriate tests. The assessments we used were WRAT-5, BASC-3, and NIH Toolbox. When running ANOVA tests using the statistical software SPSS, we have found a few factors that could potentially affect neurobehavioral performance, such as premature birth, elevated lead blood levels, and having individualized education plans. More data analysis will need to be conducted to determine if a correlation exists between exposure to PCE and neurological behavior. The results of this study can be used to inform the community about the health impact of PCE exposure and possible mitigation actions if an association is detected.

Mentor(s):

Sa Liu, Health Sciences, College of Health & Human Sciences

Marwan Alajlouni, Purdue University

Jung Hyun Lee, Purdue University

Alaina Bryant, Purdue University

College of Science

Single molecule binding kinetics of cell-penetrating peptides

Author(s):

Andrew Walke, College of Science

Abstract:

Cationic Amphiphilic Polyproline Helices (CAPHs) are cell-penetrating peptides that have great utility in delivering impermeable cargoes to cells. CAPHs are an exciting designer therapeutic that have demonstrated low cytotoxicities. The precise mechanisms of CAPH targeting, uptake, and payload potency remain mysteries that, if solved, could create actionable improvements in drug design and delivery. Using an in vitro reconstitution-based approach, we measured the binding kinetics of CAPH recruitment to model membranes of tunable compositions. Membrane-selective imaging in a total internal reflection fluorescence (TIRF) microscopy configuration enables single molecule resolution of CAPH binding and diffusional behaviors. CAPHs exhibit a marked sensitivity to the presence of cholesterol in supported bilayers, but a modest tuning in binding on rates with increased cholesterol densities. This finding will be extended to the cellular context using models of tunable cholesterol levels and spatial organization.

Mentor(s):

Shalini Low-Nam, Chemistry, College of Science

Kevin Scrudders, Purdue University

Honors College

Designing an Inhibitory Protein to SARS-CoV-2 Utilizing the Computer Program Foldit

Author(s):

Hannah Walls, College of Agriculture

Abstract:

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a virus that has caused illness and claimed the lives of millions of people around the globe. This virus enters and infects the cells of the human body through binding of its spike protein's receptor-binding domain (RBD) to the angiotensin-converting enzyme-2 (ACE-2) receptor. Scientists are actively working to find a protein that has a lower energy conformation and therefore a higher binding affinity to the Spike-RBD than the ACE-2 receptor. Currently, proteins like these already exist; however, these natural proteins are large, slow-paced, and cost inefficient. Therefore, smaller, synthetic proteins are needed. A computer program called Foldit, a game where players are given puzzles to complete and compete against each other to build and design the most stable proteins, has begun to be explored to see if therapeutic proteins can be developed and further help accelerate drug discovery. Is it possible that non-scientist players on Foldit will be able to aid in discovering an inhibitory protein for the SARS-CoV-2 spike protein? To address this question, knowledge of protein biophysics was used to design a de novo (from scratch) protein against SARS-CoV-2. The proposed protein has an energy score above 13,500, indicating high structural stability and consists of three alpha helices. The protein's backbone is composed of ninety-three segments and all hydrophobic side chains were placed toward the inside of the protein structure. In contrast, all hydrophilic side chains were placed facing outward toward the surrounding water. The resulting protein design could become a possible candidate for experimental testing as a binder protein, making it possible to treat COVID-19 at the early stages of infection.

Mentor(s):

Zahra Tehrani, Honors College

College of Education

Rules are not Neutral: Reading School Documents as Racialized Texts

Author(s):

Melanie Werner, College of Health & Human Sciences

Abstract:

Surveillance and discipline are inevitable parts of students' lives in the United States. However, there are documented disparities in the surveillance and discipline students of color receive when compared to their white peers. In our research team's previously conducted literature review, we found that students of color were approximately ten times more likely to be disciplined than their white counterparts. This racialization can have profound impacts on students of color as they may unenroll from school or become disengaged from their classes. Educators can also unknowingly create policies that discriminate against students of color. To help combat this, we designed a tool to assess the policy handbooks of school districts. Our tool focuses specifically on the language surrounding dress codes, technology, discipline, gifted classes, and other items. For our study, we plan to use our tool to review, evaluate, and compare the policy handbooks from 12 randomly selected Indiana schools, located across the six regions of the state. Study limitations include that our results may not be generalizable to other geographic locations. However, future research can use our tool to analyze the documents of other areas.

Mentor(s):

Stephanie Masta, Curriculum & Instruction, College of Education

Janelle Grant, Purdue University

Poster Presentation Abstract Number: 241 :: Social Sciences/Humanities/Education

College of Liberal Arts

The Role of Women in the Early UN

Author(s):

Erika Wheeler, College of Liberal Arts

Abstract:

This project will examine the ways in which women were present or absent in early United Nations (UN) records from 1945 to 1949. The UN is an international organization that has held a prominent place in international politics since its inception during World War II; therefore, the role of women in the UN reflects the overall role of women in this field, through not only their general abilities but also against the prevailing attitudes and norms of this period in politics and beyond. I have investigated the women involved in the UN's General Assembly at this time using primary source documentation and relevant databases. Through this research, I intended to measure their involvement and create a collective biography to chronicle their identities and work, as part of a larger effort to examine women's undervalued involvement in early UN non-diplomatic roles.

Mentor(s):

Jennifer Foray, , College of Liberal Arts

Poster Presentation Abstract Number: 242 :: Social Sciences/Humanities/Education

<div align="center">

College of Liberal Arts

COVE: Collaborative Organization for Virtual Education

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Author(s):

Arden Woodall, College of Liberal Arts

Samantha Murphy, College of Liberal Arts

Abstract:

The disproportion with which anthologies are dominated by white male authors has created a lack of accessibility and space for BIPOC students and authors in the classroom. Print anthologies are also unwieldy: they are not customizable, they are expensive, and teachers teach only portions of them. The COVE is Collaborative Organization for Virtual Education, a scholar-driven open-access platform that publishes peer-reviewed material, provides tools to support research and teaching, and advocates for the interests of the humanities. Its goal over this last year has been to make more readily available content: encoding entire anthologies in a way that allows scholars to pick the individual texts needed for a course and supplementing existing anthologies by providing over a million words of material by and about people of color. COVE is a non-profit platform that makes active learning for undergraduates more accessible. The platform is divided into two separate entities, COVE Editions and COVE Studio. COVE Studio makes it easy to create custom anthologies of reading material and to annotate together with students while COVE Editions offers active learning tools to classrooms, including a map-builder, a timeline-builder, and a gallery-builder. With a variety of methods for multi-media incorporation, collaborative work between universities/classes/instructors, and interactive education tools, COVE works to provide accessible, inclusive, and sustainable means for virtual education endeavors.

Mentor(s):

Dino Felluga, Faculty, Purdue University

College of Science

Goal-directed bilateral tactile discrimination in mice primary somatosensory cortex

Author(s):

Chaeyoung Yoo, College of Science

Abstract:

Abstract

Similar to humans, mice perform everyday tasks that require bilateral coordination of their somatosensory functions, such as interpreting the stimuli on their whiskers to decode the spatial settings on either side of the body. Mice have a unique somatotopic map of their whisker system to process individual whisker information. Along with the advantage of this unique somatotopic map, the ease of optogenetic control of specific neuronal cell types makes mice a perfect model to study the process of bilateral integration. Thus, we designed an automated goal-directed bilateral training setup that helps train mice to discriminate between go/no-go reward-associated cues. Prior to training, all except two adjacent whiskers were trimmed, and each mouse's "go" stimulus was designated as either homotopic (HM, matching) or heterotopic (HT, non-matching) touch. Then, classical and operant conditioning were used to maximize the subjects' discriminating abilities. After sufficient training had been completed, extracellular EPhys recordings were collected from both somatosensory cortices. Simultaneously, whiskers-touch information was quantified by imaging the whiskers with a high-speed (500 fps) infrared camera. As a result, we show that the primary somatosensory cortices' touch response is enhanced for reward-associated bilateral cues. By further understanding the process of bilateral integration in somatosensory functions, fundamental grounds for medicinal research in studying disorders and injuries involving a defective bilateral integration between the brain hemispheres can be established.

Keywords: goal-directed behavior training, somatosensory circuit, bilateral integration

Mentor(s):

Scott Pluta, Biological Sciences, College of Science

Hyein Park, Purdue University

Scott Pluta, Purdue University

College of Liberal Arts

Global Governance Agenda Setting on Big Tech

Author(s):

Rachel Young, College of Liberal Arts

Amanda Shie, College of Liberal Arts

Abstract:

Big technology companies like Facebook and Google have amassed wealth by serving as gatekeepers of critical infrastructures of knowledge, connection, and desire. While such gatekeeping has resulted in a successful business model, it also has detrimental effects for privacy, information, speech, and monopoly. Moreover, Big Tech's virtual landscapes impact the entire global community. This research asks: how effectively has global governance responded to the evolving challenges of Big Tech power related to privacy, speech, and monopoly? To answer this question, this research draws from the Facebook Incidents Database, which uses news data (2004-2021) to track 4,316 Facebook incidents and over 900 Facebook-related regulatory scrutiny and lawsuits. The database is the first scholarly effort to organize Facebook's global incidents in issues ranging from speech, privacy, monopoly, fake news, and radicalization to place scandals like Cambridge Analytica into wider context. Specifically, we first use the database to catalog and evaluate formal (United Nations, Organization for Economic Cooperation and Development, World Bank) and informal (G7, G8, G20) global institutional responses to Big Tech's growing influence. Second, we present case studies on global institutional agenda-setting related to three major Facebook scandals: COVID-19 misinformation, terrorism, and the Rohingya genocide. We conclude by identifying which particular challenges of Big Tech power elicit the greatest responses on an international scale.

Mentor(s):

Swati Srivastava, Political Science, College of Liberal Arts

Poster Presentation Abstract Number: 245 :: Life Sciences

College of Health and Human Sciences

The Tetrachloroethylene (PCE) contamination and exhale breath testing for children in Martinsville, IN

Author(s):

Wendi Yuan, College of Health & Human Sciences

Abstract:

The research team led by Dr. Sa Liu from the School of Health Sciences of Purdue University, in collaboration with members from Martinsville Indiana Superfund Site Association (MISSA) and Indiana University, conducted an epidemiological study, titled "Tetrachloroethylene (PCE) contamination and neurobehavioral health among children in Martinsville, IN." This research is intended to reduce factors that can affect the concentration of PCE, a known neurotoxicant.

From the Martinsville community, the team got 55 children of the ages from 6 to 11 years old and measured their exposure to PCE and other volatile organic compounds in their exhaled breath through the Proton Transfer Reaction – Mass Spectrometry. Before the exhale breath collection, we designed a questionnaire for each parent to ask about several factors that may affect the results shown in their kids' breath. We asked them whether their kids have had any dairy product consumption around the sampling period as it can affect VOC release referring to several papers. Nail polish, tobacco, cleaning products also can affect the VOCs release as well, especially for dry cleaning products which usually contain PCE. We asked them about whether their kids have exposed to those products around the testing time. We also asked them about the time their kids spent outside the same day and whether the kids slept in their own home or not last night. What's more, we asked the parents on the questionnaire about whether their kids have respiratory related health condition like asthma. If the kid has asthma, he may need to take medication, and which can also affect PCE results.

For the answers, or raw data collected from those questionnaires, we found some certain trend for the kids' condition around their time of testing.

The results of this study can be used to inform the community about the health impact of PCE exposure and potential mitigation actions if an association is found.

Mentor(s):

Sa Liu, Health Sciences, College of Health & Human Sciences

Jung Hyun Lee, Purdue University

College of Liberal Arts

Patterns in COVID Expert Communication

Author(s):

Katherine Zhang, College of Science

Abstract:

In science and research, there is a lot of technical jargon and information that can be difficult for people outside of a particular field to understand. This is a major obstacle in a pandemic, where politicians and decision makers need to understand the science to make decisions that keep their citizens healthy and safe. In this study, I investigate how experts communicate to Congress about COVID-19 and how it is prevented and treated. My goal was to determine what communication strategies the experts use to explain more complicated topics to politicians who are less experienced with science. I analyzed videos of Congressional hearings on COVID-19 where experts spoke, and tracked different good and bad aspects of their presentation. From this, I was able to find patterns in what made their presentations good. The findings in this study will hopefully be able to improve science communication, and allow politicians to make good, science-backed decisions more effectively.

Mentor(s):

Jennifer Hall, Communications, College of Liberal Arts

Poster Presentation Abstract Number: 300 :: Innovative Technology/Entrepreneurship/Design

Honors College

Mold Clip - Landon Abboud

Author(s):

Landon Abboud, College of Engineering

Abstract:

Cooling plates are integral parts that go in all engines manufactured by GE Aviation. These cooling plates have features called edgebreaks which, if not conforming to their tight tolerances, will cause an engine to fail or reduce in life. The current edgebreak inspection method is called tracing and it is decades old. This outdated inspection process requires a lot of time and attention from operators and measurements vary based on inspector interpretation. There are machines that can quickly and accurately measure edgebreaks, but most cost hundreds of thousands of dollars and finding funding in a corporate environment so deeply affected by COVID-19 is a challenge. There is, however, a cost-effective inspection machine called a digital comparator that measures edgebreaks taken on a mold of a part.

The basis of my project is to find an economically viable way to automate edgebreak inspection using a mold and digital comparator. I Created a new process and designed a fixture called a "mold clip" to make repeatable, accurate molds that are consistent enough to allow for automated inspection by comparator. My process decreases inspection time by 50%, saves about $500,000 annually per part type, and minimizes the amount of human interaction that contributes to measurement variability.

Mentor(s):

Casey Gawen, ,

College of Engineering

Implementing Privileged Instructions and Memory Protection

Author(s):

Hadi Ahmed, College of Engineering

Abstract:

The purpose of this project is to implement hardware-based memory security and protection to an embedded RISC-V processor core. This project adds numerous control and status registers, physical memory protection, and physical memory attributes as per the RISC-V version 1.12 specification. Physical Memory Protection (PMP) is done through the PMP Unit, and consists of an up-to 64 way configuration lookup table with up to 4 different addressing modes. Physical Memory Attributes (PMA) is conducted through the PMA Checker, and allows the processor to 'tag' regions of memory with certain physical attributes (Memory vs I/O, Cacheability, Idempotency, etc.). The PMA Unit is implementation-defined, with the team implementing 32 discrete regions of memory to tag. Further, this project will implement a seperate User and Machine Mode for the processor, allowing different programs to run with different computing privileges. While no results have been found – this is semester 1 of a two semester project, the objective of this project is to add these additional units without compromising the timing of the rest of the processor core running at 50 MHz. Further, all hardware protection actions must be completed within one clock cycle of a memory request.

Mentor(s):

Sarang Pramod, Electrical & Computer Engineering, College of Engineering

Mark Johnson, Purdue University

College of Engineering

ABE227 - Exploring Bacteriophage Subcluster ED2 Pattern Using Two Genes of Pham 100238

Author(s):

MarySara Albert, College of Engineering

Zhujin Xia, College of Engineering

Logan Hamilton, College of Engineering

Ben Goncher, College of Engineering

Abstract:

To annotate a bacteriophage genome according to the SeaPhages Guide, individuals take the auto-annotated genome and confirm the existence, location, and function of each gene. A pham is a group of similar bacteriophage genes, and during the annotation process, they are used as evidence to predict function. During the gene function selection process of Yuma Gene055 and Gene56, students noticed a pattern within Pham 100238. Genomes using this pham often use two genes of this pham in a row such as Gene055 and Gene056. The first one, typically shorter, is considered NKF and the following longer gene has an assigned function of either major or minor protein. This is exemplified in multiple gene pairs, particularly those within Yuma's subcluster, ED2, as well as subcluster ED1. This project will use three programs ("Splitstree" analyzing Phylogeny, "PyMol" analyzing protein structure, and python code analyzing mutations) to detect a relationship between these two adjacent genes and determine if this relationship is conserved across subclusters such as ED2 and ED1. Finding a relationship could be used to determine the function of the shorter, NKF genes or provide greater insights to the development and purpose of these gene pairs.

Mentor(s):

Lauren Novak, , College of Engineering

Kari Clase,

Purdue Polytechnic Institute

Goal Exchange Rate: An Analysis of Transfers Between Europe's Top Five Soccer Leagues

Author(s):

Brandon Allen, Polytechnic Institute

Abstract:

There remains a widespread unknown of how soccer players would perform playing in a different league. Currently there is a great divide among fans, as they debate whether a player would be able to perform well in a different league. This research examines an exchange rate for the performance of soccer players between leagues. The purpose is to assess how players adapt to new leagues by looking at advanced metrics. The first aim of this study is to identify key metrics (goals, assists, etc.) that can be used to evaluate a player's performance from one season to the next. The second aim is to use those metrics to calculate an 'exchange rate' to predict how a player might perform in a different league. The main research question is "What is the exchange rate of a player's performance between major European leagues?" Major European leagues defined in this research are the English Premier League, La Liga, Bundesliga, Serie A, and Ligue 1. To answer this question, player statistics between the 2017 and 2020 seasons are examined. The results of this study will inform an exchange rate for each league. The implications of this study will allow fans to be able to predict how a player will translate to a new league, leading to more realistic expectations for new players.

Mentor(s):

Vetria Byrd, Computer Graphics Technology, Polytechnic Institute

College of Pharmacy

Role of the gut microbiome in Parkinson's disease: Studies using germ-free mice

Author(s):

Brianna Arinze, College of Pharmacy

Abstract:

The gut brain axis is a bidirectional pathway between the gastrointestinal tract and central nervous system that allows the gut microbiome to influence neuronal function. Recent studies suggest that the gut microbiome contributes to the pathophysiology of Parkinson's disease (PD), a neurodegenerative disorder characterized by motor impairment resulting from a loss of dopaminergic neurons in the substantia nigra region of the midbrain. One of the common hallmarks of PD is the presence in surviving neurons of protein aggregates called Lewy bodies, inclusions that consist largely of fibrillar forms of α-synuclein (aSyn), a presynaptic protein involved in PD pathogenesis. In this study, we used germ-free and conventionally raised mice to examine the effects of the microbiome on aSyn pathology, microglial activation, and tyrosine hydroxylase (TH) expression in the striatum, substantia nigra, and frontal cortical brain regions. Brain sections from these three brain regions were stained with antibodies specific for aSyn, CD11b (a marker of activated microglia), and TH and analyzed using confocal microscopy and a LiCor Odyssey imaging system. In parallel with these histological studies, we are comparing global proteomic profiles in the brains of germ-free and conventionally raised mice to elucidate molecular pathways differentially modified by the presence of the gut microbiome. Collectively, the results of these studies will yield insights into links between the gut microbiome and nigral dopamine neuron health relevant to PD, setting the stage for developing new therapies or dietary strategies to modulate the microbiome in PD patients.

Mentor(s):

Chris Rochet, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Chandnee Chandrasekaran, Department of Medicinal Chemistry and Molecular Pharmacology, Purdue Institute for Integrative Neuroscience

College of Engineering

Effect of time pressure and cognitive demand on line workers' safety performance: employing   Neuro-Psychophysiological Responses in a Mixed-Reality Environment

Author(s):

Deha Ay, College of Engineering

Douglas Andrew Hermo, College of Engineering

Abstract:

Although various safety technologies have been developed to improve job site safety within the construction industry, this industry is still experiencing a high rate of fatalities. Recent research suggests that construction workers may fall prey to the cognitive biases of risk compensation by overlying on safety improvements and taking more risks. In parallel, productivity demands, time pressure, and cognitively demanding construction tasks increase workers' arousal and stress and can lead to performance breakdowns. However, it is not clear whether time pressure, productivity and cognitive demands can worsen risk compensatory behaviors. Employing a multi-modal mixed-reality environment with wearable neuro-psychophysiological sensors, this research investigates workers' cognitive processes and safety performance for a high-risk electrical task under normal and demanding conditions. Results show that risk compensation causes workers to offset the benefits of safety protections and signal them to increase their risk-taking behaviors. Further, time pressure and cognitive demand can worsen the effects of risk compensation as workers fail to process their surrounding environment and perceive potential risks which led to increases in risk-taking behaviors. This research can contribute to the body of knowledge by raising awareness regarding the risk compensation phenomenon and providing insights to improve safety training approaches.

Mentor(s):

Sogand Hasanzadeh, Civil Engineering, College of Engineering

Shiva Pooladvand, Purdue University

Poster Presentation Abstract Number: 306 :: Life Sciences

College of Agriculture

CRISPR Mediated Transformation of PmSUC2 in Plantago Lanceolata

Author(s):

Anna Bajszar, College of Science

Abstract:

The current understanding of phloem loading mechanisms in Plantago lanceolata is limited in other literature. Phloem loading is significant to plants as these pathways are affected by environmental stress. Though other research has suggested that the plant loads sucrose apoplastically, the lack of a transformation protocol made this difficult to confirm. The purpose of this study is to identify whether the sucrose transporter is apoplastic through a successful transformation protocol. This protocol was essential for Plantago Lanceolata research as it is a model species for molecular transport through phloem. Plantago Lanceolata also makes an interesting species to study carbohydrate transport as it translocates sorbitol, which is a secondary carbohydrate. This study involves inhibiting the gene known for regulating transport of sucrose (PmSUC2). The experiment is completed with the use of CRISPR-Cas 9 technology, plant transformation with agrobacterium, and plant tissue culture. Inhibiting the gene that had been identified to move sucrose throughout the plant may provide its function. Analysis of transgenic plants will be completed through quantification measurements including gene expression, photosynthesis, sugar content, plant growth, and vascular tissue molecular alterations. If the sucrose is loaded apoplastically through this transporter, the plant may not be able to survive. The presence of a different loading mechanism may result in no changes to plant health. The plants may be able compensate for a loss of sucrose transport with sorbitol, mimicking no effects on plant health. Further research directions will be made once the transgenic plants are analyzed.

Mentor(s):

Cankui Zhang, Agronomy, College of Agriculture

Honors College

Using Foldit to Design Two De Novo Proteins to Bind the Receptor Binding Domain of SARS-CoV-2

Author(s):

Kyler Bartol, College of Science

Abstract:

The emergence of the SARS-CoV-2 virus has caused the COVID-19 pandemic due to its high transmissibility, which can be attributed to the spike protein on the virus's surface. Spike binds to the ACE-2 receptor on the surface of human cells to gain entry and cause infection. One treatment method uses a binder protein that can bind directly to spike, outcompeting its receptor binding domain's (RBD) affinity for ACE-2. Currently, antibodies are used to treat COVID-19, but these are relatively large proteins that can be unstable at room temperature and are expensive to mass produce. This leaves the question: What is the amino acid sequence of a smaller binder protein that can bind to the spike protein with a higher affinity than the ACE-2 receptor? There are two main challenges that need to be addressed: there are an exponential number of possible amino acid sequences and conformations for a potential binder protein, and an effective protein design method is needed. One solution uses Foldit, a software that uses the Rosetta algorithm to compute protein stability while working in tandem with human problem-solving skills; however, the Rosetta AI within Foldit is not robust enough to solve the protein design problem alone. Two proteins will be designed: one designed from a base structure and one designed from scratch. My first protein achieved a Rosetta energy score of 13,354.409; it uses a conserved alpha helix to bind to RBD, and two alpha helices stabilize it. My second protein achieved a Rosetta energy score of 14,583; I mimicked the conserved alpha helix, and three beta sheets stabilize it. Currently, the creators of Foldit at the Institute for Protein Design in the University of Washington have tested over 99 novel protein designs from Foldit players, and these designs contribute to the pool of testable candidate drugs.

Mentor(s):

Zahra Tehrani, Honors College

Purdue Polytechnic Institute

Recycling Fiber Reinforced Composite Pre-impregnated Leftover using Water-Soluble PVA Backing Film

Author(s):

Joseph Bignotti, Polytechnic Institute

Kamryn Arnold, Polytechnic Institute

Abstract:

Redacted.

Mentor(s):

Garam Kim, Aviation & Transportation Technology, Polytechnic Institute

College of Health and Human Sciences

Determining the lower detection limits of legionella test kits used in the air sampling device

Author(s):

Anthony Bovenschen, College of Health & Human Sciences

Nicholas Pecoraro, College of Health & Human Sciences

Abstract:

Abstract: Determining the lower detection limits of legionella test kits used in the air sampling device

Authors: Anthony Bovenschen, Nicholas Pecoraro, Li Liao, Jae Hong Park*

Bioaerosols are particles of biological origin that are suspended in gas, typically in air. Pathogenic bioaerosols, for example, airborne Legionella pneumophila (L. pneumophila) can cause serious diseases. L. pneumophila is a bacterium typically found in standing water where it thrives and reproduces. If the L. pneumophila in the water is aerosolized, it can move through the air, be inhaled by people, and cause Legionnaires' disease (e.g., body pains, nausea, vomiting, fever, headaches, etc.). To protect people against exposure to airborne L. pneumophila, knowing its presence in the air is the first step. The current and conventional methods of detecting the airborne L. pneumophila involve collecting it in the field and then cultivating it in a lab which can be a time-consuming process in a situation that can be time-sensitive. To overcome this, we will combine the bioaerosol sampler and L. pneumophila dry spot test kit for rapid analysis. As a first goal, we will evaluate the lower limit of the detection (LOD) of the dry spot test kit. Specifically, we will use the known concentrations of L. pneumophila suspension. An optical density of each L. pneumophila suspension will be measured and then the concentration will be calculated. 100 µL of each suspension will be dispensed on the test strip and the aggregation will be observed. After finding the lower LOD, we will use it to estimate the concentration of airborne L. pneumophila in further research.

Mentor(s):

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

Li Liao, Purdue University Phd Graduate

Krannert School of Management

Exploring Business Student Workplace Experiences with Information

Author(s):

Garrett Brewster, School of Management

Abstract:

Workplace preparedness is an integral application of information literacy skills for students as they move forward and leave the university. It is also important to prepare students for the information needs they will face as they complete co-ops and internships during their time in academia. To best educate students in the information literacy skills they will need on-the-job, it is important for librarians to understand what types of information employers are requiring students to use in these co-op and internship experiences and in what ways. While work has been done on this regarding engineering students (Jeffryes and Lafferty, 2012), this topic is relatively unexplored with business students. In an effort to better understand the workplace information literacy needs of business students during co-ops and internships, business students and alumni who have completed an internship or a co-op were surveyed regarding their information use in these experiences. Students were asked about their experiences finding and using numerous information sources, as well as the tasks they were asked to complete using these sources. It was found that all respondents (n=39) reported using at least one information source, while students were more likely to learn to use an information source by themselves than have a supervisor or other employee teach them. Additionally, students taught to use an information source by an instructor were likely to find using the source 'Somewhat Easy' or 'Extremely Easy'. The information from this survey will be used to determine both successes and gaps in current information literacy instruction.

Mentor(s):

Margaret Phillips, Libraries

Heather Howard, Purdue University

Purdue Polytechnic Institute

Corporate Community Takeover: Outsourcing Moderation in Established Discord Communities

Author(s):

Jared Buls, Polytechnic Institute

Abstract:

Outsourcing moderation labor is common in the broader social media space, but atypical for newer social platforms like Discord. Gaming Discord communities are traditionally created by players of the game, as a place for people who have a similar interest to interact. These home-grown communities are typically run and moderated by community members and supported by the game's parent company. The community members volunteer their labor to support community growth and culture, while the parent companies promote the server and help host events. Despite this current standard, Epic Games has begun to take over the moderation teams of popular gaming communities for their flagship games Fortnite and Rocket League, replacing them with a contracted, third-party moderation team. In this poster I evaluate the potential impacts this kind of moderation outsourcing has on established communities through digital ethnographic observations and interviews. These potential impacts can stagnate community growth and harm existing members' participation in conversation within the server.

Mentor(s):

Austin Toombs, Computer Graphics Technology, Polytechnic Institute

Poster Presentation Abstract Number: 312 :: Life Sciences

Honors College

Enzymatic Degradation of Collagen Hydrogels

Author(s):

Leonard Cahya, College of Engineering

Abstract:

Tissue engineering is an emerging field that has had rapid growth due to its potential to revolutionize areas of medicine through tissue repair. As the most abundant mammalian protein, collagen plays an essential role in structure, mechanical properties, organization, and shape of tissues. Due to the combination of collagen's ability to synthesize biocompatible and biodegradable structures, the protein is extensively researched as a biomaterial. When studying cross-linked hydrogels, they must be verified to degrade in vivo for the gels to be replaced by native tissue. Additionally, it is useful to analyze different types of collagens like types I and II. Collagen type I (Col I) is found in most connective tissue including the skin, bone, and tendons while collagen type II (Col II) is found in cartilage. To assess the degradation of collagen hydrogels, I developed a macroscopic degradation protocol to analyze the degradation of collagen hydrogels in the presence of matrix metalloproteinase-1. Collagen hydrogels were subject to a 1xPBS control and MMP-1 degradation solution to study the weight loss over an 8-hour period. Hydrogels were pre-swelled in 1xPBS for 48 hours before being placed in degradation solutions in a 37 °C incubator. Col I gels and Col I/II blended gels were studied and showed that Col I/II blended gels had a slower degradation profile, specifically around three hours. These results are important as they have clinical translation in therapeutic areas such as drug delivery and can be used to analyze other variations of collagen hydrogels in the future.

Mentor(s):

Julie Liu, Chemical Engineering, College of Engineering

Carly Battistoni, Purdue University

College of Engineering

Biomass Formation Potential of Plumbing Materials

Author(s):

Daniel Ceglio, College of Engineering

Alexis Lowe, College of Engineering

Monique Watson, College of Engineering

Abstract:

Redacted.

Mentor(s):

Caitlin Proctor, Enviromental & Ecological Engineering, College of Engineering

College of Science

The Role of Neuronal NADPH oxidase in Zebrafish Retinal Ganglion Cell

Author(s):

Perapa Chotiprasidhi, College of Science

Abstract:

The NADPH oxidases (Nox) family of enzymes is composed of membrane-bound multi-subunit protein complexes that produce reactive oxygen species (ROS). Although high levels of ROS can cause oxidase stress, ROS has been proven to regulate many cellular processes. There is emerging evidence that Nox-derived ROS serve an important role in regulating neuronal development. Previous studies in the Suter lab have shown that other Nox isoforms might compensate for the loss of Nox2; however, this has yet to be fully investigated. To address this, we pharmacologically inhibit other Nox enzymes (Nox1, Nox 5, and Duox) within retinal ganglion cells (RGCs) that are deficient in Nox2 to test whether there is an alteration in growth characteristics with neurite outgrowth. In order to test this hypothesis, we performed an axonal growth assay by culturing embryonic zebrafish RGC and treated them with serum-free medium in the presence of either 0.1% DMSO (control) or 0.05 μM celastrol (CST). After which, we took time-lapse images using phase contrast and differential interference contrast microscopy. Preliminary results have shown that other Nox isoforms are involved with neurite outgrowth in developing zebrafish RGCs.

Mentor(s):

Daniel Suter, Biological Sciences, College of Science

College of Health and Human Sciences

Alcohol Use and Pandemic-Related Stress as Risk Factors for Intimate Partner Violence

Author(s):

Niamh Christie, College of Health & Human Sciences

Abstract:

Intimate partner violence (IPV) is a significant public health concern experienced by millions of individuals throughout their lifetime. Although the etiology of IPV is multifactorial, individual risk factors contributing to IPV are well-established. Heavy alcohol use and problematic alcohol consumption patterns among couples are associated with IPV and other negative relationship outcomes. Concordant and discordant drinking have been found to be both risk and protective factors for relationship health. Specifically, heavy discordant and concordant use are associated with higher likelihood of relationship conflict, whereas light concordant use is linked to increased intimacy. With prior research documenting stress as a significant risk factor for IPV and recent findings suggesting an increase in IPV during the COVID-19 pandemic, it is timely to consider how fluctuations in stress during the pandemic may affect relationship functioning. The present study uses ecological momentary assessment (EMA), to evaluate the relationship among alcohol use patterns, stress, and risk for relational aggression. Using the I3 Model of Aggression, the present study examines COVID 19-related stress as an impelling variable and couple's concordant and discordant alcohol use as disimpelling or disinhibiting variables for relational aggression. Results will inform our understanding of the complex interactions among these dynamic risk factors, and empirical and clinical implications of these findings will be considered.

Mentor(s):

Molly Maloney, Psychological Sciences, College of Health & Human Sciences

Christopher Eckhardt, Purdue University

Daniel Oesterle, Purdue University

Poster Presentation Abstract Number: 316 :: Life Sciences

Honors College

A Potential Binder Protein to Neutralize SARS-CoV-2 Designed with Foldit

Author(s):

Payton Clapper, School of Management

Abstract:

Author: Payton Clapper

On March 11, 2020 a virus known as SARS-CoV-2 was declared a pandemic due to its rapid ability to spread and potentially deadly respiratory effects. Currently there is no effective and efficient way to neutralize SARS-Cov-2; therefore, it is critical that more research is done to advance our knowledge of the virus which will aid in the development of a possible solution. Research has shown that SARS-CoV-2 has a spike protein on its surface that allows for binding to a protein on human cells known as ACE-2. One possible way to treat infection is to neutralize the virus with a binder protein that can bind to the receptor binding domain (RBD) of the spike protein more tightly than ACE-2. This project addresses the questions: Can the online game Foldit be used to design a small stable protein that can bind to SARS-Cov-2? What is the primary sequence and folded tertiary structure of such a protein? This not only would prevent the virus from binding to the human cells, it could also serve as a more feasible solution compared to antibodies. Foldit is a hybrid tool that uses artificial intelligence guided by human creativity and 3D spatial skills to allow for the design of new protein structures by non-expert scientists. Preliminary findings showed an increase in Rosetta energy after rotating the backbone of SARS-Cov-2 which was done by extending the alpha helix. This rotation allowed for the creation of more hydrogen bonds between the protein and SARS-Cov-2. It also helped satisfy the hydrophobic effect creating a more stable protein, thus creating a better chance of the protein being able to neutralize the virus.

Mentor(s):

Zahra Tehrani, Honors College

College of Science

One step ahead of a constantly evolving virus: a kinetic comparison of SARS-CoV-2 papain-like protease mutants.

Author(s):

Stephanie Clark, College of Science

Abstract:

Redacted.

Mentor(s):

Mackenzie Chapman, Biological Sciences, College of Science

Andrew Mesecar, Purdue University

Honors College

Designing a Binder for the SARS-CoV-2 Spike Protein

Author(s):

Melanie Clayton, College of Science

Abstract:

COVID-19, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has created a pandemic. SARS-CoV-2 enters host cells using its surface spike protein to bind to the human ACE-2 receptor. Once bound, it infects cells by fusing with the cell membrane and releasing its genetic information inside the cell. A binder protein against the spike protein would block interaction with the ACE-2 receptor, preventing the virus from infecting the cell. Designing a protein like this will lead to effective therapies for COVID-19, potentially at a lower cost. Synthetic proteins can be much smaller than antibodies, meaning an equal weight of synthetic protein has more binding capacity. They are also less likely to cause an immune response than antibodies. This research seeks to answer the question: Can we block COVID-19 infection by designing a protein that binds SARS-CoV-2 with a higher affinity than ACE-2? The main challenge is designing synthetic proteins with low energies. Foldit is a computer program that allows non-expert citizens to design novel proteins. Although automated programs, such as Rosetta, are available, humans in conjunction with artificial intelligence are typically more successful in protein design than computers alone due to human creative ability. For this project, fundamental principles of protein structure and folding were applied in Foldit to design a protein that binds to the spike protein. The original protein structure, part of the ACE-2 enzyme, was altered to make a more favorable binding site by optimizing the hydrogen bonding between the binder and the spike protein, as well as within the binder itself. This research may lead to effective and lower cost treatments for COVID-19.

Mentor(s):

Zahra Tehrani, Honors College

Poster Presentation Abstract Number: 319 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Development of a Semi-Autonomous Quadcopter Drone

Author(s):

Tyler Collins, College of Engineering

Ryan Jensen, College of Engineering

Jinrae Kim, College of Engineering

Vishnu Langdu, College of Engineering

Pranav Singh, College of Engineering

Abstract:

This research project was completed in our VIP Team, Robotic Exploration. Our team was tasked with designing a semi-autonomous quadcopter drone that is able to gather data from its surroundings and relay that data back to a control station monitoring its progress. The drone is able to collect data utilizing a camera, altitude sensor, and proximity sensor. The planned mission for the drone includes traveling along a predetermined route, autonomously detecting obstacles in its path, navigating around any obstacles, and returning safely to the landing pad.

The programming and electronics subgroup utilized VirtualBox, Raspberry Pi's, and a flight controller called Crazyflie to control the drone. Meanwhile, the mechanical design and aerodynamics team designed the drone on a 3D modeling software to fit predetermined constraints. Then use the estimated mass of the drone to select a propulsion system to provide an adequate amount of thrust. All subgroups had to make reasonable estimations and draw conclusions with the information given to us in order to select parts and engineer the drone.

Mentor(s):

Nichole Ramirez, , College of Engineering

Prabhpreet Dhir, Purdue University

Poster Presentation Abstract Number: 320 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Identifying Challenges and Needs faces by Families Experiencing Homelessness/Housing Instability in Tippecanoe County

Author(s):

Maggie Craig, College of Engineering

Kathryn Malerbi, College of Health & Human Sciences

Gianna Thornton, College of Health & Human Sciences

Abstract:

Background: Families experiencing homelessness/housing instability (FEH) is a national public health crisis faced by numerous counties across the US, including Tippecanoe County. A lack of stable housing increases a family's susceptibility to physical and mental health and family dynamic risks. To properly address these challenges, it is imperative to first identify the challenges and needs of this vulnerable population in Tippecanoe County. While a general understanding of challenges exists, it draws on perspectives that exclude FEH themselves. Yet, the perspectives of FEH are critical to effectively addressing identified challenges and needs. Thus, this study sought to understand from local Hoosier FEH the challenges they face and the subsequent impact of COVID-19.

Methods: Semi-structured interviews were conducted with head of households (N = 14) of local families experiencing homelessness or housing instability during the COVID-19 pandemic. Qualitative data was thematically analyzed using NVIVO software.

Results: Findings revealed challenges faced by FEH in Tippecanoe County include loss of familial support, lack of proper childcare, job and financial instability, and mental illness. Participants identified needs including accessible and reliable childcare, transportation, mental health services, and emergency housing opportunities for families with children.

Conclusion: Findings suggested that service and program efforts begin with focusing on mental health, childcare, transportation, and financial counseling. With challenges and needs identified by local FEH themselves, we can confirm their relevance by providing existing evidence for the potency for future solutions.

Mentor(s):

Yumary Ruiz, Public Health, College of Health & Human Sciences

Carlyn Kimiecik, Purdue University

Natalia Rodriguez, Purdue University

Jason Ware, Purdue University

Poster Presentation Abstract Number: 321 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Presence of comorbidities and variability in COVID-19 mortality across countries

Author(s):

William Crytzer, College of Science

Tanay Athreya, College of Science

Rasesh Ramadesikan, College of Science

Abstract:

COVID-19 is responsible for 6.1 million deaths worldwide. Despite the same disease, mortality rates varied drastically between countries likely as a result of different government responses during the pandemic, the prevalence of certain comorbidities in the populations, and variation in healthcare resources across countries. Explicitly understanding the factors associated with differential mortality rates in different countries can help different nations to identify strategies to be better equipped to tackle the pandemics and address future health emergencies.

The aim of our study was to investigate how different COVID-19 comorbidities were associated with variations in COVID-19 mortality across different countries given differences in public health and government responses. To address this question, we compiled data on 149 countries related to a country's economy, comorbidity prevalence, and demographics, spanning 2015 to 2022, from a variety of sources, such as the WHO. We ran a multiple linear regression with fourteen independent variables to analyze the effect of each comorbidity on COVID-19 mortality. Our analysis shown that GDP per capita, obesity, respiratory disease were significantly and independently associated with an increased risk for COVID-19 mortality. Region was also significant in explaining COVID-19 mortality. To conclude, our study found that the prevalence of respiratory disease and obesity in each country are independently and significantly associated with COVID-19 mortality rates. Although GDP and region differences also associated variation in COVID-19 mortality across countries, our study highlights the importance of managing respiratory and metabolic diseases such as obesity in combatting greater morbidity and COVID-19 mortality in certain countries.

Mentor(s):

Qinglan Ding, Nursing, College of Health & Human Sciences

Ryan Lunn, Purdue University

Emily Wu, Purdue University

College of Liberal Arts

The Influence of Nostalgia on Values and Business Structure at a Smallholding Farm

Author(s):

Reese Curtis, College of Liberal Arts

Abstract:

This project highlights the relationship between nostalgia, values, and how one navigates the present in a farming context. While nostalgia has long been used by the social sciences to describe an abject longing for the past, in recent years this concept has gained traction as a force with the potential to shape idealized futures. Conversely, small-scale farmers with diversified crop outputs have been on the rise in recent years despite the dominance of industrial agriculture, suggesting that this resurgence could be a result of rural nostalgia. This project is a case study investigating the influence of nostalgia on the values and business structure of Wea Creek Orchard, an intergenerational family farm. Utilizing three interviews and observational data gathered over the course of three months and 116 hours, I ultimately found that nostalgia and memories seem to guide both what is valued by the farm family and how the farm is managed as a business. More specifically, the farm family's nostalgia seems to be centered on social experiences during childhood and adolescence, making the Orchard's emphasis on social interaction significant. This case study is important for those interested in rural nostalgia and small farm work, but also those looking to utilize nostalgia and values in qualitative research.

Mentor(s):

Andrew Flachs, Anthropology, College of Liberal Arts

Poster Presentation Abstract Number: 323 :: Mathematical/Computation Sciences

College of Science

An Analysis of the Socioeconomic Determinants of the Evolution of the COVID-19 Pandemic in the Midwest of the United States

Author(s):

Soumalya Das, College of Engineering

Abstract:

Research has shown that the impact of the COVID-19 pandemic varies in relation to socioeconomic determinants, including age, gender, income level, political orientation, and other variables. Heterogeneous datasets regarding these various socioeconomic determinants and epidemiological variables can be linked so that a relationship between the number of COVID-19 cases and deaths and socioeconomic determinants can be derived via statistical and machine learning methods. This research is devoted to such a purpose with particular focus to the situation in the Midwest of the United States. In this work, we collect and integrate datasets from the World Health Organization, Centers for Disease Control and Prevention, World Bank Open Data, and governmental repositories of the states of the Midwest. We then appropriately describe the data through visualizations and descriptive measures. This analysis is ongoing and will provide data-driven insights on the evolution of COVID-19 in the Midwest population that might be of interest to public health officials.

Mentor(s):

Alessandro Maria Selvitella, Purdue Fort Wayne

College of Liberal Arts

Taking a Bite of History: Simulating Animal Bites in a Laboratory Setting

Author(s):

Erika Denker, College of Engineering

Hunter Velasquez, College of Engineering

Abstract:

When conducting research, archaeologists often recover animal remains with bone surface modifications (BSMs) on them, including those made by ancient predators. Researchers can use these marks to potentially identify the predator, providing insight into a site's paleoecology. To do this, archaeologists compare the marks on the bones from archaeological contexts to marks of known origin. Unfortunately, BSM with known origin can be pretty difficult to procure due to availability (e.g., rare or extinct predators) and the logistics of obtaining such marks from live predators, like wolves for example, in a controlled manner. In response to the need for a controlled method of acquiring such marks, we constructed JAWS (Jaw Actuating Wildlife Simulator). This device manipulates a cast of a gray wolf skull using compression to reproduce bite marks on bones without using live specimens. The system employs pneumatics that can be adjusted to give variable force output. The bite marks then undergo 3D morphometric analysis, deep learning, and Bayesian inference to compare these marks with other marks of unknown origin. By building up catalogs of marks created by JAWS, archaeologists will have access to many marks of known origin to compare with unknown marks, improving identifications. In summary, combining anthropological statistical analysis with engineering design processes and knowledge has yielded a unique way to create BSM. JAWS solves the problem of how researchers can reliably produce marks of known origin to match with those of unknown origin.

Mentor(s):

Erik Otarola-Castillo, Anthropology, College of Liberal Arts

Trevor Keevil, Purdue University

Melissa Torquato, Purdue University

Poster Presentation Abstract Number: 325 :: Life Sciences

<div align="center">

College of Agriculture

The effects of heat lamp placement on piglet survivability

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Author(s):

Alicia Denton, College of Agriculture

Alton Holstine, College of Agriculture

Abstract:

Preweaning survivability has been steadily decreasing in piglets in recent years as litter sizes have increased, partially due to their inability to regulate their body temperatures after birth. The purpose of this study was to evaluate the effects of heat lamp placement (sow's udder side (HLU) or back side (HLB)) in the farrowing crate as well as piglet placement around the sow after birth (udder (PU) or vulva (PV) of sow). The study was a 2x2 factorial with four treatments: HLU/PU; HLB/PU; HLU/PV; and HLB/PV. Piglets were individually identified and weighed at birth, at 24h, and weekly for three weeks. SAS v9.4 was used to evaluate the effects of heat lamp location and piglet placement on piglet colostrum intake, growth, and survival. Additional evaluations looked whether piglets with birth weights of <1.0kg, 1.0-1.5kg, or >1.5kg responded to treatments differently. Piglets that were placed at the udder approached the udder faster (P<0.001) and suckled sooner (P=0.0186) compared to piglets that were placed at the vulva, regardless of heat lamp location. However, this did not result in increased colostrum intake (P=0.6581), average daily gain throughout lactation (P=0.2359), or piglet survival (P=0.1581). Piglets < 1.0kg had higher mortality (39%) than heavier pigs (7-12%, P<0.0001), but neither heat lamp placement nor piglet placement improved survival or ADG in these lightweight piglets. Placing piglets at the udder decreased time from birth to first suckle. Piglet body weight was the largest driver of colostrum intake, nursing behaviors, and survival to weaning.

Mentor(s):

Kara Stewart, ,

Poster Presentation Abstract Number: 326 :: Life Sciences

Honors College

De novo design of a SARS-CoV-2 spike protein inhibitor using Foldit

Author(s):

Alyssa Easton, College of Engineering

Abstract:

Since the development and widespread distribution of SARS-CoV-2 mRNA vaccines, the virus has evolved several variants capable of evading host immune response, highlighting an immediate need for antiviral drug development. Small synthetic proteins are an attractive option for antivirals because they are more stable and easier to deliver intranasally than larger molecules like monoclonal antibodies. The S-glycoprotein on the surface of the SARS-CoV-2 membrane plays a crucial role in viral entry to the host cell, which makes it a good target for both vaccines and therapeutic interventions. Minibinder inhibitors of the spike protein developed at the Institute for Protein Design have demonstrated success at competitively binding the spike receptor-binding domain (RBD) in vivo, and are now in clinical trials. While de novo designs can be generated by protein-folding algorithms such as Rosetta, artificial intelligence still lacks the spatial reasoning and creativity of the human mind. As such, human involvement in the protein design process can produce not only more effective designs, but also aid in the development of better AI. Here, we designed a novel minibinder from a template of the ACE2 receptor (the target of the spike protein) using the protein design game Foldit. Protein designs with high affinity for the spike RBD would out-compete ACE2 for binding to the RBD, thus preventing the spread of infection at a molecular level. The goal of this work was to create a stable protein with high binding affinity, characterized by a low energy state, which was represented by a high number of Foldit "points." Here, the process to create a novel protein is detailed, and the final design with a score > 13,500 points is shown.

Mentor(s):

Zahra Tehrani, Honors College

College of Liberal Arts

Caucasus Heritage Watch Historical Site Monitoring

Author(s):

Peyton Edelbrock, College of Liberal Arts

Abstract:

In 2020, there was a war in the disputed territory between Azerbaijan and Armenia called Nagorno-Karabakh. Because of this war, thousands of people were displaced from their homes and many others died. Along with human casualties, historical sites in the region suffered damage as well. Through the Caucasus Heritage Watch with Professor Ian Lindsay of Purdue University and Cornell Professors, there is research and work to discover the damage.

The topic of this research focuses on monitoring historical sites and seeing if they were damaged or destroyed during the war. This research uses the program ArcGIS to georectify declassified imagery from the CORONA and HEXAGON satellite reconnaissance program, which was active during the 1960s and 1970s. Georectification lets researchers compare the CORONA images to a modern-day map of the region, which allows them to see what condition historic landmarks are in. The purpose of this research is to help hold those who destroyed these historic landmarks accountable for their actions, as well as to help preserve the remaining ones.

Mentor(s):

Ian Lindsay, Anthropology, College of Liberal Arts

College of Engineering

Introduction of AI Acceleration to an Open-Source Design Platform

Author(s):

Zachary Ellis, College of Engineering

Brian Colananni, College of Engineering

Abstract:

When working in Artificial Intelligence applications, traditional (Von Neumann) computer architecture suffers great inefficiency due to the substantial number of memory transactions needed for the requisite computations. AI accelerators have emerged as a solution for addressing these problems by shifting the bulk of this workload to specialized computation units within or adjacent to the memory arrays themselves. AI accelerators may also take advantage of known properties of machine learning datasets (such as sparsity) to further optimize their computation for speed or energy usage. Concurrently, the growing area of open-source technology in both design and implementation in the semiconductor space presents new opportunities for diverse groups of candidates to submit designs for manufacture on relatively mature processes. The research presented highlights a particular implementation of a machine learning accelerator to be fabricated on the open-source SkyWater 130nm process and taped out using the open source zero-to-ASIC platform. Taking design inspiration from prior work done at Purdue and open-source projects like NVIDIA's NVDLA and Eyeriss, the accelerator consists of a 2D array of processing elements fed by global memory. Moreover, it leverages close proximity and exclusive bus access to the memory in order to reduce latency and energy usage. The final design will be manufactured as a portion of the Efabless chipIgnite 2204C shuttle and will be evaluated to provide feedback to the program on how similar designs can be reliably fabricated and used by future projects.

Mentor(s):

Mark Johnson, Electrical & Computer Engineering, College of Engineering

Mustafa Ali, Purdue University

Honors College

Using AI-driven software to design and model a high-efficacy, resource-efficient SARS-CoV-2 infiltration inhibitor

Author(s):

Jacob Eyster, College of Health & Human Sciences

Abstract:

SARS-CoV-2, responsible for causing COVID-19 in humans, infiltrates human cells via binding of its spike protein's receptor binding domain (RBD) to a single receptor on the surface of human cells known as ACE2. By creating a synthetic protein capable of binding and competitively inhibiting Spike's RBD from contacting ACE2, Spike can be effectively neutralized, preventing COVID-19 infection. While there exist monoclonal antibodies that capitalize upon this mechanism, their potential is limited by their cost- and resource-inefficiency, in addition to the high probability of failure in the face of a mutated RBD site; in turn, the prospect of a broadly effective, resource-efficient binder protein presents marked potential. This investigation comprises the design of a synthetic binder protein that might bind to spike's RBD and retains superior energetic favorability (Rosetta energy > 13500). Guided by knowledge of protein biophysics, a candidate was developed using FoldIt, a protein modeling software guided by the Rosetta energy calculation algorithm. The software optimizes orientation and quantifies the protein's adherence to thermodynamic principles of protein folding, which is otherwise difficult to characterize. Because the algorithm itself seeks to constantly optimize, it may exclude more effective solutions once it identifies a local energy minimum. On the other hand, human innovation and visual abilities allow the manual introduction of structural changes that may lead to more stable protein structures. The candidate presented here is a derivative of the ACE2 template; to form a core, interior residues facing the spike protein have been mutated to hydrophobic amino acids. 65 alpha helices comprise much of the protein's secondary structure, accompanied by four loops located in the center that pack together and hydrogen-bond. Inner-facing helices are aligned tangent to spike, promoting binding. In light of these optimizations, the protein's Rosetta energy stands above 13000, a significant improvement over the original (~11700).

Mentor(s):

Zahra Tehrani, Honors College

Purdue Polytechnic Institute

Analyzing the Reasons for Declining Shark Populations in Australia

Author(s):

Joshua Fechtman, Polytechnic Institute

Abstract:

Shark populations are important for ecological balance and controlling the populations of both larger and smaller organisms. If these populations change drastically, other marine species will be impacted, resulting in effects that can harm people's livelihoods or access to food. The fishing industry will be hurt by the loss of sharks due to the profitability of shark products. The tourism industry could also be impacted as populations expand and decrease as a result of changes to shark populations. These concerns have resulted in marine sanctuaries and fishing regulations, but this raises the question of how useful these regulations are. This research will explore the extent of population changes to Australian shark populations as well as examine which policies are most effective for causing shark populations to rebound. Overfishing and climate change are a few reasons causing these changes. These changes impact trophic pyramids and affect populations of other species. Analysis of data provided by the Queensland Department of Agriculture and Fisheries are used as a key source of secondary population data along with the Global FinPrint database, which catalogs global shark sightings. Tableau software will be used to aid comprehension and visually highlight insights. This data will be used to show the extent to which global warming and overfishing have affected shark populations as well as the effectiveness of counteractive policies.

Mentor(s):

Vetria Byrd, Computer Graphics Technology, Polytechnic Institute

Poster Presentation Abstract Number: 331 :: Social Sciences/Humanities/Education

College of Liberal Arts

Driver's License Suspension Laws

Author(s):

Daniella Ferrante, College of Health & Human Sciences

Emily Gonzalez, College of Health & Human Sciences

Marco Rivero, College of Liberal Arts

Melanie Sperrazza, Polytechnic Institute

Stella Yao, College of Health & Human Sciences

Abstract:

Collateral consequences affect millions of Americans convicted of crimes. This study examines the proliferation of laws providing for driver's license suspensions after criminal convictions. It addresses two research questions: (1) How do criminal record-based limitations on driver licensing vary at the state level? (2) What state-level social, political, and economic characteristics predict the adoption of more numerous and more onerous collateral consequences in the area of driver licensing? To build the dataset needed to answer these questions, we read relevant state-level statutes and recorded their years of adoption. Subsequent statistical analyses will analyze the contextual factors predicting the adoption of license suspension laws.

Mentor(s):

Spencer Headworth, Sociology, College of Liberal Arts

David McElhattan, Purdue University

College of Agriculture

Picture this: Reimagining Pictured Rocks National Lakeshore's Front County

Author(s):

Abigail Fisher, College of Agriculture

Abstract:

Pictured Rocks National Lakeshore is experiencing unprecedented growth in visitation rates, and this increase is expected to continue into the future. Pictured Rocks boasts unreal landscape features that attract visitors from all over the Midwest, but areas of high visitation must be balanced with preserving biodiversity in wildlife and nature. Over-visitation is posing a threat to wildlife habitat, but is also creating hazardous conditions for the visitors themselves. This project seeks to identify where negative effects of over visitation are happening and redistribute areas of activity to more suitable and safe places. ARCGIS will be used to overlay natural and built environment data sourced from the NPS database along with aerial photograph interpretation, site-observation, and input from project stakeholder and community members in order to determine where landscape interventions can be placed to benefit visitors with a minimal impact on the land. The GIS analysis is showing that there are numerous opportunities to site new infrastructure in proximity to existing front-country visitation areas, with a potential to connect these existing areas. Siting new infrastructure where there is already a presence of tourists will help maintain wildlife areas and draw people away from sensitive ecosystems and places that are hazardous to human safety. Based on the findings, landscape proposals will be made to strengthen and connect the programmatic activities in existing visitor areas to appropriately increase visitorship and create a complete front-country experience.

Mentor(s):

Aaron Thompson, Horticulture & Landscape Architecture, College of Agriculture

Poster Presentation Abstract Number: 333 :: Life Sciences

College of Agriculture

Stable isotope analysis of chimpanzee (Pan troglodytes) diet and evidence for meat sharing in females

Author(s):

Sophia Flores, College of Agriculture

Alexis Proudman, College of Agriculture

Abstract:

Chimpanzees (Pan troglodytes) consume a diverse array of wild plant and animal species, including fruits and figs, leafy material, flowers, mammals, and insects. Males tend to hunt and share meat more often than females, and females tend to allocate more effort to foraging for insect prey with tools. However, there is high behavioral variation in diet, and hunting and food sharing among chimpanzee social groups. For example, adult males at the Tai Forest, Ivory Coast, frequently hunt and share meat, but female chimpanzees on the savanna at Fongoli, Senegal routinely hunt small mammals with tools and share meat with other group members. Less is known about chimpanzees using savanna-woodland habitats, and more research is needed on hunting and meat consumption from multiple study sites to assess behavioral and dietary variation between savanna chimpanzee populations. From 2020–2022 we collected hair samples of female and male chimpanzees from the Fongoli and Assirik populations in Senegal. We used stable isotope analysis to evaluate the diet of chimpanzees to determine if there was a significant difference in diet between the two sites. Examining isotopic values in chimpanzee hair can estimate the relative contribution of meat to the overall diet because meat has a greater $\delta15N$ than plant-based foods and is an indication for greater hunting of meat in the chimpanzee population.

Mentor(s):

Elizabeth Flaherty, Forestry & Natural Resources, College of Agriculture

Stacy Lindshield, Purdue University

Poster Presentation Abstract Number: 334 :: Mathematical/Computation Sciences

College of Engineering

SoCET Processor Cache Design

Author(s):

Aedan Frazier, College of Engineering

Rufat Imanov,

Dhruv Gupta,

Mitch Arndt,

Abstract:

Redacted.

Mentor(s):

Mark Johnson, Faculty, Purdue University

Sarang Pramod, Purdue University

Cole Nelson, Purdue University

College of Engineering

SoCET SoC Cache Design

Author(s):

Aedan Frazier, College of Engineering

Dhruv Gupta, College of Engineering

Rufat Imanov, College of Engineering

Abstract:

The purpose of our research is to design and verify our own system on a chip or SoC. SoCs are integrated circuits where a processor as well as other components that would normally be on their own silicon chip are included onto one singular chip. Our specific sub-team deals with the digital design of the caches and surrounding logic for our SoC. In short, caches are very fast memory storage that are located close to the processor. Accessing memory from a cache is going to be faster than accessing memory from a larger and further away source of memory such as RAM or Disk. This property and fact that caches can exploit the ways that programs work, decrease a benchmark for the processor called "average memory access time" or AMAT. Decreasing the average time that it takes to access memory (which the processor must do at least once per instruction) means that we can execute more instructions per clock cycle on average than we would without a cache, resulting in better performance. Our cache team is working on the design and verification of these caches for our processor. My specific role is under the design side. This involves creating specifications as well as writing HDL (hardware description language) code to design logic on top of smaller test benches to quickly verify our cache designs.

Mentor(s):

Mark Johnson, Electrical & Computer Engineering, College of Engineering

Sarang Pramod, Purdue University

Cole Nelson, Purdue University

Mitch Arndt, Purdue University

Poster Presentation Abstract Number: 336 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Understanding Social Support of Families Experiencing Homelessness/Housing Instability in Tippecanoe County

Author(s):

Summer Funkhouser, College of Health & Human Sciences

Dakota Brandenburg, College of Health & Human Sciences

Kelly Haddow, College of Health & Human Sciences

Abstract:

Background: Of the 1,446,000 people experiencing homelessness in the U.S., 35% are families with children. Experiencing homelessness places families at increased susceptibility to poor health outcomes. COVID-19 exacerbated these health risks and negatively impacted family dynamics. Despite these challenges, coping strategies have been found to help families persevere in the midst of adversity, in particular, social support has been found to positively influence the mental and physical health. However, little is known about social support experiences in Tippecanoe County homeless families. This study aimed to identify and understand the role played by formal and informal sources of support in the lives of these vulnerable families.

Method: Head of households (N = 14) from families who have experienced homelessness or housing instability since COVID-19 in Tippecanoe County participated in semi-structured interviews that were thematically analyzed.

Results: Participants described the formal and informal social supports they utilized that enabled them to cope. Formal support centered around churches, schools, and organizations which provided resources and aided them financially. Whereas, informal support included friends and family, their children in particular, provided strength to preserve despite challenging circumstances.

Conclusions: Support FEH received from organizations allowed them to tap into resources that could aid them in overcoming homelessness or housing crisis while their families and peers gave them the fortitude to remain optimistic and hopeful. Understanding these coping strategies and their connection to enhancing outcomes for this population can inform efforts that aim to empower and serve this population through strength-based approaches.

Mentor(s):

Yumary Ruiz, Public Health, College of Health & Human Sciences

Carlyn Kimiecik, Purdue University

Natalia Rodriguez, Purdue University

Jason Ware, Purdue University

College of Health and Human Sciences

Enhancing Wellness and Self-efficacy through Targeted Health-Focused Interventions for Clients of the Lafayette Transitional Housing Center

Author(s):

Kylee Gall, College of Health & Human Sciences

Abstract:

Homelessness is indiscriminate in its impact, yet individuals of the homeless population share some commonalities concerning certain clinical maladies. These commonalities are often compounded by a lack of access to consistent preventative care, an insufficient and unvaried diet not aligned with clinical needs, exposure to the elements, and the medical challenges homelessness presents along with the economic instability and stress it induces. The dependence on external mechanisms of support adds insult to injury, further hindering their sense of control over their situation. Garnering a sense of control is a critical component in their path toward lasting wellness, yet moving the needle in this direction requires the incorporation of education along with supplementation. This study aims to investigate the impact short health lessons with associated intervention kits will have on enhancing the self-efficacy of clients at Lafayette Transitional Housing Center (LTHC) along with their behavior and health decisions. Following each session, participants will voluntarily complete a survey following each intervention to evaluate their intent of incorporating lesson concepts in their daily lives. Furthermore, the distribution of surveys to LTHC staff will occur in the weeks following each intervention session to discern the lasting impact not only on client behavior but also their self-efficacy.

Mentor(s):

Lisa Hilliard, Health Sciences, College of Health & Human Sciences

College of Science

YemiJoy2021 Genome Analysis and Research

Author(s):

Andrea Garcia Duran, College of Engineering

Matthew Spinazze, College of Engineering

Trevor King, College of Engineering

Abstract:

Last fall, the bacteriophage YemiJoy2021 with host Mycobacterium smegmatis mc2 155 was isolated from a soil sample found at Purdue University. In 2022, YemiJoy2021 was then sent for genome sequencing at the Pittsburgh Bacteriophage Institute. The phage's genome was found to be 155,660 bp long. This semester, the group annotated the phage's genome from 128,241 base pairs to the end of the genome. Each gene's start site and function were "called" by making evidence-based decisions from several bioinformatic tools such as DNA master, Phamerator, Starterator, and Genemark. The group also focused on three different aspects of protein and gene research: mutation analysis, protein folding, and phylogeny. Each group member used different platforms to advance the project such as Pymol, Phyre 2, Python, splitstree, Mega, and phyML.

For protein structure, structural motifs were found for the predicted models for the genes based on their known function, and some of the genes had such good matches on Phyre2 that a predicted structure could be determined.

 The group also analyzed the mutations found between our genes and other similar genes from non-draft genomes. To do this, one member created a Python program that accepts two identical-length DNA strands as inputs and returns information containing the locations and classifications of each mutation. Mutations were found and classified using this method for the chosen genes.

The phylogeny analysis determined the evolutionary relationship between the genes in YemiJoy2021 and genes with the same function in other phages using both a bootstrap and neighbor-joining method.

Mentor(s):

Aaron Gin, ,

College of Science

A High-Throughput Screen for Activators and Inhibitors of HYPE-mediated AMPylation

Author(s):

Alyssa George, College of Science

Lukas Dolidze, College of Science

Kevin Ryu, College of Science

Abstract:

Aggregation of the pre-synaptic protein α-synuclein into formations called Lewy bodies is one of the major hallmarks of Parkinson's disease. We previously showed that the sole human Fic protein, HYPE, can attach an AMP moiety to α-synuclein through the process of adenylylation (AMPylation), leading to a decrease in many of the neurotoxic phenotypes associated with Parkinson's disease. HYPE is intrinsically inhibited in vivo and upregulated under stress of misfolded proteins, so the ability to manipulate HYPE's activity is of significant therapeutic relevance. The purpose of this study is to identify small molecule activators and inhibitors of HYPE, which can cross the blood-brain barrier and facilitate drug development. To this end, we developed a fluorescence polarization-based dual high-throughput screen, which uses the fluorescent ATP analog FL-ATP to measure HYPE's AMPylation activity as a readout. Results from our pilot assay identified the first small-molecule activators and inhibitors of HYPE. However, these molecules were not optimized for the central nervous system (CNS) or drug development. Our current assay screens larger, more diverse chemical libraries (DIVERSet™ ChemBridge and CNS-Set™ ChemBridge) whose compounds have a higher probability of blood-brain barrier penetration and are more applicable to the CNS. We have identified several compounds capable of modulating HYPE's activity in vitro, and the most bioactive candidates will be validated using in vivo assays for AMPylation activity and cytotoxicity. Druggable activators we identify in this screen will be developed into therapeutic treatments for Parkinson's disease.

Mentor(s):

Seema Mattoo, Biological Sciences, College of Science

Ali Camara, Purdue University

College of Science

BERT Transformer and Graph Neural Network Application for Top Anti-Top Quark Identification in CMS Detrctor

Author(s):

Mason Giacchetti, College of Science

Mitchel Craven, College of Engineering

Sean Flanary, College of Science

Abstract:

The Standard Model of particle physics compiles all of the known elementary particles and describes their interactions through fundamental forces. Of the many theories that comprise the Standard Model, quantum chromodynamics (QCD) describes the interactions of quarks, a subgroup of fundamental particles which constitute the building blocks of matter, through the strong nuclear force. QCD's complexity makes producing accurate predictions difficult, and thus further testing is necessary. Among the various predictions made by QCD, one states that a bound-state of the top and anti-top quarks, toponium, is impossible due to the near-instantaneous decay of top and anti-top quarks. This state, if observed, would suggest a shortcoming of QCD, and could lead towards a more robust theory. Top and anti-top quark events are being explored at the Compact Muon Solenoid detector at the LHC for instances of toponium. The instability of these quarks requires that these events are reconstructed from their decay products. One issue is that they decay into various other fundamental particles, some of which are undetected such as neutrinos. Transformers, a type of machine learning algorithm which performs reconstruction and classification, provide a means for identifying these lost products and thus top and anti-top events within the detector. We plan on repurposing BERT, a transformer used in natural language learning, to accomplish this. We also hope to utilize pre-existing machine learning algorithms like graph neural networks to benchmark our transformer's performance in classification, and possibly to perform classification instead if the transformer does not have the desired performance.

Mentor(s):

AJ Wildridge, Physics & Astronomy, College of Science

Andreas Jung, Purdue University

Poster Presentation Abstract Number: 341 :: Mathematical/Computation Sciences

College of Engineering

In Situ Diagnostics of Additive Manufacturing Processes

Author(s):

Michael Goldberg, College of Engineering

Andy Ding, College of Engineering

Frances O'Leary, College of Science

Abstract:

In-situ diagnostics of fused filament fabrication (FFF) 3D printing can result in vastly increased reliability of 3D printed components. Current commercial 3D printers cannot make alterations to the G-Code if an error occurs during the print. This study implements a structured-light 3D vision system to allow the printer to have full, closed-loop control over a print, and works in the following manner: a 3D file is sliced, and a G-Code file is produced. This file is sent to a host PC which splits it into the different printable layers, forming a set of expected profiles for each layer. The first G-Code layer is then sent to the printer, and a scan is taken - with the scan data sent to the host PC. This data is compared to the expected profile and defects are determined where these two profiles do not match. Based upon which defects are detected, custom G-Code instructions are generated and sent to the printer in an attempt to fix the issue. The next layer is then printed and the process repeats.

This research is still being conducted, with the system presently in development - thus there are no results to share at this time. Current efforts are focused on calibration between the printer and camera coordinate systems to allow for dimensionally accurate G-Code alterations to be generated. If this system proves successful for FFF printers, the results can be used as a starting point to adapt it to other methods of 3D printing such as SLA and direct-ink.

Mentor(s):

Caroline Blanchard, Graduate Student, Purdue University

College of Health and Human Sciences

Assessing the utility of a pre- and peri-natal risk questionnaire to identify autism spectrum disorder

Author(s):

Abigail Hamilton, College of Health & Human Sciences

Abstract:

To date, a large body of epidemiological research has identified a number of risk factors associated with development of autism spectrum disorder (ASD). The purpose of the current study was to evaluate whether a caregiver-report questionnaire of known pre- and peri-natal risks could be used to differentiate young children diagnosed with ASD from children diagnosed with other neurodevelopment disabilities. Participants included 63 high-risk young children aged 20-45 months that were referred for an ASD evaluation; 48 participants were diagnosed with ASD and 15 received a non-ASD diagnosis (e.g., global developmental delay). Caregivers completed the 26-item risk factor questionnaire, which included questions related to family medical history (e.g., parent/sibling with ASD, maternal autoimmune conditions) and pre- and peri-natal items (e.g., pregnancy/delivery complications, gestational age, birth weight), in order to determine their overall risk scores. An average binary risk score (0/1 per item) and a weighted risk score (calculated based on odds ratio for each item) were calculated. The average binary score for ASD participants (M = 0.17, SD = 0.09) did not differ significantly from non-ASD participants (M = 0.22, SD = 0.06; p=0.103). A similar result was observed for weighted scores (ASD: M = 0.27, SD = 0.16; non-ASD: M = 0.35, SD = 0.12; p=0.102). Preliminary findings from the current study suggest risks, as reported by caregivers, may not be a meaningful predictor of ASD outcome. Future research should examine whether specific risks may be a more sensitive indicator to differentiate ASD from other neurodevelopmental disabilities in high-risk cohorts.

Mentor(s):

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

College of Science

Developing a broad-spectrum inhibitor against human-infecting Coronaviruses, targeting the papain-like protease (PLP)

Author(s):

Cassidy Hardin, College of Science

Abstract:

Redacted.

Mentor(s):

Mackenzie Chapman, Biological Sciences, College of Science

Andrew Mesecar, Purdue University

Honors College

Neutralizing SARS-CoV-2 with De Novo Design of an Inhibitory Protein using Foldit

Author(s):

Sarah Hauser, College of Pharmacy

Abstract:

COVID-19 is a severe upper respiratory infection that was first noted in Wuhan, China, but quickly spread to infect the rest of the globe on a pandemic scale. The virus infects healthy human cells by utilizing a receptor binding domain (RBD) on its spike protein to attach to angiotensin-converting enzyme 2 (ACE2) on the cell surface. One way to block viral entry into cells is to create a mini-binder protein that can attach to the RBD and inhibit the interaction with the ACE2 receptor. Importantly, the binding protein must have a higher affinity for the RBD than the natural affinity between the RBD and ACE2. To design this protein, the online gaming software Foldit was utilized. Unlike automated computational methods, humans have the spatial-visual abilities to alter protein structures in ways that might be energetically costly at first, but ultimately lead to more stable structures; computer algorithms, such as Rosetta, lack such intuition. Here, a novel binder protein is presented with three adjacent alpha helices, characterized by a core of added hydrophobic residues that drives protein compaction. Increasing hydrophobic interactions and hydrogen bonds within the backbone and between amino acid residues improved the stability of the binder protein to an energy score above 13,000. Given the similarity of the SARS-CoV-2 infection mechanism to other life-threatening viruses such as HIV, Ebola, and Influenza, designing a successful binder protein using this approach could have implications beyond than SARS-CoV-2.

Mentor(s):

Zahara Tehrani, Honors College

College of Agriculture

Effects of Rest Time Between Collections on Boar Semen Quality

Author(s):

Hailey Hedrick, College of Agriculture

Abstract:

Stress in boars can negatively impact semen production and quality, reducing the amount of usable sperm cells for insemination doses. One identified stress is collection frequency. The objective of this study was to explore how infrequently altering rest times between semen collections affects semen quality in boars. Boars (n=4) were randomly allotted to two treatment groups: boars collected once per week (CON) and boars collected two times per week (2X). All boars were placed on a consistent weekly collection frequency to establish baseline semen production for each boar and continued for 13 weeks of the study. During weeks 4, 8, and 11 boars in the 2X treatment were collected twice in the week, decreasing days rest from 7d to 3 or 4d. Semen was evaluated at each collection for total sperm, morphological abnormalities, and viability. Data was evaluated using SAS v9.4 with the main effects of treatment and phase relative to increased collection periods. Increasing collection frequency had no effect on total sperm production (P = 0.7668) or sperm motility (P = 0.5545). 2X boars had higher normal cells (P = ¬0.0384) and viable cells (P = 0.052), likely a random effect of only having two boars per treatment. There were no treatment by phase interactions for semen quality parameters suggesting infrequently altering rest times between collections did not affect semen production or quality.

Mentor(s):

Kara Stewart, Animal Sciences, College of Agriculture

College of Agriculture

Sequencing of Vulture Carrion Consumption Patterns

Author(s):

Amanda Herbert, College of Agriculture

Abstract:

Black vultures (Coragypus atratus) and turkey vultures (Cathartes aura) coexist throughout much of their distributions where both scavenge carrion for food. However, little is known about the sequence with which they consume different portions of carcasses. Such knowledge can provide insights into controversies about black vulture predators of livestock. We studied black vulture and turkey vulture carrion consumption patterns by placing stillborn calf carcasses in open grassy fields and observing vulture consumption using remote cameras. We recorded the elapsed time between carcass deployment until consumption of the eye, tongue, perineal structures, umbilicus, and hooves for both vulture species. To assess if vultures consumed specific parts of the carrion earlier or later, we formed a 5x2 contingency table and performed a Fischer's exact test. This test demonstrated the sequence of consumption of these features was significantly different from random for both species. Multiple pairwise comparisons determined turkey vultures consumed the eye, perineal structures, and tongue significantly earlier than the umbilicus or hooves. Black vultures consumed perineal structures and tongue significantly earlier than the hooves. Black vultures are known to rely on turkey vultures' acute sense of smell to locate carrion, yet little is known about interspecific competition for specific anatomic structures. Our study suggests there is competition between turkey and black vultures for the tongue and perineal structures of carrion. Our results also have implications for forensic studies in terms of understanding what features are consumed first as a means of estimating the duration and intensity of vulture scavenging pressure.

Mentor(s):

Patrick Zollner, Forestry & Natural Resources, College of Agriculture

Marian Wahl, Purdue University

Landon Jones, Mississippi State University

Grant Burcham, Purdue University

College of Science

Constraining the Upper Lithostatic Discontinuity Structure beneath the Main Hawaii Island using Teleseismic Receiver Functions with a High Density Station Array

Author(s):

Brandon Herr, College of Science

Abstract:

The Hawaiian Islands represents the youngest portion of the much larger Hawaiian-Emperor Seamount chain that stretches across the Pacific plate as the result of long-lived hotspot volcanism. Complex structures related to the volcanic system, such as magmatic underplating and transport to the surface through pre-existing oceanic lithosphere complicates seismic wave propagation, making studies with few event-station pairs inconclusive. For this study, 3530 teleseismic event/station pairs were considered across 47 stations, most of which in close proximity to Kilauea. We analyze P-wave radial receiver functions to constrain the discontinuity structure below the main island of Hawaii. With this data, we create a 3D volume of discontinuity structure using an Adaptive Common Conversion Point stacking algorithm that incorporates a topographic correction to more appropriately account for the large elevation variations across the island. This new model images the Moho at ~15 kilometers beneath most of Hawaii, which then merges with a very shallow (~6 km) discontinuity. The location of this shallow discontinuity is consistent with deformation in cumulate olivine crystals from ~5km depth, likely representing a magma reservoir of ultramafic-mafic solid-melt system based on its seismic properties and the presence of olivine phenocrysts. Below this region, subvertically-oriented seismicity containing long-period and tremor events extends down to ~40 km and has been interpreted to represent deeper pathways of magma through the lithosphere. The seismic discontinuity structure beneath Kilauea provides a better understanding of the magma pathways and storage in ocean islands that may be applicable to many other areas experiencing oceanic hotspot volcanism.

Mentor(s):

Jonathan Delph, Earth, Atmospheric, and Planetary Sciences, College of Science

College of Health and Human Sciences

Investigating Lead Levels in Mulch on Purdue University Campus

Author(s):

Belle Hinshaw, College of Health & Human Sciences

Abstract:

Lead-contaminated soil is a hazardous source of lead exposure, potentially leading to health consequences including brain and kidney damage. Although research has been conducted to investigate lead in soil as well as rubber mulch, less information is available about the presence of lead in wood mulch. The primary objective of this analysis is to determine the presence and concentration of lead in wood mulch and whether the level varies by newness or location. On the Purdue University West Lafayette campus, four locations were identified for wood mulch collection: Purdue University Airport, Cary Quadrangle, the median on Northwestern Ave., and the Engineering Fountain. Four samples were collected from each location. Four samples of new, control mulch were supplied by the Purdue Grounds Department. Lead was measured using x-ray fluorescence (XRF) (Niton XL3t GOLDD+ XRF analyzer; ThermoScientific, Billerica, MA). The highest mulch levels were present at the airport (mean lead: 28.3 ppm, standard deviation (SD): 20.6 ppm), followed by Northwestern (mean: 9.9 ppm, SD: 4.3 ppm), Cary (below limit of detection (LOD)), Engineering (<LOD), and unused mulch (<LOD). The EPA standard for lead in bare soil is 400 ppm for play areas and 1200 ppm for non-play areas; therefore, our mulch samples are well below this standard. Results suggest lead in mulch is likely absorbed from the environment, as areas with higher vehicle traffic contained higher contents of lead. These results could indicate areas of campus more prone to lead contamination as well as locations in need of more frequent mulch replacement.

Mentor(s):

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

Kenneth Burnell, Purdue University

Johnathan Klicker-Wiechmann, Purdue University

College of Science

Electrochemical study of α-Keggin tungsten polyoxometalate in imidazolium-based room temperature ionic liquids

Author(s):

Danny Hristov, College of Science

Abstract:

Tungsten polyoxometalate (WPOM) compounds are of interest to applications in energy production storage due to their ability to undergo multiple electron transfers while retaining their structural integrity. The electrochemical performance (i.e., mass and electron transfer) of WPOM is greatly influenced by the properties of the electrolyte. Room-temperature ionic liquids (RTIL's) are attractive electrolytes for electrochemical systems due to their wide stability potential window. In this work, the electrochemical performance of an α-Keggin WPOM (W12PO403-) was studied in imidazolium-based (RTIL's)with bis(trifluoromethanesulfonyl)imide (TFSI) as counter anions. We used eight RTIL's of varying length of the side alkyl chain length from the imidazolium cation to systematically study the effect of the structure of the RTIL cation on the diffusion and electron transfer of WPOM. We used cyclic voltammetry (CV) and square wave voltammetry (SWV) to study the reversibility of the electron transfer processes. From the voltametric data, we observed that imidazolium RTIL's with longer alkyl chains promote a more reversible electron transfer of W12PO403- and enable the observation of up to 5 reversible electron transfer processes in their electrochemical window of stability. Meanwhile, shorter alkyl chains produce less reversible redox peaks. We also notice precipitation from strong ion pairing between the imidazolium cation and W12PO403- with shorter alkyl chains. Overall, these results indicate that the length and composition of the side alkyl chain of the imidazolium cation play a major role in the overall electrochemical performance of W12PO403- + RTIL systems, which is relevant to the design of efficient batteries or supercapacitor devices.

Mentor(s):

Hugo Samayoa-Oviedo, Chemistry, College of Science

Julia Laskin, Purdue University Dept. of Chemistry

College of Engineering

Drying Induced Residual Stress Characterization of Cellulose Nanocrystal Films

Author(s):

Xinzhu Huang, College of Engineering

Abstract:

Cellulose nanocrystal (CNC) film assemblies have been proposed as a sustainable substitution for petroleum-derived barrier coatings in food packaging applications. A current challenge preventing the commercialization of these unique materials is the significant residual stresses that develop in films cast from aqueous suspension during water removal. Here, we take advantage of the bending of a bilayer system induced when a stiff thin film is placed onto a more compliant thicker film to quantify these residual stresses. By optimizing the processing conditions used to fabricate our films, we have a more robust understanding of how the drying kinetics and CNC assembly can impact final film properties. A custom flow coater was developed over the course of this project to deposit CNC suspensions to compliant substrates at constant deposition rates. Simultaneously, the solvent mixture was changed by varying the ethanol: water ratio to slow down the evaporation rate during drying. Further, the relative humidity during drying was tuned. Following film formation, the bilayer films were removed from the substrate and the radius of curvature of each film was measured through optical microscopy to calculate residual stresses. Through this systematic study, the processing condition effects on the residual stress formation in anisotropic particle films was determined. Future studies will focus on varying CNC film thicknesses by tuning the flow coater velocity and CNC concentration in suspension.

Mentor(s):

Chelsea Davis, Materials Engineering, College of Engineering

College of Agriculture

Optimizing and Quantifying the Ultrasound-assisted Extraction of Total Phenolic Compounds (TPC) from Walnut Husks and Leaves

Author(s):

Avery Hurst, College of Agriculture

Abstract:

Walnut trees produce phenolic compounds in their roots, husks, and leaves. Phenolic compounds contain antioxidative properties, and the specific compound Juglone exhibits phytotoxic properties that could serve as a natural herbicide. Walnuts are consumed across the globe but only the small kernel is edible, leaving behind environmental waste from the husk and leaves. To combat this issue, phenolic compounds can be extracted and used to improve our health or act as a natural antioxidant and herbicide. This study compares conventional shaking extraction (CSE) method and ultrasound-assisted extraction with probe (UAE-P) method to optimize the extraction of total phenolic compound (TPC) from black walnut husks (BWNH), green walnut husks (GWNH), and green walnut leaves (GWNL). UAE-P method yields the highest TPC in all three samples over CSE. GWNL contain the highest concentration of TPC and BWNH the least. As Juglone is a phenolic compound, its extraction is expected to increase with TPC, but GWNH contain the highest concentration, indicating other phenolic compounds are stored in the leaves. In GWNL samples, TPC extracted increased with extending UAE time. Antioxidant activity was observed in terms of % DPPH inhibition to ensure its activity is not lost due to extraction time. Higher TPC will show higher % DPPH inhibition if its antioxidative properties are maintained. Results of this study indicate that UAE-P extraction yields a higher extraction of TPC and GWNL contain higher amounts of TPC and stronger antioxidant capacity over GWNH and BWNH.

Mentor(s):

Qin Xu, Food Science, College of Agriculture

College of Engineering

The Lyophilization Of Watermelon

Author(s):

Aidan Jennewein, College of Engineering

Christine Mayo, College of Engineering

Abstract:

Food waste plagues farms across the United States, as over 20 billion pounds of produce are discarded each year in favor of profit. Watermelon is a unique challenge to harvest due its large size and its heightened potential for damage and bruising. This, combined with the high-water activity of watermelon, leads to an estimated twenty to thirty percent of the fruit being abandoned. Many medications experience similar instability, and cannot be kept in liquid or frozen states for long periods of time. These pharmaceutical products are often subjected to lyophilization, which removes moisture and allows them to exist in a stable, solid state that can be reconstituted for later use. The purpose of this experiment is to apply the pharmaceutical process of lyophilization to watermelon to reduce food waste and increase its potential for commercial products. Data has been collected for the freeze-drying microscopy of watermelon juice, as well as the lyophilization of watermelon juice, flesh, and flesh with microwave assistance.

The goal of the current semester is to determine the commercial feasibility of creating a food product using lyophilized watermelon. For economic purposes, production costs and throughput analysis are being calculated based on models of purchasing, building, and sourcing a lyophilizer for product development. An additional goal of this project is to access resources from Purdue's food science department for comparing the chemical components of watermelon before and after lyophilization, as well as conducting a sensory study for pilot products.

Mentor(s):

Alina Alexeenko, Chemical Engineering, College of Engineering

Andrew Strongrich, Purdue University

Jennifer Gray, Purdue University

Poster Presentation Abstract Number: 353 :: Social Sciences/Humanities/Education

College of Education

Invite Me: Developing Positive Practices Through Relationships with Students' Families

Author(s):

Zoe Johnson, College of Health & Human Sciences

Nadia Crace, College of Liberal Arts

Abstract:

This qualitative study explored the development of positive relationships between pre-service teachers and their students with disabilities in elementary classrooms. Participants were asked to participate in non-instructional activities with their students (I.e., eating lunch with students, attending after school events, maintaining communication with families). This includes an activity called "Invite Me" letters, in which pre-service teachers asked families to invite them to outside events alongside their family. The current study explores this activity by analyzing reflections written by twenty-one preservice teachers majoring in special education on their perceptions and experiences participating in the "Invite Me" activity. The content of each participant reflection was coded by a research team and analyzed for themes. Data analysis is ongoing and we are presenting preliminary results. Themes identified thus far, signify a need for practices that encourage preservice teachers to develop teacher-family relationships outside of instructional times to further pre-service teachers' relationships with students with disabilities.

Mentor(s):

Jennifer Smith, Educational Studies, College of Education

Jasmine Begeske, Purdue University

College of Liberal Arts

Evaluating Robustness of Global Privacy Legislations to Regulate Surveillance Capitalism

Author(s):

Shannon Kang, College of Liberal Arts

Nathan Miller, College of Liberal Arts

Kaitlyn Petratos, College of Pharmacy

Madeline Yang, College of Engineering

Abstract:

In this modern age of surveillance capitalism, technology companies like Facebook and Google extract vast amounts of user data online and offline. While such surveillance has resulted in a successful business model, it also has detrimental effects for privacy. Governments around the world are gradually responding to these surveillance challenges. This poster asks: How do major data privacy legislations compare in their robustness to address surveillance harms? To answer this question, this research draws from the Facebook Incidents Database, which uses news data (2004-2021) to track 4,316 Facebook incidents and over 900 Facebook-related regulatory scrutiny and lawsuits. The database is the first scholarly effort to organize Facebook's global incidents in issues ranging from speech, privacy, monopoly, fake news, and radicalization to place scandals like Cambridge Analytica into wider context. The database also relies on human coders to track any resulting legislation. For this research, we first use the database to present a survey of the proposed and passed privacy legislations around the world. Second, we present case studies to evaluate the robustness of three major legislations: the European Union's General Data Protection Regulation (GDPR), the California Consumer Privacy Act (CCPA), and Virginia's Consumer Data Protection Act (CDPA), given Facebook's surveillance harms in the privacy-related incidents. We conclude with future policy recommendations.

Mentor(s):

Swati Srivastava, Political Science, College of Liberal Arts

College of Liberal Arts

An Analyzation of Human Trafficking in India

Author(s):

Isheeta Khurana, College of Liberal Arts

Abstract:

The purpose of this research is to analyze human trafficking, more specifically sex trafficking, in India while evauating the current policies in place to combat the crime as well as understanding the role NGOs play. This study outlines the the supply and demand factors of human trafficking while recognizing which exsist in India and how they increase the rate of crime. NGO work in India is also researched to better understand the policies on prevention, punishment and care of victims that the Indian government has in place. An important aspect to this project is a case study of the state of Karela in India which seeks to explain Karela's relation to the United Arab Emirates and how it acts as a hub for human trafficking through sending labor abroad. Policy recommendations are given in the ways India can work to decrease the percentage of women that are exploited domestically and internationally.

Mentor(s):

Alfred López, Interdisciplinary Studies, College of Liberal Arts

College of Agriculture

Conifer species alter leaf anatomy in response to drought event

Author(s):

Jaden King, College of Agriculture

Abstract:

Stomata are pores in leaves that regulate CO_2 uptake and water loss. When the stomata are open, plants take up CO_2 but lose water. Under drought conditions, plants must find a way to minimize water loss but also maintain CO_2 levels for survival. They can do this by modulating the aperture of stomata in existing leaves and/or via plasticity of epidermal development in new leaves. Little is known about leaf epidermal plasticity in response to water stress in conifers. Therefore, we tested the hypothesis that conifer trees would alter their leaf anatomy under drought conditions. We evaluated leaf epidermal plasticity in three widespread conifer species: English Yew (Taxus baccata), Loblolly pine (Pinus taeda), and Norway spruce (Picea abies). Plants were grown under three media water content treatments: 100 (control), 50, and 30%. Leaves were harvested from each plant and the epidermal traits were assessed. In Pinus and Picea, there was a lower stomatal pore index (SPI) in the water stressed plants as a result of reduced stomatal density (SD) and stomatal area (SA). In Taxus, there was not a reduction in SPI because there was no change in stomatal index, and the SA was reduced but the SD increased. Therefore, even though these species respond differently, our data provides evidence that these plants altered their leaf anatomy in response to the drought.

Mentor(s):

Michael Mickelbart, Botany & Plant Pathology, College of Agriculture

College of Pharmacy

Chromatin Remodeling Complexes in the Neuroendocrine Differentiation of Prostate Cancer

Author(s):

Sam King, College of Pharmacy

Abstract:

In the US, prostate cancer is a leading cause of cancer and the second leading cause of death in men. Prostate cancer progression is driven heavily by epigenetic factors. One of such factors is SWI/SNF, a multi-subunit ATP-dependent chromatin remodeler. Chromatin remodelers restructure nucleosomes which effects gene expression levels. The purpose of my project is to understand the role of BAF170, a subunit in the BAF Switch/Sucrose Non-Fermenting complex in neuroendocrine differentiation of prostate cancer. In lab we have established a cell line derived from lymph node carcinoma of the prostate (LnCaP) cells to overexpress and "knock down" the expression of BAF170. To model androgen deprivation, these cell lines are grown in androgen-deprived cell culture media. After growth, the cells were imaged to determine average neurite length for each cell line to find the difference between respective controls and cells over/under expressing BAF170. Simultaneously cells were harvested for quantifying protein and mRNA expression levels using Western Blotting and polymerase chain reactions, respectively. The experimental results indicate that overexpression of BAF170 increased neurite length in androgen deprived conditions whereas knockdown of BAF170 leads to reduced neurite length. Further experiments are being done to understand the expression levels of other neuroendocrine differentiation markers and understand the growth phenotypes of these cells. Understanding the role of BAF170 in neuroendocrine prostate cancer makes it eligible for pharmacological targeting. This is promising as neuroendocrine prostate cancer has the lowest patient survival rate compared to any other subset of prostate cancer.

Mentor(s):

Emily Dykhuizen, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Surbhi Sood, Purdue Univeristy

Honors College

Detection of α-Amanitin in Kidney Using Amatox LFIA Strips

Author(s):

Carley Knosp, College of Science

Abstract:

People and animals (especially dogs) can be exposed to Amanita phalloides mushrooms through accidental ingestion; if α-amanitin is present in sufficient amounts, it can result in liver and kidney damage and even death. There is a need for a relatively rapid assay to diagnose A. phalloides poisoning in animals that present to necropsy with severe liver and kidney damage. The goals of this study are to use Amatox Lateral Flow Immunoassay (LFIA) test strips to determine if A. phalloides mushrooms in Indiana contain α-amanitin and to determine if Amatox LFIA test strips can be used to detect α-amanitin in canine kidney tissue. Amatox LFIA test strips rapidly detect the presence of α-amanitin through the use of an α-amanitin-specific monoclonal antibody in a lateral flow format. An Amanita phalloides mushroom was obtained from the Purdue Herbarium. An edible Agaricus bisporus mushroom was used as a negative control. Discarded canine kidney was obtained from the ADDL. α-Amanitin was from Sigma Aldrich. 0.1M phosphate in water or 1000 μg/mL α-amanitin in methanol were used as controls. Homogenates of mushroom or kidney were extracted in 30% 0.1M phosphate in acetonitrile followed by 0.1M phosphate. 100 μL of each created sample, after clean-up (with varying α-amanitin concentrations) was placed on an individual LFIA test strip. The results of this study will help determine if Indiana A. phalloides mushrooms contain α-amanitin and if α-amanitin can be detected in spiked canine kidney samples.

Mentor(s):

Stephen Hooser, Animal Disease Diagnostic Laboratory, College of Veterinary Medicine

College of Education

Textbook Use of Connections to Children to Support Prospective Elementary Teachers' Geometric Understanding

Author(s):

Sydney Kohn, College of Education

Abstract:

Researchers have suggested using examples of children's mathematical thinking to support prospective elementary teachers' (PTs) mathematical understanding. This study extends the notion of using the care PTs have for children as a motivator to include all potential connections to children in mathematics content course textbooks designed for PTs, investigating the top three used textbooks for evidence of connections to children in geometry and measurement. Findings indicate opportunities for PTs to consider various mathematical concepts using a variety of connections to children (e.g., standardized assessments, children's actual thinking), allowing PTs to develop their specialized content knowledge while considering children and mathematics.

Mentor(s):

Brooke Max, Mathematics, College of Science

College of Engineering

Simulating Thermal Tuning Efficiency of Doped Integrated Silicon Photonic Heaters

Author(s):

Jamie Lam, College of Engineering

Gabriel Alminauskas, College of Engineering

Alexander Fink, College of Engineering

Abstract:

As Silicon photonics are being use more widely to replace the traditional electric circuits, there is an increasing need for optimizing and tuning these circuits. Photonic circuits are even more susceptible to rampant heat from any electrically powered device like a heater, causing deleterious effects to the unpowered devices in an effect called thermal crosstalk. To reduce thermal crosstalk, efficient heaters must be designed so that photonic circuits can be more widely used in more substantial applications. To do so, simulations of the thermal tuning efficiency for metallic heaters and doped silicon heaters are performed to vary the parameters of each to find the best possible thermal tuning efficiency. Once the simulations are done, comparisons can be made to see which heater performs better without inducing any additional optical loss. Heater geometries being compared include metallic slabs on top of the waveguide and doped silicon wafers parallel to the waveguide.

Mentor(s):

Lucas Cohen, Electrical & Computer Engineering, College of Engineering

College of Engineering

3D Obstacle Detection Model for Autonomous Vehicles: Computer Vision and LiDAR

Author(s):

Seoyoung Lee, College of Engineering

Chun Lee, College of Engineering

Sohan Zaveri, College of Engineering

Heath Lovell, College of Engineering

Aditya Agrawal, College of Engineering

Louis Liu, College of Science

Sunwoo Park, College of Engineering

Sudhanva Donakonda, College of Engineering

Laula Huang, College of Engineering

Abstract: The purpose of our research is to create a 3D object detection model for avoiding obstacles in roads. The model incorporates the YOLOv5 object detection models and the LiDAR models. The YOLOv5 models output object locations and classifications with efficient runtime speed and comparable accuracy and the LiDAR-RCNN model uses a point-based RCNN to output 3D bounding boxes. Incorporating these two, the system detects and locates objects with respect to the 3D perception of the surrounding environment.

We have decided to apply the pretrained YOLO and LiDAR models with the following road scenario datasets: KITTI, BDD100k and Small Obstacle Detection. We hope to first optimize the YOLO and LiDARdetection models by performing hyperparameter tuning and finding the optimal pretrained models. We aim for fast runtimes as well as high recalls; it is essential to minimize the probability of missing an obstacle. For the YOLO model, we will use image data and for the LiDARmodel, we will use the LiDAR point cloud data. Afterward, we plan to create an algorithm that incorporates both models and performs 3D object detections. We have run the YOLOv5 models on the COCO dataset (Common Objects in Context) as a benchmark. The model has relatively low run-time speeds of about 0.10s per image on average and consistently generates accurately labeled bounding boxes around the classified objects with average precisions of about 0.58 and average recalls of about 0.68 . This step has helped us analyze and assess the YOLOv5 model as well as customize the datasets and models. We plan to optimize the YOLOv5 model for custom datasets of road images. For running the LiDAR-RCNN model, we will use a similar method: we will run the model on a generic point cloud dataset as well as specific data that represent road scenarios. We will output comparative analyses of the model performances with different hyperparameters, specifications and constraints.

Our research improves automated object detections and decision making processes of autonomous vehicles. The benefits of training obstacle detection models would be transferable for other fields such as self-driving cars, autonomous drones, autonomous robots, or help in classifiers and counters. The model structures and parameters would be applied / scaled for these applications. A higher accuracy and lower runtime in computer vision based object detection models will reflect directly as improvements in the performance and safety of autonomous cars.

Mentor(s):

Aly El Gamal, Faculty, Purdue University

Shreya Ghosh, Purdue University

College of Health and Human Sciences

Exploring Middle-Schoolers' Perspectives Related to Community, Community Challenges, and Barriers to Civic Engagement

Author(s):

Elizabeth Lenart, College of Health & Human Sciences

Abstract:

Background: Civic engagement influences social responsibility, and sense of belonging and cohesion among youth; factors linked to community participation (e.g., volunteerism) and later involvement (e.g. voting). Initiatives to increase community and civic engagement skills among youth exist, but primarily focus on high-schoolers, leaving middle-schoolers with little opportunities to develop these skills. Because little is known about whether or not middle school-age youth would be interested in community participation or capable of engaging in civic efforts, this study explored middle-schooler's awareness of community issues, their views on community challenges, and barriers to engaging in civic efforts.

Methods: Youth ages 11-13 (N = 39, Mage = 12.1, SD = 1.12, 51.2% male) from low-income families who attended a summer sports camp participated in interviews that were thematically analyzed.

Results: When describing their community, youth shared that neighborhood social support contributed to their sense of community cohesion. Community challenges were identified that aligned with the social determinants of health including individual (e.g., lack of knowledge and responsibility), interpersonal (e.g., family challenges), organizational (e.g., school bullying), and community (e.g., crime and violence). They identified supportive adults as necessary for them to engage in community change efforts and identified barriers, such as not believing in themselves, to engaging.

Conclusion: Participants articulated ways their neighborhood and social networks contributed to their sense of belonging and community cohesion. Findings suggest that middle-schoolers are aware and interested in participating in civic efforts, thus providing support for developing opportunities for these youngsters to develop community and civic engagement skills.

Mentor(s):

Yumary Ruiz, Public Health, College of Health & Human Sciences

Carlyn Kimiecik, Purdue University

Poster Presentation Abstract Number: 363 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

Analyzing Global Deforestation Through Visualizations of Regional Datasets

Author(s):

Jiaxiang Li, Polytechnic Institute

Abstract:

Deforestation and artificial tree planting have become the environmental issue for countries to consider in past decades. While some regions have gained forest expansion, areas like the Amazon rainforest still suffer loss in tree coverage. This research uses data analytics and visualizations to examine the extent of net tree coverage change worldwide. Secondary and tertiary sources from the Food and Agriculture Organization of United Nations are utilized. These data are processed and visualized using Excel, Tableau, and Orange. Static and Interactive graphs are used to help develop stories of regions that gained the most vegetation area and regions that needed more attention from authorities to prevent further environmental damage. These representative locations, including China, Brazil, and Australia, are then examined with datasets retrieved from the United Nations and local governments to develop insights about their current state of woodlands, natural preserves, and plantations. Their trend of future vegetation coverage and its impact on the global environment are extrapolated. Based on net tree growth of regions in ratio/percentage with their land area, the result graphically displays those that performed remarkably or needed aid to prevent more deforestation. Both analyses and visualizations provide insights for potential solutions for avoiding forest death hereafter and suggestions for allocating human resources and materials.

Mentor(s):

Vetria Byrd, Computer Graphics Technology, Polytechnic Institute

College of Agriculture

Quantifying the abundance of Mannheimia haemolytica in nasal swab samples of beef cattle with BRD

Author(s):

Erica Long, College of Agriculture

Abstract:

Bovine Respiratory Disease (BRD) is a highly transmissible bacterial disease that can affect both the lower and upper respiratory tract in both beef and dairy cattle. Four bacteria; Mannheimia haemolytica, Pasteurella multocida, Histophilus somni, and Mycoplasma bovis are all normally present in the upper respiratory tract of healthy cattle. Currently, elevated levels of the bacteria are isolated in lung tissues of sick cattle, but in most of the cases, isolation can be done post-mortem. Therefore, the objective of this project is to quantify the abundance of Mannheimia haemolytica present in nasal swab samples of beef cattle diagnosed with BRD clinical signs compared to visually healthy animals. Nasal swabs were collected from three different farms. We intend to perform a Quantitative polymerase chain reaction (qPCR) to measure Mannheimia haemolytica abundance between BRD-cattle and visually healthy animals.

Mentor(s):

Ruth Eunice Centeno Martinez, Animal Sciences, College of Agriculture

Johnnie Cheng, Purdue University

Timothy Johnson, Purdue University

Purdue Polytechnic Institute

A Survey on the Propensity of Cheating

Author(s):

Xavier Lopez, Polytechnic Institute

Abstract:

Redacted.

Mentor(s):

Stephen Elliott, Faculty, Purdue University

College of Engineering

Biofilm-Water Interactions During Stagnation

Author(s):

Alexis Lowe, College of Engineering

Abstract:

Redacted.

Mentor(s):

Caitlin Proctor, Enviromental & Ecological Engineering, College of Engineering

Poster Presentation Abstract Number: 367 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

VIP AMP Airfoil Validation

Author(s):

Isaac Martinez, College of Engineering

Max Lee, College of Engineering

Akshay Godhani, College of Engineering

Dan Spillane, College of Engineering

Jasper Hochbaum, College of Engineering

Ian Quan, College of Engineering

Abstract:

The objective of this research is validating the use of an airfoil for the autonomous motorsport's vehicle and provide improvements to the airfoil design. The analysis will utilize aerodynamic theories on fluid dynamics and use computational fluid dynamics software. The analysis will also be comprised of test data from the vehicle and utilize simulations. After the completion of the fluid analysis, a report will be sent to the AMP team regarding the validation for the use of an airfoil on the car. If the airfoil is a reasonable addition to the car, then the research will investigate improvements to the original design and steps to manufacturing. If the airfoil is not recommended the research will explore other solutions for creating downforce.

Mentor(s):

Shreya Ghosh, Electrical & Computer Engineering, College of Engineering

Poster Presentation Abstract Number: 368 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

The Relationship Between Adult input and Autism Spectrum Disorder Diagnosis in Children with Neurogenetic Syndromes

Author(s):

Kelly Mathis, College of Health & Human Sciences

Faith Anthony, College of Health & Human Sciences

Allison Eisenhut, College of Health & Human Sciences

Abstract:

Some evidence suggests that children with neurogenetic syndromes such as Angelman Syndrome (AS), Down syndrome (DS), and fragile X syndrome (FXS) overhear fewer adult words (AWC) than typically developing children (Reisinger et al., 2019). Some individuals with neurogenetic disorders demonstrate features of autism spectrum disorder (ASD), which may also be associated with overhearing fewer AWC (Warren et al., 2009). However, the relationship between AWC and ASD diagnosis in populations with neurogenetic syndromes has yet to be studied. We hypothesize that participants with a neurogenetic syndrome who meet symptom criteria for ASD will experience lower AWC than participants who do not meet symptom criteria. We assessed the association between ASD classification and AWC for 65 children with neurogenetic syndromes (FXS, n=10; DS, n=29; AS, n=26). We obtained AWC from daylong recordings collected using the Language Environment Analysis system. We determined ASD classification using the research cut-off of the Autism Diagnostic Interview, Revised, completed by each participant's parent. A Mann-Whitney Wilcoxon Rank Sum Test indicated that AWC did not differ by ASD classification for the overall sample (p=.678). Cohen's d effect sizes of AWC in the ASD vs. no ASD groups for each syndrome suggested a small effect in AS, a medium effect in DS, and a large effect in FXS (AS d=0.010, DS d=0.531, FXS d=1.413). The results of this study reveal that the language environment associated with ASD may differ in some neurogenetic syndromes relative to reported patterns in idiopathic ASD. Future research should explore syndrome-specific patterns in larger samples.

Mentor(s):

Lisa Hamrick, Psychological Sciences, College of Health & Human Sciences

Bridgette Kelleher, Purdue University

College of Engineering

Verifying SoC Components in Development with Universal Verification Methodology

Author(s):

Maxwell Michalec, College of Engineering

Abstract:

This research project explores the use of Universal Verification Methodology (UVM) to verify system on chip (SoC) components that are in development. During SoC development, features of components are continually added and improved, requiring them to be continually tested and verified to identify design errors. To research UVM's ability to verify such designs, a test bench for an adder circuit was created using UVM and test benches for a counter and I2C that use UVM were explored and modified. This gave insight into how UVM can be utilized to create scalable test benches with a level of abstraction away from the register-transfer level design of the SoC component, allowing for simultaneous development and verification of the component. UVM's core benefits are derived from its use of object-oriented programming since it is a library of classes that can be expanded upon to create modular test benches with environments that interface with the device under test to verify the functionality of its features. Once the test bench's framework is built, it is easy for new tests to be created by instantiating a new object and populating its attributes with either a defined testcase, or with randomized values that may better simulate the real-world use of the component.

Mentor(s):

Sarang Pramod, Electrical & Computer Engineering, College of Engineering

Poster Presentation Abstract Number: 370 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Blessing or Burden? The Impact of PTSD Service Dogs on Military Families

Author(s):

Elise Miller, College of Science

Abstract:

While PTSD service dogs are specifically trained to interact with their veterans, emerging evidence suggests that service dogs may also have an impact on other members of veteran households. To build on cross-sectional pilot data (McCall et al., 2020), we conducted the first longitudinal study to quantitatively measure the impact of PTSD service dogs on military family wellbeing. Data was collected from survey responses of 88 veteran spouses or cohabitating partners who rated their experiences on standardized clinical outcome measures. Surveys were completed at two timepoints: (1) baseline, and (2) three months post-baseline (follow-up). Spouses in the service dog group (n=48) were partnered with veterans who received a service dog after baseline, while spouses in the control group (n=40) were on the waitlist for the duration of the study. Multiple regression analyses yielded statistically significant differences between the waitlist and service dog groups which suggested that service dogs may increase caregiver burden and decrease caregiver satisfaction, but potentially encourage increased participation in activities for veteran spouses. Small effect sizes suggested service dogs may also foster increased companionship and positive affect in veteran spouses. Analyses indicated no notable impact on veteran children. These findings demonstrate that the impact of PTSD service dogs may extend to veteran spouses, possibly prompting interest and investment in this complementary intervention option. Our results also emphasize the need to inform the military family of practical strategies to minimize possible detrimental effects, which would likely lead to an improved family experience with the service dog.

Mentor(s):

Marguerite O'Haire, Comparative Pathobiology, College of Veterinary Medicine

Leanne Nieforth-Bomkamp, Purdue University

College of Science

Synthesis of β-Cyclodextrin Polyrotaxanes for the Treatment of Stargardt Disease and Niemann-Pick Type C

Author(s):

Stephanie Moga, College of Health & Human Sciences

Abstract:

Lysosomal storage disorders are a category of 46 rare diseases distinguished by waste product accumulation in the lysosome. Two of those are Stargardt disease (characterized by the buildup of lipofuscin bisretinoids in the lysosomes of the retinal pigment epithelium - RPE) and Niemann-Pick Type C (characterized by the buildup of unesterified cholesterol in the late endosome/lysosome (LE/LY) compartment of the cell). Evidence has shown the effectiveness of beta-cyclodextrin (β-CD) in the removal of both lipid bis-retinoids from the RPE and unesterified cholesterol from the LE/LY compartment. However, the low molecular weight of β-CD causes low persistence, requiring high doses or continuous administration to maintain effectiveness. Increasing molecular weight can improve β-CD's circulation time and lower clearance rates. For this purpose, we synthesized polyrotaxanes by threading β-CD on a polymer core and including bulky end-caps to keep the β-CDs in place. We used bath sonication and probe tip sonication to encourage β-CD to thread onto the polymer core in a hexane solution. Carbamate linkages were created to attach end-caps to either end of the polymer chain. These end-caps respond to pH or enzyme activity to allow for the release of cargo. Through these methods we were able to successfully create polyrotaxanes that could be used to facilitate lipid bis-retinoid and unesterified cholesterol removal, as confirmed by 1H NMR spectroscopy. Further investigation is needed in regards to biodistribution and durability in vivo.

Mentor(s):

Giulia Murbach de Oliveira, Chemistry, College of Science

David Thompson, Purdue University

Poster Presentation Abstract Number: 372 :: Innovative Technology/Entrepreneurship/Design

College of Agriculture

Horticulture Park: Research-Based Design

Author(s):

Margaret Morse, College of Agriculture

Zachary Cody, College of Agriculture

Abstract:

Our new vision for Horticulture Park will transform one of Purdue's most significant assets into a living laboratory for education, conservation, research, and wellness. Located adjacent to Stewart Woods and the President's Westwood Mansion, the study area encompasses 35 acres of prairie, lowland woods, and upland woods surrounding the Todd's Creek corridor originating from Dr. Flint's 1972 plan. Our plan for Horticulture Park addresses the increasing need for the Purdue community to connect to nature, implement green infrastructure, and educate visitors about sustainable practices. The research completed consists of social science methods used to identify the needs of the community, including site user observation and document analysis of the 2018 Purdue Giant Leaps Master Plan. Ecological science methods were used to evaluate site conditions, including plant inventory and assessment. Further, spatial analysis methods were used to process LiDAR Digital Elevation Models in GIS to study slope, hydrology, and potential planting zones on site. Overlaying this information with our own site assessments supported identification of a trail hierarchy and connection to the Third Street Student Success Corridor. Our assessment of the site hydrology revealed the opportunity to connect upland water flows to the Todd's Creek Corridor which addresses site drainage and provides an educational opportunity for wetland restoration. These analyses support the design process, which included student engagement in a master planning collaboration between Purdue University faculty, staff, and private consultants from Andropogon & Associates and Lake Flato Architects. Following this process we are producing detailed designs and supporting graphics.

Mentor(s):

Aaron Thompson, Horticulture & Landscape Architecture, College of Agriculture

Paul Siciliano, Purdue University

College of Science

Child Audio Speech to Text Background and Motivation

Author(s):

Vishaak Narayan, College of Science

Alex Marks, College of Engineering

Shaan Luthra, College of Science

Adrien Dubois, College of Engineering

Anish Bhowmik, College of Science

Guna Avula, College of Engineering

Aarohi Panzade, College of Science

Jasper Koliba, College of Engineering

Aakanksha Shripal, College of Engineering

Abstract:

In the last decade, the field of Automatic Speech Recognition (ASR) has rapidly transformed. The field went from a niche to a prevalent part of our everyday lives with products like Amazon's Alexa being heavily reliant on the technology. However, current ASR systems are trained with adult speech and do not accurately transcribe young children's speech. The team tested five major speech transcription services with 20 child audio files to get a benchmark of where the market currently stands. On average, these services had a Word Error Rate (common metric to evaluate ASR systems based on transcription accuracy) of 0.85, making the transcriptions practically useless. This is a problem that is faced by early development researchers. Most of their research is based on recorded interactions which must be transcribed to be properly analyzed. As current technology is not suitable for child speech, all interactions must be manually transcribed. One minute of audio can take up to 5 minutes to accurately transcribe. This is a large time suck that takes away from the work that should be the researcher's focus. Over the course of the last 2 years, the CAST team has been working on an automatic speech recognition solution that will accurately transcribe child speech and fill this gap in the field. This year, the team has worked on data preparation and model building. By the end of this semester, the team will have multiple iterations of the machine learning model finished and tested for accuracy.

Mentor(s):

David Purpura, ,

College of Agriculture

Characterizing the role of fungal Cdc14 phosphatases in response to cell wall stress

Author(s):

Noelle Naughton, College of Agriculture

Abstract:

Fungal pathogens cause diseases in plants and humans, leading to both agricultural and medical challenges. Hospital-acquired fungal infections are an increasing problem for immune-compromised individuals, such as chemotherapy and organ transplant recipients and COVID-19 patients. Fungi can develop resistance to antifungal drugs, and consequently, there is constant need for development of new strategies to combat fungal pathogens. The Hall lab has proposed that Cdc14 phosphatase may be a useful target for novel antifungal drugs. The objective of my project is to characterize the sensitivity of Candida albicans lacking CDC14 or expressing a catalytically deficient Cdc14 enzyme to cell wall stresses like the echinocandin antifungal drugs. The reduced activity mutant was intended to simulate effects of a Cdc14-targeting drug. I accomplished my objective using agar plate spotting assays in the presence and absence of different drug concentrations. I found that C. albicans with reduced Cdc14 activity are hypersensitive to the echinocandins micafungin and caspofungin that inhibit cell wall synthesis. Additionally, I performed microscopy to observe morphological changes caused by loss of Cdc14 activity. Reducing Cdc14 activity impairs C. albicans cell separation and hyphal differentiation, consistent with a previous characterization of a cdc14 deletion strain. This is significant because hyphal differentiation is required for lethal systemic infections. My results demonstrate that full Cdc14 activity plays a critical and unexpected role in maintaining cell wall integrity in Candida albicans, and likely other fungal pathogens. This function may make Cdc14 a useful target for novel antifungal therapeutics to prevent infections and overcome drug resistance.

Mentor(s):

Mark Hall, Biochemistry, College of Agriculture

Andrew DeMarco, Purdue University

College of Science

Fluo-4 Calcium Imaging of human-induced pluripotent stem cell-derived neurons carrying a Voltage-Gated Sodium Channel Nav1.2-L1342P Genetic Variant

Author(s):

Conrad Otterbacher, College of Science

Abstract:

Epilepsy is a chronic neurological disorder characterized by repeated and unprovoked seizures. It affects 60 million people worldwide and about 1 in every 100 adults in the United States. The SCN2A gene, which encodes for voltage-gated sodium channel Nav1.2, has been associated with genetic epilepsies. A recurrent variant of the SCN2A gene is L1342P [1]. CRISPR-edited induced pluripotent stem cells (iPSCs) provide an exciting opportunity to interrogate the functional impact of disease-relevant mutations. Human iPSCs can differentiate into any cell type, including neurons. In a process between 45-50 days, we generate functionally mature neurons in a dish. Calcium imaging is a versatile tool used in cellular biology to visualize and measure the calcium dynamics of neurons. As an ion, calcium plays a crucial role in a cell's essential functions, and calcium imaging serves as a surrogate to study the change of neuronal activity and action potentials firing. In this poster, we will use matured iPSC-derived neurons to interrogate the calcium dynamics of the L1342P epilepsy mutation. To obtain calcium imaging measurements, we used Fluo-4, a non-ratiometric fluorescent calcium indicator that highlights cytoplasmic calcium. Upon binding to calcium ions, an increase in fluorescence can be observed. In our experiments, we employed a Nikon Eclipse epifluorescence microscope for imaging and NIS elements software to analyze our data. We found that iPSC-derived neurons containing the L1342P mutation exhibited distinct calcium patterns compared to our control samples, which may be a cellular underpinning of the seizures phenotypes of patients carrying these disease-causing genetic mutations.

References

[1] Que, Z., Olivero-Acosta, M. I., Zhang, J., Eaton, M., Tukker, A. M., Chen, X., ... & Yang, Y. (2021). Hyperexcitability and pharmacological responsiveness of cortical neurons derived from human iPSCs carrying epilepsy-associated sodium channel Nav1. 2-L1342P genetic variant. Journal of Neuroscience, 41(49), 10194-10208.

Mentor(s):

Maria Olivero-Acosta, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Yang Yang, Purdue University

Poster Presentation Abstract Number: 376 :: Social Sciences/Humanities/Education

<div align="center">

College of Health and Human Sciences

Caregiver Outcome Priorities for the Angelman Syndrome Community

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Author(s):

Mili Patel, College of Science

Abstract:

Angelman Syndrome (AS) is a neurodevelopmental disorder characterized by communication and motor challenges, inconsistent sleep patterns, and seizure activity (National Library of Medicine, 2020). Capturing AS stakeholder experiences is essential in addressing the needs and goals of this community (Grieco, 2018). This qualitative study aimed to identify desired target skills and outcomes that AS caregivers prioritize for their children. Participants included eight mothers of individuals with AS. The age range of dependents with AS was 2-32 (M= 10.63, SD 9.91). Caregivers virtually participated in focus group discussions which included questions related to parent outcome priorities. Transcripts were analyzed using a thematic analysis approach with Nvivo software. Consensus coding, labeling, and categorization of codes were completed to identify subthemes within the data. Analyses identified themes related to parents outcome priorities and desired growth areas for their children with Angelman Syndrome. Identified outcome priorities included: Improved Seizure Control, Communication Motor Skills, Sleep Quality, Behavior in Social Environments, and Adaptive Skills. Working progress towards greater independence was also a highlighted goal for this community. Results suggest that outcome priorities highlighted by caregivers of individuals with AS coincided with expressed daily challenges relating to present abilities, co-occurring conditions or symptoms, and needed supports. Additionally, achievement of these outcome priorities over time was perceived as meaningful change to this community. In future research, this work could be expanded to include fathers and caregivers that are not parents to the individual with AS to compare additional varied caregiver experiences.

Mentor(s):

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

Veronika Peskova, Purdue University

Bridgette Kelleher, Purdue University

College of Health and Human Sciences

Martinsville Well Water Sampling

Author(s):

Jackson Pechin, College of Health & Human Sciences

Abstract:

The Pike and Mulberry Streets PCE Plume, located in Martinsville, Indiana, was designated as a Superfund site by the U.S. Environmental Protection Agency (EPA). The primary contaminants are tetrachloroethylene (PCE) and trichloroethylene (TCE) in groundwater, soil, and indoor air. TCE is a known carcinogen, PCE is a probable carcinogen, and both are neurotoxicants. Although there have been efforts to mitigate the contamination over the past 15 years, problems at the site remain. Despite of the seriousness, only some residents of the community are aware of the issue, and they are deeply concerned about their health and the exposure risk to the toxic substances. The main purpose of this study was to measure PCE, TCE, and metal contaminants in well water and tap water in response to concerns raised by the community. We collected samples of private well water, and tap water from 8 residence to explore the level and extent of PCE, TCE, and metal contaminants exposure. We identified trace amounts of metal ions such as aluminum, copper, and manganese using inductively coupled plasma-optical emission spectrometry (ICP-OES). PCE and TCE were analyzed in accordance with EPA's methodology, using gas chromatography-mass spectrometry (GC-MS), and were not detected in any residences. According to our results, water analysis can be a valuable method for community-engaged environmental health research in evaluating the extent and level of community exposure.

Mentor(s):

Sa Liu, Health Sciences, College of Health & Human Sciences

Jung Hyun Lee, Heath Sciences

Marwan Alajlouni, Health Sciences

Thomas Wallace, Martinsville Indiana Superfund Site Association

College of Health and Human Sciences

Designing an Impactor to Collect Pathogenic Bioaerosols Using a Simulation Model

Author(s):

Nicholas Pecoraro, College of Health & Human Sciences

Anthony Bovenshen, College of Health & Human Sciences

Abstract:

Airborne biological aerosols (bioaerosols) are found in various environments. Some bioaerosols are pathogenic can cause diseases. Airborne SARS-CoV-2 causing COVID-19 and Legionella Pneumophila causing Legionnaires disease are examples of pathogenic bioaerosols. To prevent or minimize exposure to these pathogenic bioaerosols, a rapid detection method will be utilized. To detect pathogenic bioaerosols, they need to be collected in media before being observed and analyzed. Current methods of detecting bioaerosols are generally time consuming and expensive. To overcome these limitations, a more rapid and inexpensive method should be developed. An important component to beginning this project is to develop an impacter. The developed impactor will then be combined with other inexpensive rapid analysis methods such as immunochromatographic assays. The collection efficiency of the impactor will be simulated with various design parameters. Specifically, the optimal number of jets and airflow rate to reach the target cut-off diameter of the impactor (d50) will be determined. The d50 value is important because it will allow control over the size of the aerosols captured. The target d50 is 1 μm which means the impactor can collect bioaerosols larger than 1 μm. For example, SARS-CoV-2 virus is 120 nm and Legionella Pneumophila is about 1 μm. After finding the optimal parameters, we will fabricate the impactor and evaluate the collection efficiency in further studies. We will also combine the developed impactor with the previously mentioned analysis methods in the future.

Mentor(s):

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

Honors College

Investigating COVID-19 Variants in Symptomatic vs. Asymptomatic Cases

Author(s):

Nicole Perry, College of Science

Jack Dorman, College of Science

Abstract:

SARS-CoV-2, a virus which emerged in early 2020, has led to millions of deaths worldwide, and studies are warranted to understand the transmission of different variants that have developed as the virus continues to evolve. The purpose of this study was to investigate the distinction in variants between asymptomatic and symptomatic COVID-19 positive case samples acquired from Purdue University. This research was done by collecting samples characterized as positive for SARS-CoV-2 by RT-PCR with Ct value <30 and sequencing them using the Nanopore GridION technology to determine CDC "Variants of Concern." From the 677 samples successfully sequenced in this study, the results showed that the B.1.2 variant had the highest prevalence overall for both asymptomatic and symptomatic cases. When looking more closely at World Health Organization (WHO) designated variants of concern, the majority of cases identified as those variants were symptomatic, except for the Delta variant. Most of the 35 variants detected, including all variants of concern, had a prevalence of more than 50% of cases characterized as symptomatic, besides the previously mentioned variants. Based on analyses, we also concluded that mean Ct values for symptomatic cases were significantly different than those of asymptomatic cases for both the N gene and ORF1ab gene. This study shows great utility in tracking variants and transmission on college campuses and can be expanded to other settings. This work, coupled with maximizing COVID-19 testing and improving vaccine efficacy can aid in implementing targeted control measures to limit virus transmission.

Mentor(s):

Catherine Searle, Biological Sciences, College of Science

Giovanna Carpi, Purdue University (former)

Ilinca Ciubotariu, Purdue University

College of Engineering

Experimental Investigation of the Rheological Characteristics of Printable Fiber-Reinforced Thermoplastics

Author(s):

Pattiya Pibulchinda, College of Engineering

Abstract:

Short Fiber-Reinforced Polymers (SFRP) are widely used in industry due its processability and the enhancement in mechanical properties in the direction of dominant fiber orientation. This work focuses on investigating the rheological characteristics of SFRP used in Extrusion Deposition Additive Manufacturing (EDAM). While the addition of fibers enhances the mechanical and thermomechanical properties of the polymer, the rheological behavior of the suspension of fibers in molten polymer becomes more complex than the neat polymer and depends on the local fiber orientation. This study characterized the rheological response of two commercial SFRPs that have been developed specifically for large format EDAM. The materials investigated include Acrylonitrile Butadiene Styrene (ABS) reinforced with 20 percent by weight of carbon fiber (CF-ABS) and Polyetherimide (PEI) reinforced with 20 percent by weight of carbon fiber (CF-PEI). The pellets were compression molded into disk preforms with dimensions of 25 mm in diameter and 1 mm thickness. This process produced specimens with fibers that have a number average fiber length of about 150 µm in randomly oriented. Given the relevance to the EDAM process, the rheological characteristics investigated include the shear yield strength, and the viscosity as a function of temperature and as a function of the shear strain rate. Oscillatory frequency sweep and steady stress sweep experiments were conducted using a parallel plate fixture in a Discovery HR-2 (TA Instruments, New Castle, DE. USA) rheometer equipped with a heated chamber. The storage modulus, loss modulus, and complex viscosity were characterized as a function of the shear strain rate in the range from 0.6 to 650 1/s. The results revealed higher shear thinning in the CF-ABS compared to the CF- PEI. Further, the yield strength and viscosity were measured as applied stress increased from 0 to 6000 Pa. The yield strength of the CF-ABS was higher than the CF-PEI. The complex viscosity characterized as a function of temperature and the shear-strain rate was also used to characterize a rheological model that captures the dependence of both parameters on the complex viscosity.

Mentor(s):

Eduardo Barocio, Composite Manufacturing & Simulation Center, College of Engineering

College of Health and Human Sciences

Experimentation with Preservation Solutions to Retain Elasticity of Lung Tissue

Author(s):

Holly Pickett, College of Health & Human Sciences

Abstract:

The utilization of a variety of active learning modalities predominates anatomy and physiology instruction. From cadaveric to virtual dissections, the benefits of three-dimensional models in elevating students' fundamental knowledge gains and cognitive skills are apparent. While innovations in virtual dissection technology bring potential long-term financial gains as a result of reusability as well as absence of preserved tissue exposure, it lacks the contextual and sensory inputs inherent in manual manipulation of cadaveric tissue. Furthermore, interaction with the true human form fosters a depth of understanding of morphological structure and function that is critical for the intellectual development of future practitioners. However, this is also where former fixation methods falter. Historically, standard tissue fixation methods present an unrealistic representation of in vivo tissue morphology. These resultant alterations not only hamper development of key connections between form and function but also the critical diagnostic skills necessary to attain clinical gains. The aim of this project is to develop a preservation method to bridge such gaps. This will involve assessing the effects of a solution containing a modified-release fixation component, albumin, and physiological electrolytes indicative of in vivo plasma. Following placement of porcine lung lobes in experimental solution, tissue degradation, inflatability and elasticity will be measured to discern preservation and retention of morphological integrity. The preservation method can then be applied in the construction of functional anatomical models to be utilized in active learning environments to facilitate the intimate clinical connections between structure and function.

Mentor(s):

Lisa Hilliard, Health Sciences, College of Health & Human Sciences

College of Engineering

Radiation Hardened Technologies in Earth's Orbits

Author(s):

Hannah Pike, College of Engineering

Abstract:

With a rapid increase in the interest of space applications for satellites in various orbits, from low earth orbit, to geosynchronous, and beyond, there is a large need for a wide range of electronics to be qualified for use in these orbits. However, the lifetimes of these electronic components are sensitive to the radiation environment of space, which can be a major factor in potential disruptions or even permanent failures. Therefore, it is important to characterize the radiation environments that may be expected in these various orbits. The modeling tool SPENVIS, developed by the European Space Agency and available freely online, was used to simulate the average and peak radiation levels, particularly with respect to protons, electrons, and gamma rays. The radiation levels were then decomposed by the various particle energies and plotted as a cumulative distribution. The potential effects of the expected radiation environments were then integrated using the total ionizing dose methodology over the course of one year with an average level of solar radiation. This provides a measure of the average expected dose, which can be translated into an expected level of performance degradation. Satellite designers can then apply these findings to choose appropriate electronics to provide a high probability of success for the expected mission lifetime and beyond.

Mentor(s):

Peter Bermel, Electrical & Computer Engineering, College of Engineering

Allen Garner, Purdue University

Charles Grey, Purdue University

College of Engineering

AI for Small Unit Maneuver

Author(s):

Dhanyasree Prem Sankar, College of Engineering

Kevin Kang, College of Engineering

Abstract:

The goal of this project is to help the US Navy with beta testing for an autonomous robotics challenge called AI for Small Unit Maneuver (AISUM). The goal of the mission is to enable a drone to independently examine a building of interest, particularly under severe situations. To enable the drone to do so, we are developing a deep reinforcement learning-based navigation system. It is necessary to use a DRL-based navigation system because a majority of the other navigation systems use pre-loaded static maps and therefore cannot efficiently maneuver in a dynamic environment. With a DRL-based navigation system, the path-planning can be enhanced since the algorithm is constantly changing according to the data that it collects about its environment. We are using Microsoft Airsim as our simulation environment and the environment in simulation is a hospital building of interest.

Mentor(s):

Aly El Gamal, Faculty, Purdue University

Shreya Ghosh, Purdue University

Poster Presentation Abstract Number: 384 :: Social Sciences/Humanities/Education

<div align="center">

College of Health and Human Sciences

Parent-Adolescent Communication about Sex: Narratives from Youth from Latinx Farmworker Families

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Author(s):

Madeline Prospero, College of Health & Human Sciences

Abstract:

Evidence has shown that adolescents from Latinx migrant farmworker (LMFW) families experience higher levels of sexual risk-taking relative to their non-migrant counterparts. While parent-adolescent communication about sex has been found to mediate youth engagement in risky sexual behaviors, little is known about communication patterns about sex among LMFW youth and their parents. Due to this, there is a critical need for researchers to assess if LMFW parents discuss sex with their children and the content of these communications. Participants were LMFW youth aged 10-18 (N=24, Mean age= 13.88, 67% male, 25% sexually active) recruited through a summer Migrant Education Program in Indiana. Youth participated in semi-structured one-hour long interviews that were thematically analyzed using NVivo, a qualitative software. Analysis of youth-reported narratives of parent conversations about sex revealed (1) no communication among youth and parents, as one-third of participants reported no conversations with their parents. These participants were younger (10-14), male, and all non-sexually active participants. (2) Parents provided reasons to avoid sexual behavior, and (3) parents offered ways to handle a situation if it did occur. Analysis also revealed that the youths' feelings about the conversation and their future intentions to discuss sexual behavior with their parents were impacted by how parents provided this information. Study findings have implications for future research and interventions aimed at fostering parent-adolescent communication about sex and expanding the impact of these conversations in LMFW families.

Mentor(s):

Yumary Ruiz, Public Health, College of Health & Human Sciences

Zoe Taylor, Purdue University

Lucrecia Mena Melendez, Purdue University

Poster Presentation Abstract Number: 385 :: Life Sciences

College of Agriculture

Variation in stable isotope signatures of chimpanzee diet items: implications for mixing model analyses

Author(s):

Alexis Proudman, College of Agriculture

Sophia Flores, College of Agriculture

Abstract:

Chimpanzees (Pan troglodytes) are omnivores whose diets mostly consist of ripe fruit, but they also ingest animal foods, such as meat and insects. There is further research showing a male-bias for hunting mammalian species, and a female-bias for using tools to collect insect prey. Stable isotope analysis can estimate the relative contribution of different food items to the overall diet of a consumer using a mixing model. This research method would allow for evaluating the importance of meat to the chimpanzee diet. However, before using this analysis, food items must be collected and analyzed to evaluate their isotopic differences prior to their incorporation into the mixing model. From 2020–2022 we collected a wide range of diet samples that occur in chimpanzee habitats from Fongoli and Assirik, Senegal. These samples included many species of flowers, leaves, fruits, and insects. All samples were prepped and analyzed for isotopic signatures to determine significant differences between the dietary samples. We analyzed these signatures using a MANOVA to separate food items into isotopically similar groups for incorporation into a future model. This model then will use these food groups along with isotopic signatures found in hair, and fecal samples to determine the relative contribution of different foods to the diet of chimpanzees in Senegal.

Mentor(s):

Elizabeth Flaherty, Forestry & Natural Resources, College of Agriculture

Stacy Lindshield, Purdue University

College of Engineering

Biomass Estimation via UAS Imagery for Soybean

Author(s):

Qingzhuo Qi, College of Engineering

Abstract:

Biomass estimation via unmanned aircraft systems (UAS) has the advantages of being rapid, low-cost and non-destructive compared to traditional methods. This research project is aimed at optimizing an algorithmic model to estimate soybean biomass based on imagery captured by UAS. As part of this project, plot images captured by UAS were stitched together to form a single georeferenced orthomosaic image for each flight using Pix4D Mapper. Then a tool called Crop Image Extraction (CIE), developed in Dr. Keith Cherkauer's lab, was used to extract individual plots from the larger experiment. A second tool, Vegetation Indices Derivation (VID), was utilized to find the average values of plot reflectance for each spectral band of a multi-spectral camera. The camera included a Blue, Green, Red, Red-edge and Near infrared bands. Multiple regression models were applied to understand how biomass correlated with the calibrated reflectance in each spectral band, together with canopy cover fraction and canopy height. Preliminary results were used to identify a multivariate linear relationship between biomass measured in the field and values of the Green, Red, and Near infrared bands. Multicollinearity occurred when the Blue and Red-edge bands were considered; however, further optimization is required to achieve the best-fit model. Non-linear regression will also be considered in further research to improve estimation accuracy. The potential improvement to accuracy of UAS biomass estimation models from this work can help farmers predict yields and make crop management decisions.

Mentor(s):

Keith Cherkauer, Agricultural & Biological Engineering, College of Agriculture

Bilal Abughali, Purdue University

College of Science

Role of glucose metabolism in liver and lung metastatic breast cancer cell viability and migration

Author(s):

Alekya Raghavan, College of Science

Abstract:

The five-year survival rate for women diagnosed with breast cancer localized to the primary site is 99%; however, it is 28% for those whose cancer has metastasized. Therefore, preventing the progression to metastatic disease is critical to alleviate the burden of breast cancer-related mortality. We aimed to determine whether metastatic cell lines differentially metabolize glucose, and how these differences support survival and migration, key steps in metastasis. We studied non-metastatic M-Wnt cancer cells, and metastatic metM-Wntlung or metM-Wntliver cell lines; the latter preferentially metastasize to lung or liver, respectively. At 5 mM glucose concentration, employing stably labeled 13C6-glucose flux, we demonstrated glycolysis is higher in metM-Wntlung compared to the M-Wnt and metM-Wntliver cell lines. There were no significant differences in key glycolytic gene mRNA abundance (qRT-PCR) between the metastatic cell lines, though the glucose transporter GLUT1 is more abundant in metM-Wntlung compared to metM-Wntliver. Additionally, both metastatic cell lines were more viable (MTT assay) in 5 mM glucose conditions compared to 1 mM; however, at 25 mM glucose, the metM-Wntlung are significantly more viable whereas the metM-Wntliver are less viable compared to both lower concentrations. Interestingly, the effect of glucose concentration on viability is inversely related to its effect on cell migration (transwell assay). These results indicate that the metastatic lung cells rely on glucose as a primary source of energy to promote survival, and that the metastatic liver cells are less viable in higher glucose concentrations, potentially due to the inability to shift to a more glycolytic phenotype.

Mentor(s):

Dorothy Teegarden, Nutrition Science, College of Health & Human Sciences

Chaylen Andolino, Purdue University

Emily Hicks, Purdue University

College of Science

An Analysis of Standard Model and Supersymmetric Subatomic Particle Events through Deep Neural Networks

Author(s):

Shyam Ravichandran, College of Science

Ryan Rushing, College of Science

Abstract:

The Standard Model is a theory which classifies elementary particles and details their interaction. However, it fails to explain recorded phenomena such as Dark Matter. It also incorrectly predicts the mass of the Higgs Boson and Neutrinos; predicting the mass of the Higgs Boson as infinite and Neutrinos as massless when both have been confirmed experimentally to have finite and non-zero mass respectively. One theoretical solution addresses these issues by introducing Supersymmetric partners for all elementary particles in the Standard Model. Supersymmetry provides an extension to the Standard Model, which alleviates some differences between theoretical predictions and experimental events. Theoretical calculations regarding Supersymmetry predicts that angular distributions of the particles differ when traveling through the detectors. However, differences between Standard Model and Supersymmetric events are undetectable through human testing, and building a systematic approach by hand would be impossible. Thus leading to the use of Deep Neural Networks to create a dynamic training model to search for differences through binary classification and simulated data created by Monte-Carlo simulations that theorize the properties of Supersymmetric events . While effective, Deep Neural Networks need optimization to its architecture and hyperparameters to achieve high accuracy that can be applied and generalized to new data that will be detected and recorded by the CMS detector at the LHC in Geneva. This research project will show the process of writing and optimizing hyperparameters in a Deep Neural Network in an attempt to detect and classify Standard Model and Supersymmetric Events through their differences in angular distributions.

Mentor(s):

Abraham Koshy, Physics & Astronomy, College of Science

Andreas Jung, Purdue University

College of Health and Human Sciences

Resilience among people experiencing homelessness: The contribution of personal strengths and coping mechanisms and the influence of physical and mental health

Author(s):

Katie Reich, College of Science

Sage Thompson, College of Health & Human Sciences

Hannah Williams, College of Science

Abstract:

Background: Approximately half a million people in America experience homelessness each year with 5,625 people experiencing homelessness (PEH) in Indiana. Alongside socioeconomic adversity, PEH are more vulnerable to poor physical and mental health. Resilience, which draws on individual strengths, characteristics, and resources has been found to enhance individual's capacity to withstand and rebound from adversity. This study sought to investigate how individual strengths, coping strategies, and health statuses promote or hinder resilience in PEH.

Methods: Mixed method data were collected with 56 individuals experiencing homelessness in Tippecanoe County via interviews and surveys. Interviews underwent qualitative thematic analysis. Descriptive, correlation, and crosstabulation statistical analyses were conducted on survey data.

Results: Qualitative findings showed that PEH reported engaging in both harmful and meaningful activities, and that social supports, and individual strengths (e.g., hope, optimism, self-determination, self-reflection) helped PEH cope with multiple challenges. Mean descriptive scores were calculated for resilience (M = 2.92, SD = 0.65), overall health (M= 2.78, SD= 0.54), and specific self-reported physical (M= 3.16, SD = 1.56) and mental (M= 2.96, SD= 1.46) health. A positive correlation between overall health and resilience (r = 0.358, α = 0.01) was found.

Conclusion: Findings highlight that protective factors help PEH cope with their adverse conditions. This study can inform future interventions that seek to enhance promotive factors among members of this vulnerable population. Specifically, a strengths perspective versus a deficit-model view will contribute to the development of practices that include and advocate for strength-based approaches.

Mentor(s):

Yumary Ruiz, Public Health, College of Health & Human Sciences

Carly Kimiecik, Purdue University

Natalia Rodriguez, Purdue University

College of Engineering

Sail Context Camera Software Development for NASA Solar Cruiser

Author(s):

Becca Reinecke, College of Engineering

Dylan Huntoon, College of Engineering

Katie Kneeland, College of Engineering

Sikang Sun, College of Science

Jon Tierney, College of Engineering

William Whitsitt, College of Engineering

Elliot Wong, College of Engineering

Abstract:

NASA's 2025 Solar Cruiser mission will test an innovative method of space propulsion using solar sails to propel a spacecraft with solar radiation pressure. The Cruiser's sail will be monitored through a camera capable of verifying sail deployment, analyzing sail performance, and capturing high-quality images for public engagement. Prior to delivery of NASA mission hardware, software is being developed to operate a lab camera, and perform sail analysis. The software is being written in Python for use on a Raspberry Pi lab set up, chosen for ease of use and rapid design. The focus of the system design is on control software with basic image processing functions that builds on the existing framework and graphical user interface from the Fall 2021 semester. The proposed package will allow users to interact with camera settings onboard the RaspberryPi and capture images while simultaneously analyzing sail performance. Research will continue into topographical analysis and edge detection to analyze the performance of the sail. Topographical analysis through photogrammetry measures the shape of the sail in 3D space, while edge detection outlines the sail and measures its billow. Sail shape is a major determinant for efficiency and important for monitoring behavior in flight. Upon completion of software capable of controlling the camera functions and processing images, testing will begin with a physical simulation of the Solar Cruiser's sail and the PiCamera. Once the mission camera is finalized, the imaging system will be built upon the methods developed with the PiCamera.

Mentor(s):

Katherine Fowee Gasaway, Aeronautics & Astronautics, College of Engineering

Alina Alexeenko, Purdue University

Anthony Cofer, Purdue University

College of Engineering

Simulated Imaging Environment for NASA Solar Cruiser Sail Context Camera

Author(s):

Becca Reinecke, College of Engineering

Brendan Klaas, College of Engineering

Mark Kosmerl, College of Engineering

Ishaan Rao, College of Engineering

Samuel Smith, College of Engineering

Abstract:

Solar sails have gained prominence in recent space missions as an alternative propulsion method for small spacecraft. NASA's 2025 Solar Cruiser mission will test the largest solar sail near the first Earth-Sun Lagrange point. Purdue University is testing a camera system which will be used to monitor the sail and perform image processing on NASA's Solar Cruiser mission. Testing the camera requires a simulated environment with similar conditions to those experienced by the spacecraft after sail deployment. The simulated environment in the laboratory is composed of an imitation sail, the camera, simulated sunlight, and a black background. The sail and camera simulate the spacecraft, while the light and background simulate high contrast photographic conditions in space. After a thorough design and review, the background was constructed of melamine and wood and painted with Musou Black to minimize reflected light. To accurately represent the sun in this environment, the light source needs to mimic the light intensity and color temperature of the sun. This can be achieved by using a 65,000 lumen, 500 Watt light, 5000 Kelvin light source. While the chosen light source will have a larger sky area, and produce less lumens, it has the correct light temperature, allowing for highly accurate photographs. The light also has an adjustable angle to determine the effect of incidence angle on photographic conditions.

Mentor(s):

Katherine Fowee Gasaway, Aeronautics & Astronautics, College of Engineering

Alina Alexeenko, Purdue University

Anthony Cofer, Purdue University

College of Health and Human Sciences

Assessment of Nuclear Security Culture at Radiological Facilities Across the United States

Author(s):

Emma Rekeweg, College of Health & Human Sciences

Karina Paone, College of Health & Human Sciences

Abstract:

Radiological facilities such as academic institutions and medical centers may contain varied amounts of radiological material for beneficial purposes. The greatest challenge to guarding against radiological threats (such as radiological dispersal devices (RDD) or radiological emission devices (RED)) is the sheer prevalence and use of radioactive materials in these facilities, which makes securing them difficult. Cultivating and promoting a robust nuclear and radiological security culture at these facilities, combined with other physical protection systems can assist in the prevention of radioactive material theft and sabotage. This promotion is highly dependent on a relevant self-assessment tool that would evaluate the attitudes, beliefs, and values of radiation personnel regarding culture at their facility.

This study investigates a series of culture indicators by assessing a wide range of medical centers and academic institutions across the United States. A quantitative method of online surveys is used to measure current perceptions and identify areas of strength and weakness in particular aspects of security culture. Respondents to the survey include technicians, nurses, and other authorized users of radioactive materials at medical centers and radiation safety staff and students from academic institutions. The study attempts to examine the influence of human factors in the current state of emergency preparedness, security violations, preventative education and training, policy, and management oversight. The resulting outcome of the analysis outlines appropriate recommendations for facility-based security culture development, provides a process for raising security awareness, and promotes the sharing of best practices.

Mentor(s):

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

Shraddha Rane, Purdue University

Poster Presentation Abstract Number: 393 :: Physical Sciences

College of Science

XENONnT Electron Power Law Dependence

Author(s):

Caleb Remocaldo, College of Science

Cameron Chevrier, College of Science

Kyler Harrison, College of Science

Eric Klueppelberg, College of Science

Abstract:

XENONnT is a a liquid xenon time projection chamber designed to look for the direct detection of dark matter. Delayed electron signals plague these type of detectors that inhibit their ability to search for low mass dark matter interactions. Our team is working to understand delayed electron signals after S2 events. The size of XENONnT time projection chamber limits the duration that an electron can drift through the detector to 2.5ms. Data shows that electron signals are produced in the chamber up to 1 second after a primary S2 event. Some of these delayed signals are understood to be due to the photoelectric effect, but events after a 5ms threshold of a primary S2 event are believed to be due to a different phenomenon. Previous research on XENON1T has showed that these delayed signals fall off as a power law function. Our research is directed toward investigating how these power law functions change between XENON1T and XENONnT and to understand how the power law changes for different primary S2 area ranges. By understanding these power laws, we hope to better understand what phenomenon could lead to the characteristic power law drop off rate over increasing delay time.

Mentor(s):

Amanda Baxter, Physics & Astronomy, College of Science

Rafael Lang,

Poster Presentation Abstract Number: 394 :: Mathematical/Computation Sciences

College of Agriculture

Testing for Disequilibrium in Futures Markets

Author(s):

Jaden Retter, College of Agriculture

Abstract:

This study assesses the forecasting power of simple technical trading systems in futures markets using industry standard backtesting procedures. This study breaks down the performance of technical trading systems optimized over a ten-year period in the agricultural grains sector. Using TradeStation backtesting programs, eight technical trading systems were selected and applied to three grain futures contracts: corn, soybeans, and Chicago wheat. The results were pulled from TradeStation's Strategy Performance Reports and various metrics were used in assessing the results, such as profitability, risk/reward ratios, and measures comparing performance to transaction costs were also included.

Overall, the systems generated results that were above transaction costs, indicating that the systems were able to detect market disequilibrium at a profitable level. However, when comparing to the returns of other assets, like Treasury Notes, over the same timeframe, the overall results were not overly appealing. Additionally, returns throughout the period were not consistent; there were periods of higher returns and periods of lower returns that were less variable. Nonetheless, the returns of the three grain contracts were fairly consistent across all systems, a point that could be valuable when analyzing factors such as portfolio diversification and risk management. Biases such as optimization practices and the parameters of the systems themselves offer room for these tests to grow in accuracy. The intent of this paper is to lay a framework for further tests and applications of the value in evaluating the performance of popular technical indicator systems that are so prevalent in today's markets.

Mentor(s):

Mindy Mallory, Agricultural Economics, College of Agriculture

Honors College

Utilizing Foldit to Create a Binder Protein Against SARS-CoV-2

Author(s):

Kathleen Reyna, College of Health & Human Sciences

Abstract:

COVID-19, the illness caused by SARS-CoV-2, has resulted in millions of deaths and even more health complications worldwide. Prior research has shown that the spike protein of SARS-CoV-2 binds to the angiotensin-converting enzyme 2 (ACE2) receptor on human cells as a means of viral entry. The only available treatment options for COVID-19 are trial medications and mRNA vaccines. Some studies predict that a binder protein may be the best option to eradicate the ongoing pandemic. The binder protein would attach to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein thus eliminating its ability to bind to the ACE2 receptor. Is it possible to use Fold-It to create a binder protein to reduce that potentially fatal interaction? The biggest challenge of protein design is finding the lowest energy state of an amino acid sequence, for which there are many possibilities. Fold-It has proven to be more effective for de novo protein design than artificial intelligence alone because humans are more willing to explore various design options before settling. By adjusting residues and changing the length of the overall starting protein I was able to create a structure stable enough to bind to the SARS-CoV-2 spike protein. Through novel research and trials, binder proteins have potential to be a therapeutic option that can save lives and prevent infection before it happens.

Mentor(s):

Zahra Tehrani, Honors College

College of Science

Exploring Genetic Differences between the Autoimmune Disorders

Author(s):

Grace Reynolds, Temporary

Josie Bryant, College of Science

Abstract:

Exploring Genetic Differences between the Autoimmune Disorders

Grace Reynolds, Josie Bryant, Apostolia Topaloudi, Peristera Paschou

Autoimmune disorders are classified as heterogeneous disorders where failure occurs in self-tolerance mechanisms, triggering self-attacking autoantibodies. Autoimmune disorders are often found to be comorbid, making it difficult to differentiate between them in a clinical setting. They have also been shown to share genetic loci, notably in the human leukocyte antigen (HLA) locus. In hopes to better distinguish between these disorders, we explored genetic differences between them, initially focusing on comparisons between Ulcerative Colitis (UC) vs Crohn's Disease (CRD), and Rheumatoid Arthritis (RA) vs Systemic Lupus Erythematosus (SLE). We performed case-case Genomewide Association Studies (ccGWAS) analyses with the tool ReAct, using summary statistics data from previously published GWAS to explore the genetic differences between the cases of correlated disorders. Our ccGWAS identified 4 significant, novel loci for UC vs CRD, and 38 significant loci for RA vs SLE. For both comparisons, ccGWAS-specific genes were found to be involved in immune related pathways. In conclusion, our analyses revealed differential loci between cases of correlated autoimmune disorders. In the future these loci may provide insight for better diagnoses and disorder-specific treatment.

Mentor(s):

Peristera Paschou, Biological Sciences, College of Science

Apostolia Topaloudi, Purdue University

College of Science

Predicting Short-term Cryptocurrency Volatility using Twitter Data

Author(s):

Jacob Roach, College of Science

Abstract:

In recent years, the investment in and use of Bitcoin has exploded. As more individuals and entities purchase the digital currency, businesses have slowly begun to adopt Bitcoin as a means for transaction. The importance of understanding Bitcoin's, or any cryptocurrency's, change in value will only grow. Coupled with the emergence of cryptocurrency has been the steady growth in social media usage. Gone are the days when social media only reacted to the events in the world: it now helps to create them. In the past, Twitter metadata has been used to predict price fluctuations for various financial instruments, including stocks and cryptocurrencies. However, there has been little research as to using the actual content of a "Tweet" to determine variations in the value of Bitcoin. This poster investigates the feasibility of using machine learning and natural language processing as a method to do just that. To predict the price increase or decrease Bitcoin, a Tweet's text is cleaned and preprocessed, and then used as input to a recurrent neural network, or RNN. The output of the RNN corresponds to an increase or decrease in the value of Bitcoin in the next twelve hours, and is accurate roughly 85% of the time. This level of accuracy suggests social media data is a viable means to predict changes in the value of Bitcoin, as well as other financial instruments.

Mentor(s):

Mark Daniel Ward, Vice Provost for Teaching & Learning

College of Science

Impact of Farming Activity on Ice Nucleating Particles

Author(s):

Joseph Robinson, College of Science

Abstract:

Farming activities cause particles such as dust, dirt, and plant material to be emitted into the air. Some of these aerosols can become Ice Nucleating Particles (INP), which serve as seeds for cold, mixed-phase clouds. While there have been ground-based studies in the western great plains and a single air-based study in the Indiana, there is a distinct lack of ground-based studies in the Midwest. In Indiana, over two-thirds of the state is farmland with over 75% of land in Tippecanoe County used for agriculture. Despite being such an important part of life in Indiana, the connection between agricultural activities and INP concentrations in the area has not been explored. Using field observations taken at the Purdue Agronomy Center for Research and Education (ACRE), we hope to study the impact of harvesting on INP concentrations in the Midwest United States. The field experiment took place from May to November 2021 at the ACRE site, with data coming primarily from the Spectrometer for Ice Nuclei (SPIN). SPIN measures the size-resolved number concentrations of INPs and was ran on days when farming activity was observed. It is hoped that the data from this project will provide further insight into the composition and number concentrations of INPs from harvesting through ground-based field observations as well as insight into INP concentration in the rural Midwest.

Mentor(s):

Gouri Prabhakar, Earth, Atmospheric, and Planetary Sciences, College of Science

Daniel Cziczo, Purdue University

College of Pharmacy

The Effects of N-terminal Methylation on Substrate Localization in Yeast Cells

Author(s):

James Rooney, College of Pharmacy

Abstract:

The purpose of this study was to understand the effects of N-terminal methylation on substrate localization in yeast cells. N-terminal methylation is catalyzed by enzymes called N-terminal methyltransferases. Two genes that encode these enzymes, NTMT1 and NTMT2, exist in humans, and their catalytic action is associated with cancer. A paralogue of these genes called Tae1 exists in yeast. Tae1 recognizes and binds to a subset of substrates by recognizing a preferred N-terminal amino acid sequence. Conceptually, we investigated the possibility that if protein N-terminal methylation were prohibited in some way, the substrates may localize to a different area of the cell, thus indirectly altering their function.

Variant strains of yeast expressing each substrate were used to test the effects of N-terminal methylation on substrate localization in yeast. Substrate proteins in the strains were tagged with green fluorescence protein (GFP) for visualization using confocal microscopy. The yeast strains were constructed in a manner to block substrate methylation, or they had the TAE1 gene knocked out. The localizations of the substrates were then visualized in the strains with deficient or blocked methylation and compared with a strain that was methylation competent.

The localizations of at least two substrates, both with mitochondrial functions, appeared to be affected by N-terminal methylation based on confocal microscopy, but the results were inconclusive. In order to obtain more conclusive evidence, a more quantitative method of evaluating substrate localization must be pursued. Mitochondrial fractionation could be used to evaluate the localization of these two substrates more quantitatively.

Mentor(s):

Tony Hazbun, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Panyue Chen, Purdue University

Poster Presentation Abstract Number: 400 :: Life Sciences

College of Science

Mendelian Randomization Study of the Plasma Proteome and Neurodevelopmental Disorders

Author(s):

Carlos Rubin de Celis, College of Science

Abstract:

Common neurodevelopmental disorders such as Tourette Syndrome (TS), Attention-Deficit Hyperactivity Disorder (ADHD), Obsessive-Compulsive Disorder (OCD), and Autism Spectrum Disorder (ASD) are often comorbid. Genome-wide association studies (GWAS) have identified numerous variants associated with the different neurodevelopmental disorders, but the relationship with protein expression is unknown. Here, we perform a Mendelian Randomization (MR) analysis to identify putative causal relationships between the plasma proteome and the different childhood neurodevelopmental disorders. Exposure data were extracted from a large GWAS of 2,994 plasma proteins in 3,301 subjects of European descent, while outcome data were obtained from GWAS summary statistics of the various disorders from the Psychiatric Genomics Consortium (PGC). Genome-wide Complex Trait Analysis (GCTA) software is used for the analysis, and the Single Nucleotide Polymorphism (SNP) instruments are chosen at a p-value threshold of 1e-05. The results of this analysis could identify proteins causally associated with the disorders that could potentially be used as novel drug targets for the treatment of these conditions.

Mentor(s):

Peristera Paschou, Biological Sciences, College of Science

Pritesh Jain, Purdue University

College of Science

PRL2 deletion increases PTEN protein to hinder tumorigenesis in an in vivo Trp53-null mouse model

Author(s):

Diego Ruiz-Avila, College of Science

Abstract:

Redacted.

Mentor(s):

Zhong-Yin Zhang, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Frederick Nguele Meke, Purdue Universtiy

College of Science

Regular Expression Reuse via Language Approximation

Author(s):

Charlie Sale, College of Science

Efe Barlas, College of Engineering

Abstract:

Regular expressions (regexes) are used by software developers and IT staff to solve string matching tasks. They are used in many projects to solve problems such as form validation and parsing text. Despite their widespread use, existing studies have shown that regexes are hard to write and difficult to search for. Their syntax is unintuitive, and it is difficult to read a regex and understand precisely what it does. While some projects have the resources to hire regex experts, many do not, so unexperienced developers must write regexes. As a result, the regexes found in projects may be poorly written and lead to bugs.

To alleviate the burden of writing regular expressions, research has suggested synthesizing regular expressions to perform a user-defined task. Although this approach is interesting, synthesized regexes do not generalize well. Their specifications are often incomplete, so the generated regexes do not perform exactly as the user might want.

In this paper, we explore a different approach to make regexes easier to use: regex reuse. Our study presents a novel system that allows users to query a database of pre-written regular expressions for specific regexes that might meet their specific use-case. We evaluate the efficacy of this system by conducting a user study to determine if it aids developers with using regular expressions.

Mentor(s):

Jamie Davis, Electrical & Computer Engineering, College of Engineering

College of Agriculture

Aux/IAAs Role in Stomatal Development

Author(s):

Kelly Sammons, College of Agriculture

Abstract:

Author(s):

Kelly Sammons, College of Agriculture

Abstract:

Stomata are organelles on the surface of the leaf responsible for the intake of carbon dioxide and release of oxygen. Based on preliminary data we can determine that water use efficiency and stomata are related. Understanding the proteins involved in the pathway of stomatal development can help us to create a plant with better water use efficiency. It has been previously suggested that the protein family Aux/IAA have a role in the development of stomata in Arabidopsis thaliana. Aux/IAA proteins act as negative regulatory proteins. Currently, we are screening several members of the Aux/IAA family using T-DNA insertion mutants. Early assessment of stomatal development in each mutant suggests an increase in stomatal density and a decrease in size both in the abaxial and adaxial side of the leaf in Aux/IAA7 mutants.

Mentor(s):

Michael V. Mickelbart, College of Agriculture, Botany and Plant Pathology Santiago Franco Lopez, College of Agriculture, Botany and Plant Pathology

Mentor(s):

Mike Mickelbart, Botany & Plant Pathology, College of Agriculture

Santiago Franco Lopez, Purdue University

College of Agriculture

Effects of the Inclusion of Dry-Aged Beef Trimming as a Value-added Quality Enhancer for Ground Beef

Author(s):

Katie Schmucker, College of Agriculture

Abstract:

The objective of this study was to determine the potential of using dry-aged beef trimmings as a novel ingredient addition to ground beef. Paired beef loins, M. longissimus lumborum, from 13 beef carcasses were collected at 5 days postmortem and were randomly assigned to four different aging methods: wet-aging (WA), dry-aging (DA), dry-aging in a water permeable bag (DWA) and UV-light dry-aging (UDA). The control and dry-aging+fat (DA-FAT) patties were made with an 80:20 lean to fat ratio. The WA, DWA, DA, and UDA patties were constructed with 50% lean meat, 30% treated trim and 20% treated fat. The addition of the trimmings only affected the chewiness of the patties in a significant way. The hardness, adhesiveness, resilience, cohesion, springiness, and gumminess were not affected by the addition of the dry-aged trimmings ($P<0.05$). The TBARS assay values varied significantly across display period, but not across treatments. The patties had higher TBARS values with a display period of 5 days versus 1 day. The control patties had a lower average pH ($P>0.05$) than the rest of the treatments, however, there were no significant differences with the DA-FAT patties. The dry-aged beef trimmings had no adverse impact on the water holding capacity of the ground beef patties. The redness, yellowness, hue and chroma of the ground beef patties were significantly different over the display period of 5 days while the lightness of the patties was not different over the span of 5 days between all of the treatments ($P>0.05$). The final steps of this project are to complete a trained sensory panel to identify different flavors in each sample and then get a volatile analysis of each patty as well. The results of the present study indicate a potential usage of dry-aged beef trimmings as a value-adding ingredient for manufacturing of ground beef.

Mentor(s):

Brad Kim, Animal Sciences, College of Agriculture

Derico Setyabrata, Purdue University

College of Agriculture

The Role of Dimerization in the Catalytic Mechanism of Cdc14 Phosphatases

Author(s):

Jack Schwartz, College of Agriculture

Abstract:

Cdc14 phosphatases are found in most eukaryotes where they dephosphorylate specific substrates of cyclin-dependent and/or MAP kinases. In several pathogenic fungi, Cdc14 was recently implicated in host infection. Because Cdc14 is required for fungal pathogenesis, it may be a promising, novel antifungal target. To pursue Cdc14 as an antifungal target it is important to first understand the mechanism by which Cdc14 enzymes work and identify differences between fungal and animal orthologs that could be exploited for drug development. Fungal Cdc14 enzymes appear to function as dimers, with dimerization required for enzyme activity. Unlike the active site, which is nearly identical in all Cdc14 enzymes, the dimer interface is poorly conserved between yeast and animal orthologs, and therefore it could be a useful target for inhibitor development. However, it is still unknown how dimerization contributes to enzyme activity, as existing Cdc14 structures do not offer an obvious explanation. Recently, our lab identified a conserved, pseudosubstrate motif in the C-terminus of fungal Cdc14 enzymes that is required for normal enzyme activity, cell wall integrity, and pathogenesis, and which may be mechanistically linked to dimerization. Our hypothesis, supported by structural modeling with AlphaFold, is that this motif evolved to stimulate enzyme activity by binding the catalytic site of the opposite subunit at the phosphoenzyme hydrolysis step, thus providing a plausible explanation for the conserved dimeric structure. I am testing this hypothesis using site-directed mutagenesis, a two-step affinity purification to isolate heterodimers containing one active and one inactive subunit, and enzyme kinetic assays.

Mentor(s):

Mark Hall, Biochemistry, College of Agriculture

Mark Hall, Purdue University

College of Engineering

Food Detection

Author(s):

Robert Sego, College of Engineering

Santiago Guada, College of Engineering

Preethi Goli, College of Science

Rahul Ashok, College of Engineering

Theodore Tsai, College of Engineering

Abstract:

The purpose of this project is to calculate the volumes of different foods in an image and estimate the calories those volumes represent. Dishes customers are unfamiliar with may contain allergens or harmful ingredients for those with food allergies or obesity. For consumers to become more health conscious, they need access to a tool that can provide this information for unlabelled meals or ambiguously labelled packaged foods. Our team has created a pipeline of image processing methods that can segment, classify, and estimate the volume of food using a single image with a fiducial marker placed within the frame. Using the U-Net neural network architecture, our model segments 73 different classes of food in the UNIMIB 2016 dataset. Once segmented and classified, a 3D geometric volume that is most similar to the food classes general shape is selected, and the segmented pixels of the image are used to estimate the chosen volume models dimensions. To test volume estimation method our team is curating a dataset of images of meals next to fiducial markers taken at a pose angle of 45 degrees and an approximate distance of one foot in order to capture the silhouette of their 3D shapes. This project has extensive applications in meal and diet planning, and by creating a tool that removes the need for prior user knowledge about dishes, we can remove dietary risks and provide a more accurate calorie count than a user could estimate.

Mentor(s):

Carla Zoltowski, Electrical & Computer Engineering, College of Engineering

Edward Delp, Purdue University

College of Health and Human Sciences

Effect Of Stress On Neural Activity Within The Prefrontal Cortex In Male And Female Rats

Author(s):

Nisha Sen-Gupta, College of Health & Human Sciences

Abstract:

Post-traumatic stress disorder (PTSD) is characterized by factors of intrusion symptoms, avoidance, and negative alterations; generalization of fear being one such common symptom. The main purpose of this study was to look at the indications of stress on the brain. We tested 16 male and 16 female rat subjects with or without stress exposure to compare sex differences and group differences. Stress was implemented via the delivery of unsignaled and unpredictable footshocks followed by a test for fear generalization in a novel context one day later. Brains were extracted 60-90 minutes after the test session for immunohistochemistry analyses. Neuronal images were taken from the prelimbic and infralimbic subregions of the prefrontal cortex to observe cFos expression as a marker of neuronal activity that occurred during the test session. Males and females that were exposed to stress showed elevated fear during the generalization test compared to their control counterparts, although only males showed statistical significance. cFos analyses showed lower expression in both prefrontal regions in stressed females compared to control females, although this did not reach statistical significance. These preliminary findings indicate sex differences are present in response to stress both in fear generalization behavior and neuronal activity within the prefrontal cortex.

Mentor(s):

Sydney Trask, Psychological Sciences, College of Health & Human Sciences

Susan Sangha, Indiana University School of Medicine

College of Engineering

Various Technologies and Methods Used in 5G Network

Author(s):

Leo Seo, College of Engineering

Leng Lohanakakul, College of Engineering

Rajeev Sashti, College of Engineering

Jake Heimlich, College of Engineering

Vishal Urs, College of Engineering

Abstract:

The purpose of this team is to understand and simulate Ultra-Reliable Low-Latency Communication (URLLC) techniques that helps improve the "reliability" and "latency" during transmission. Our team divided into subgroups to further conduct research in following subjects:

- NYUSIM 5G Channel Simulator
- 5G/6G Development Survey Report
- Error Correction
- Frame Recovery

The goal of the NYUSIM 5G Channel Simulator subteam is to learn and document the capabilities and limitations of the 5G mm-wave channel simulator developed by NYU. Several input parameters can be adjusted to simulate different scenarios from urban microcell to rural macrocell. This subteam aimed to understand the resulting output graphs that indicate the power delay profile and shadow fading. Further experiments will be held with more various input environments.

The 5G/6G Development Survey Report team's goal is to determine how 5G/6G development is ongoing and how 5G/6G works. Before going further, this team will have to know how OFDM works which is widely used to transmit and receive signals in modern days. Survey report team will also learn and understand cyclic prefix. Ultimately, our goal is to write a survey report about current goals and the latest research focus of the 5G network.

The Error Correction team researched different error correction codes that could be used to determine and fix errors that are found in the transmission of data. It was found that using 7,4 Hamming code was best as it had the fastest bit rate while also having a low percentage error. This code was implemented in MATLAB and is used to be able to detect and correct errors in data that is transmitted.

The Frame Recovery team researched how to implement frame recovery and it was found that the best way to implement this was to use preamble and then a matched filter in order to, first, identify the data being transmitted, and then maximize the signal to noise ratio (SNR) of the data being transmitted in order to recover the correct data at the receiver.

Mentor(s):

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

James Krogmeier, Purdue University

David Love, Purdue University

College of Engineering

Rheological Properties of Internally Cured Cementitious Materials

Author(s):

Akul Seshadri, College of Engineering

Ethan O'Banion, College of Engineering

Abstract:

Due to unmatched material properties of strength, workability, and durability, concrete is the most widely used building material worldwide. However, concrete production accounts for 10% of global carbon dioxide emissions. Materials science research for the improvement of this ubiquitous material is backed by significant environmental and economic need.

Properly curing concrete maximizes the material's properties.. Curing is currently maintained through rudimentary techniques of externally supplying the concrete with water. water often doesn't permeate the structure to prevent shrinkage. Excess water is often wasted in the process. Externally curing concrete structures creates unneeded environmental and economic costs.

Superabsorbent polymers (SAPs) are a material that absorb and trap water to form a hydrogel. Swelled hydrogel can be mixed with concrete to internally hydrate the entire structure, ensuring even curing. SAPs as an internal curing agent in concrete signal a future of optimal concrete properties in construction.

The addition of SAPs adds a new variable into concrete's workability. This work characterized the rheology (deformation and flow behavior) of cement pastes over time as dry SAP particles are mixed in, absorb and subsequently release fluid. Initial design of experiments, and literature review informed what tests would be useful for construction and 3D printing applications of cement. Important rheological properties like yield stress and shear thinning index as well as long range rheological behavior of viscosity and shear stress under different parameters were studied. The work investigated the effect of SAP size and varying water to cement ratio on the cement pastes.

Mentor(s):

Kendra Erk, Materials Engineering, College of Engineering

Ria Corder, Purdue Univeristy

Caitlin Adams, Purdue MSE

College of Agriculture

Evolutionary analysis of Podoviridae Phabuloso tape measure protein

Author(s):

Peyton Shafer, College of Engineering

Abstract:

Analysis of bacteriophage genomes and proteomics is of great importance in the growing field of bioinformatics. Bacteriophages are viruses that target bacteria, and thus have great use in medical and industrial settings to specifically target and lyse bacteria in a system. Only around 40% of phage genomes have known function, and annotating and analyzing genes allows for furthering knowledge on mutational analysis, protein folding methodology, and phylogeny (evolution). Tape measure proteins have a proportional length to the length of a phage tail, as the tape measure protein is used during tail assembly to dictate final length. Studying the evolution of tape measure protein phabuloso gene 18 is important to understand how the physical structure of the tail changes, and how DNA is transited to the host cell along the length of the tail. The nucleotide base pair sequence was compared to Leroy gene 18, also a tape measure protein, and the mutation types and sites determined. The base pair sequences are 30.03% similar and the protein sequence 7.53%, assuming no frameshift mutations. The majority of the mutations are transversions, leading to a 0.49 ratio of transitions to transversions. Most of these mutations caused a change in the encoded amino acid, with a 18.53 ratio of nonsynonymous to synonymous mutations. Tape measure protein of Phabuloso gene 18 is functionally the same as many other genes in the pham and cluster, yet from an amino acid level is greatly mutated from Leroy gene 18.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Lauren Novak, ABE Graduate student under Dr.Clase

Poster Presentation Abstract Number: 411 :: Mathematical/Computation Sciences

Purdue Polytechnic Institute

Smart Monitoring and Detection of ECG and Breathing Sound Signals With Deep Learning

Author(s):

Xiaxin Shen, Polytechnic Institute

Corbin Newhard, Polytechnic Institute

Abstract:

Signals like electrocardiogram (ECG) and breathing sounds from medical sensors are critical for monitoring human health and identifying illness indications. Deep learning (DL) approaches with advances in signal processing show outstanding performances compared to traditional machine learning methods on anomaly detection tasks by achieving higher accuracy and performance. In this paper, we propose a framework with convolutional neural network (CNN) and recurrent neural network (RNN) to implement classification tasks for ECG and breathing sounds signals. Wearable devices with sensors are used to collect the bio-signals. The signals are transformed into visuals to be fed to the DL models. The proposed system integrates DL and advanced signal processing for analyzing both ECG and breathing sounds signals to detect the validity of the signals as well as anomalies accurately, outperforming previous work.

Mentor(s):

Smriti Bhatt, Computer Information, Polytechnic Institute

Miad Faezipour, Purdue University

College of Health and Human Sciences

Building Interconnected Knowledge of the Cardiovascular System Through Functional Model Manipulation

Author(s):

Lauren Skadberg, College of Health & Human Sciences

Abstract:

Three-dimensional model manipulation has become a standard component of anatomy education due to the known connections between tactile manipulation and learning gains. It is known these types of activities result in higher engagement levels due to their student-centric nature, yet their ability to foster elevated interconnected knowledge gains further supports their implementation; however, certain modeling methods present potential challenges. Static models lack the structural and morphological changes inherent in living organisms. This dynamic absence creates a disconnect between form and function that introduces difficulties in extrapolating learning to living organisms. While virtual models afford a slightly more dynamic visual representation of the human form, they lack the tangible benefits garnered through kinesthetic exploration and manipulation of physical models. A model incorporating tactile engagement along with maintenance of the dynamic link between form and function in states of health and disease could address these challenges and illicit stronger deductive reasoning gains from students. This is of paramount importance in the training of future practitioners. The goal of this project is to do just that, create a manipulatable cardiovascular peripheral perfusion model to emulate clinical symptoms often encountered in select states of cardiac dysfunction. Student volunteers will engage with the model during active instruction sessions. In addition to post-session surveys about preferences, impressions, and perceived knowledge gains, participants will be given an application assessment incorporating problem-based questions to discern both enhanced and transferrable learning gains.

Mentor(s):

Lisa Hilliard, Health Sciences, College of Health & Human Sciences

College of Health and Human Sciences

Object Labeling: Semantically Related Toys and Vocabulary Development

Author(s):

Kennedy Skipper, College of Health & Human Sciences

Abstract:

An ongoing and important area of research is figuring out how children build networks of words in their minds as they grow their vocabulary. How do these mental networks of word meanings reflect children's experiences with physical objects in the world? Prior research shows that building semantic networks and introducing semantically related words helps to develop vocabulary knowledge (Hadley et al., 2019). We explore how children and their caregivers label objects and ask if labeling semantically related toys impacts the child's vocabulary development. Videos were coded of caregiver-child dyads (N=52) talking and playing with toys for 15 minutes at 24 months. Objects labeled by the child or caregiver were tagged. The objects were then grouped into semantically related categories (vehicles, animals, fruits, music, and no category) to determine the frequency that each category was labeled per video. These frequencies were then compared to the child's vocabulary skills at 24 months. We hypothesize that caregivers who label semantically related toys more often than non-categorical toys will have children with higher vocabulary scores. This data will support the growing body of knowledge recommended to parents and educators on how to best support child vocabulary growth through speaking and play.

Mentor(s):

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

Poster Presentation Abstract Number: 414 :: Life Sciences

Honors College

Creation of Novel Protein Binder for SARS-CoV-2 Spike Protein using Foldit

Author(s):

Thomas St. Pere, College of Science

Abstract:

The current COVID-19 pandemic is caused by a novel severe acute respiratory syndrome virus, SARS-CoV-2, which enters the body through the nasal cavity and uses its surface spike protein to bind to the ACE2 human receptor. Human antibodies neutralize the virus by binding to the RBD of the spike protein and novel, synthesized binder proteins can mimic this method of viral neutralization. Protein prediction software, such as Rosetta, are great tools in aiding the protein design and folding process, but are not sufficient by themselves as they get stuck in certain configurations and are not as creative as humans. Here, the online program Foldit was used to design a novel binding protein for the SARS-CoV-2-RBD with the ultimate goal of decreasing virality through blocking ACE2 access. The proposed protein has an increased Rosetta energy from 11,753 to 13,543 with a length of 92 amino acids. The increase is Rosetta energy score achieved suggests that the novel protein would be an effective binder and could decrease binding potential of the SARS-CoV-2 spike protein. This stability was achieved by adding residues to the end of the protein which helped stabilize the core and shield internal, hydrophobic residues. External hydrophobic residues Leu190, Leu194, and Ala198 were all mutated to hydrophilic side chains to form favorable interactions with water. The tertiary structure was also modified so that the protein fit well within the binding area of the RBD, which led to more interactions and tighter binding.

Mentor(s):

Zahra Tehrani, Honors College

Poster Presentation Abstract Number: 415 :: Social Sciences/Humanities/Education

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College of Health and Human Sciences

Cognitive Consequences of Exposure to Nature Stimuli

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Author(s):

Jake Strachan, College of Health & Human Sciences

Abstract:

Cognitive Consequences of Exposure to Nature Stimuli

Substantial evidence has been found that provides support for Attention Restoration Theory, a proposed explanation for supposed cognitive benefits when exposed to natural as opposed to urban environments. However, much of the research in this field has had limitations due to small sample sizes and experimental design oversights. In the current study, we tested college students to examine the effects of natural versus urban images and sounds on cognitive processes, specifically attention and working memory. We also aim to address criticisms of this field of research by addressing the problem of practice effects and control groups in our experimental design. Results are discussed in the context of the broader literature of Attention Restoration Theory research.

Mentor(s):

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

College of Health and Human Sciences

Optimizing Culture Conditions for Accelerated Astrocyte and Neuron Development

Author(s):

Madeleine Strom, College of Health & Human Sciences

Abstract:

Human induced pluripotent stem cell (hiPSC)-derived neuronal cultures have become a promising tool for studying neurodevelopmental disorders, neurodegenerative disorders, and neurotoxicity and drug development screening approaches. While current differentiation protocols that utilize Shi et al. media produce mature neurons, astrocyte development takes a protracted time consistent with normal development. Astrocyte development is critical to neuronal maturation in the human brain. Additionally, astrocytes greatly influence susceptibility of the culture towards toxicants. This study investigates a differentiation protocol that favors the development of astrocytes to accelerate the production of mature hiPSC-derived neuronal cultures by utilizing a medium containing 10% fetal bovine serum (FBS) advancing astrocyte development, whereas the current Shi et. al. media used no FBS. hiPSCs were differentiated into neuronal progenitors using dual-SMAD inhibition. Following 11, 16 or 21 days, cultures were maintained in either Shi or our FBS-containing astrocyte media. Two months after plating, neurons and astrocytes in both culture conditions were examined via immunocytochemistry and image analysis. Maturation of neurons was defined by dendrite count and branchpoint count. Image quantification revealed that the number of mature-like neurons was greater in the astrocyte media than the Shi et al. media. The number of dendrites in astrocyte media is comparable to the Shi et al. media dendrite count. Our data suggest that the astrocyte media accelerates neuronal maturation and increases neuron density in hiPSC-derived neuronal cultures perhaps via the increased abundance of astrocytes. Thus we present an efficient hiPSC differentiation protocol for modeling developmental neurotoxicity and neurodegenerative disorders.

Mentor(s):

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

Anke Tukker, Purdue University

Poster Presentation Abstract Number: 417 :: Social Sciences/Humanities/Education

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College of Health and Human Sciences

Systematic Review of Popularity, Reliability, and Validity of Wearable Sensors for Autistic Participants

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Author(s):

Anna Strong, College of Health & Human Sciences

Julia Suter, College of Health & Human Sciences

Abstract:

Wearable sensors have the potential to measure clinical population outcomes and experiences in naturalist settings. To employ these devices in clinical trials, clear industry standards and reliability/validity metrics are needed (Nicolelle et al., 2018). The goal of this review was to examine the popularity of various types of sensors in autistic populations, as well as the degree to which reliability and validity data are reported in these studies. The following databases were searched: PsycINFO, PubMed, Web of Science, ProQuest Technology Collection. Included studies: (1) were published since 2015; (2) included participants with Autism Spectrum Disorder; and (3) collected data using a wearable sensor. Data extracted included type of wearable sensor used, whether validity and reliability metrics were reported. Where reported, we summarized variables across studies. In total, 149 studies were included in the final review. The most frequently reported sensors were accelerometers, with only four out of ninety-five reporting reliability metrics (4.21%). There were no reports of reliability for electroglottograph, electropalatograph, functional near infrared spectroscopy, nasal-oral radiometer, nasality microphone, and polysomnograph devices. We defined validity as comparing results of the same signal between multiple sensors. Only five articles (3.36%) validated their sensor by comparing it to another sensor. These results suggest that wearable sensors are being incorporated into studies, but not many are documenting reliability and validity in autistic populations. Both are essential to ensure that data being gathered is replicable and results are accurate.

Mentor(s):

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

Bridgette Kelleher, Purdue University

Amy Schwichtenberg, Purdue University

Wei Siong Neo, Purdue University

Purdue Polytechnic Institute

Stretchable Fiber-Reinforced Elastomer Composite Using Wavy patterned Fiber Reinforcement

Author(s):

Drake Tackett, Polytechnic Institute

Roy Su, Polytechnic Institute

Abstract:

Redacted.

Mentor(s):

Garam Kim, ,

Timothy Ropp, Purdue University

College of Engineering

Optimizing Membrane Water Vapor Permeance Through Temperature-Dependence Analyses

Author(s):

Meghan Thai, College of Engineering

Abstract:

Today in the United States, HVAC systems account for 15% of the energy consumed in buildings, and buildings account for 40% of the nation's total primary energy consumption. Conventional air conditioning systems operate at low temperatures, allowing condensation-based dehumidification, a significant source of inefficiency. Many technologies aim to eliminate condensation. Selective membranes are a strong barrier that can provide mechanical water separation out of the air, a more efficient method than condensation. It is proposed to combine membranes and air cooling in an energy exchanger system to optimize dehumidification and avoid condensation in air conditioning systems. However, for this system to efficiently adsorb and diffuse water vapor, the membranes must have high water vapor permeance to separate water vapor from the air. In past studies, many polymeric membrane materials have increased membrane performance with lower temperatures. To understand this relation, two different polymeric materials, Pebax 1657 + GO and PVA + TEG, are tested at various temperatures and humidities according to ASTM E96. These tests confirmed that permeance increases with decreasing temperatures and increasing relative humidity. Both materials exhibit temperature dependence due to the high hydrophilic properties in the material. By implementing membranes with temperature dependence, air cooling can enhance the membrane performance by maximizing the water vapor permeance for greater humidity removal. Thus, the dehumidification efficiency can increase by combining membranes with air cooling, reducing energy consumption compared to conventional systems.

Mentor(s):

Andrew Fix, Mechanical Engineering, College of Engineering

David Warsinger, Purdue University College of Mechanical Engineering

Hamid Fattahi Juybari, Purdue University

James Braun, Purdue University

College of Science

Crowd-Machine Partnership on Road Infrastructure Quality Recognition and Resilience

Author(s):

Eric Thompson, College of Science

Abstract:

Public roads are a vital component of modern-day society, as they are necessary for the transportation of people and capital; consequently, it is important that they are regularly and effectively maintained. Unfortunately, this maintenance is difficult to manage due to the sheer area that roads span. It is an arduous task to locate every instance of road damage, as well as to determine the urgency that each bit of damage necessitates. Repairing road damage has high costs in labor, time, and money. To provide a more efficient way to monitor road conditions, we are designing a mobile application that collects information about the roughness of pavement through built-in sensors on mobile phones. Our application will inform drivers about road anomalies using crowdsourcing. The app also will provide navigation capabilities during the data collection. We will conduct data analysis on the collected phone data from users' driving routes to determine portions of road that contain damage. This analyzed data will be used to produce glanceable feedback for the user during the navigation, such as visualizations on the map, or voice alerts. We will iteratively improve the user interface through user studies to prepare for large-scale deployment. Going forward, we plan to release the app publicly and crowdsource the data collection.

Mentor(s):

Tianyi Li, Computer Information, Polytechnic Institute

Chengcheng Tao, Purdue University

Tanmay Surve, Purdue University

Purdue Polytechnic Institute

3D printed thermoplastic composite machining strategy and parameter optimization

Author(s):

David Tilley, Polytechnic Institute

Abstract:

3D printed fiber-reinforced composite is a new advanced material combining high-performance fiber reinforcement with a polymer matrix. If not appropriately machined, the addition of fibers to thermoplastics causes defects in the material. The final geometrical shape of printed parts is not accurately identified with the design. Optimizing the machining parameters is vital to increasing the quality of the part. When machining fiber-reinforced materials, we must look for fiber pull-out, breakage, and melted polymer evidence. Thus, we establish optimal machining parameters for fiber-reinforced polymers associated uses while exploring the relationship between machining parameters and material characteristics, including glass transition temperature and melting temperature. 3D printed composites building process stacks material layer by layer. First, a test specimen is built using extruder deposition additive manufacturing (EDAM). Next, samples are machined with computer numerical control (CNC), where different surface speeds and feed per tooth are analyzed. The simultaneous use of a thermal camera senses temperatures ranging from ambient to glass transition or polymer's melting point. After each test specimen is machined and temperature data is logged, each is microscopically analyzed using a stereomicroscope. Finally, a surface roughness tester is used to identify surface finish quality. Tests concurrently lead to optimal feed rate and spindle speed associated with thermoplastics studied. The optimal result for each type of 3D printed thermoplastic is yielded, including how the thermal performance of the polymer affects optimal machining parameters to achieve the highest finish quality while minimizing fiber breakage and tear out, further impacting industry 4.0 composite tool quality.

Mentor(s):

Garam Kim, Aviation & Transportation Technology, Polytechnic Institute

Poster Presentation Abstract Number: 422 :: Innovative Technology/Entrepreneurship/Design

<div align="center">

Purdue Polytechnic Institute

Application of Reverse Engineering Technologies to reconstruct Purdue Pete

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Author(s):

David Tilley, Polytechnic Institute

Abstract:

Purdue Pete's history as a mascot has contributed a great deal of pride to the school spirit within the university. Since the 1950's Pete has undergone several transformations; now, the Composites Manufacturing & Simulation Center research laboratory manufactures the mascot head out of high-performance carbon fiber composites. Currently, the master mold used to generate the associated geometry of Pete is using older technologies such as silicone molds to manufacture the mascot. This project increases the effectiveness of Pete's manufacturing process. First, the Pete master mold needed to be restored by hand, then point cloud data is gathered using laser 3D scanning technology to scan the only existing master mold. Point cloud data generates a mesh through a software interface. This mesh is turned into a surface in CAD. The Surface and mesh are refined to create a 3D model of the original master mold. Computer-aided manufacturing (CAM) software enables the machining of a scanned model. The model of the master mold is machined out of tooling board then checked for deviation from the original mold with laser 3D scanning and CAD. Once the computer model is perfected, a new master mold is 3D printed using carbon fiber reinforced thermoplastics further refined with five-axis machining. A three-piece mold will replace the current silicon mold, and carbon fiber ply geometry is simulated in CAD to help increase the quality of the finished mascot head. Purdue Pete's manufacturing process is now up to industry 4.0 specifications to modify design elements and mass manufacture.

Mentor(s):

Garam Kim, Aviation & Transportation Technology, Polytechnic Institute

College of Engineering

Computer-aided tree diameter, straightness, and volume computation

Author(s):

Hoang Tran, College of Science

Anshul Kulkarni, College of Engineering

Jessica Budde, College of Engineering

Xilai Dai, College of Engineering

Aaradhya Jajoo, College of Engineering

Sohan Pramanik, College of Engineering

Abhiram Saridena, College of Engineering

Abstract:

Forest inventory analysis is a labor intensive task involving manual measurements of individual trees, for which we previously developed a semi-automated system. Since then, we have experimented with using integrated inertial measurement units (IMU) for tree seperation. However, due to accumulated accelerometer drift, the system became unable to tell apart trees reliably after 20+ meters. We eventually found that a combination of frame-based tree detection and on-the-fly user-made corrections was a better solution. Additionally, we have experimented with computing tree diameter using still depth images rather than depth videos. We were able to reduced the diameter measurements' root mean square error from 1+ cm to 0.73 cm when measuring trees from distance of 0.3 meters by eliminating motion-induced pixel blurring. We have also expanded our system to allow for log volume computation. Utilizing diameter and straightness computation, we were able to compute trees' board feet using the Doyle Rule with an accuracy of 74%. However, we were unable to compute the volume accurately in certain cases where the trunk extended beyond the camera's vertical FOV. Finally, we looked into constructing a custom stereo depth camera in order to better suit the needs of forest inventory analysis compared to a more generic depth camera. Using a Raspberry Pi combined with two Arducam modules, we can achieve an object space resolution of 0.6mm, half than that of our current system. In the future, we plan to explore how different camera setups affect measurment accuracy and alternative volume computation methods.

Mentor(s):

Goufan Shao, Forestry & Natural Resources, College of Agriculture

Keith Woeste, USDA Forest Service Hardwood Tree Improvement and Regeneration Center (HTIRC) at Purdue

Song Zhang, Purdue University

College of Engineering

Thruputer - Emulator and Compiler Prototyping

Author(s):

Minh Tran, College of Engineering

Matthew Kraynik, College of Engineering

Raymond Ngo, College of Engineering

Christopher Priebe, College of Engineering

Chase Lacoursiere, College of Engineering

Tomas Kolar, College of Engineering

Chris Morrison, College of Engineering

Abstract:

In the recent years, the surge of studies in machine learning and data analysis has created a lot of demand for hardware acceleration to have better run time. ThruPuter (TP) is a Dynamically Programmable Logic Element (DPLE) designed with the intention to support those software systems. Its application is somewhat similar to a Field Programmable Gate Array (FPGA), a type of Integrated Circuit that is often used by hardware designers to verify their designed hardware, except TP consumes lower power and is a significantly faster replacement of FPGA logic for said hardware acceleration application in general and existing software models in specific. TPs are operated together creating an array of DPLEs called ThruPuter system. This system is designed around an Instruction Set Architecture (ISA) called Very Large Instruction Word (VLIW) in which each instruction can operate up to 4 data moves and 2 data operations per clock cycle in comparison to 1 data move and 1 data operation per clock cycle in modern standard ISAs.

The team is divided into 2 subgroups: Compiler and Microarchitecture. Compiler team is tasked with compiling a programming language (C for example) to VLIW that TP supports. The microarchitecture team is responsible to create a hardware emulation of TP in C++.

Mentor(s):

Christopher Chiminski

Mark Johnson, Purdue University

David Meyhew, NVIDIA

Matthew Swabey, Purdue University

College of Health and Human Sciences

Effect of Cancer Therapies on Vascular Function in Tissue Associated with Metastases as measured by DCE- CT

Author(s):

Austin Trebley, College of Health & Human Sciences

Abstract:

The purpose of this study is to analyze the effects cancer therapies (drug and radiation) have on blood vessel vasculature and functionality in common metastatic organs using dynamic contrast-enhanced computed tomography (DCE-CT). In this study, athymic mouse models with a breast or pancreatic tumor was treated with either radiation or drug therapy (a VEGFR2 inhibitor). A sequence of computed tomographic images was acquired prior to and after injection of a contrast agent (DCE-CT) and taken before and after treatment. Utilizing computer programs and mathematical models, information about how the contrast is flowing through the blood vessels can be extracted to take a closer look at the functionality of the blood vessels of organs commonly associated with metastases. The functionality of the blood vasculature system is quantified by analyzing the perfusion, permeability, fractional plasma volume, and fractional interstitial space of the blood vessels. Preliminary results show some changes in varying parameters depending on the organ and what kind of treatment was performed. Radiation-treated mice showed a significant decrease in perfusion in the lung and significant changes in the permeability and fractional plasma volume in the liver. Drug-treated mice showed modest changes in the liver but no significant changes (potential trends). These results are only seen as preliminary results as the quality of these fits are currently being evaluated. Determining and predicting changes in blood vessel functionality can allow researchers and other professionals know how these cancer therapies are affecting normal tissue physiology and potential metastatic niches.

Mentor(s):

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

College of Agriculture

Analyzing the effects of high fat diet and circadian disruption on triacylglycerol concentration in milk and plasma of lactating mice using a colorimetric enzyme assay

Author(s):

Alicia Trujillo, College of Agriculture

Abstract:

In this study, we aimed to quantify the amount of triacylglycerols (TAGs) in the plasma and lactation day 12 milk of mice using a colorimetric enzyme assay to identify any effects of the study conditions of high fat diet and circadian disruption on TAG concentrations. We also utilized our findings to determine whether these effects on TAG concentrations could explain observed differences in neonate growth. This study measured the amount of triacylglycerols using an enzymatic treatment that removes the glycerol head from the fatty acid tails and converts it into dihydroxyacetone phosphate, using the additional hydrogen peroxide product to produce a violet color that can be detected at 530-550nm. This treatment was used on a 1:100 dilution of milk and a 1:2 dilution of plasma obtained from study mice. The mice in this study were subjected to either a high fat diet of 60% fat or control diet of 10% fat and placed under one of three lighting conditions: 12 hours dark and light with no circadian disruption, 5 lux of continuous light for low circadian disruption, and 100 lux of continuous light for high circadian disruption. Upon conclusion of the assay on milk, it was found that mice with the high fat diet had significantly lower and less variable amounts of triacylglycerols in their milk than the control diet mice. Mice under the high fat study conditions had average triacylglycerol concentration of 2081.96 mg/dL, standard deviation 799.35, while control diet mice exhibited average triacylglycerol concentrations of 8762.20 mg/dL with a standard deviation of 5735.23. Circadian disruption was not a significant factor in the amounts of triacylglycerols in milk. This study is ongoing, and results of the plasma assay are awaiting final analysis. The results of this study contribute to our overall understanding of how prenatal obesity and circadian disruption affect lactating mothers during pregnancy and postpartum. Maintaining an average body mass index prior to and throughout pregnancy can improve the nutritional value of milk with implications in both production industries and in postpartum care of infants.

Mentor(s):

Theresa Casey, Animal Sciences, College of Agriculture

Kelsey Teeple, Purdue University

College of Engineering

Redefining Computational Research in Nanotechnology Simulations: A New Approach on Data Caching and Analysis

Author(s):

Darin Tsai, College of Engineering

Aloysius Rebeiro, College of Engineering

Alan Zhang, College of Engineering

Abstract:

This study aims to implement database caching with modern GUI and increase the runtime efficiency of nanoHUB's 3D nanowire transport simulation. As this simulation is widely used globally by graduate students and independent researchers for their research in nanoscale transistors, efficiency and ease of use were emphasized in the study. This study involved three stages of implementation. A library in Python known as SimTools is first implemented to cache data into nanoHUB. If simulations with the same values were ran in the past, SimTools enables results to be fetched instantly, completely skipping simulation calculations that vary in the hours. The next step was to rewrite the entire script into Python 3 from legacy Python 2. By creating a simtool backend file and a front-end workflow file to replace the old XML and Rapture file, a large portion of code was rewritten into a more efficient and organized format, ensuring its compatibility with modern Python libraries. The use of modern libraries' displays, sliders, and data plots are much more open to configuration by the user to aid their research, allowing for more in-depth interaction with the actual simulation itself. Our study provides a solid basis for updating and reinstating other outdated simulations. With our in-depth documentation, we take a step forward to improving the world of online nanotechnology simulation.

Mentor(s):

Daniel Mejia, Network for Computational Nanotechnology, Discovery Park

Gerhard Klimeck, Purdue University

College of Engineering

Development of Software and Electronics for the Zero-G FEMTA Suborbital Flight Experiment

Author(s):

Jacob Valdez, College of Engineering

Evan Rittner, College of Engineering

Joseph Kawiecki, College of Engineering

Abstract:

The Film Evaporation MEMS Tunable Array (FEMTA) is a novel micropropulsion device for small satellite attitude control that uses ultra-pure deionized water as a propellant. In a 2023 suborbital flight test, two experiments testing FEMTA functionality will be conducted aboard a Blue Origin New Shepard rocket. These include a Propellant Management Experiment (PME) to demonstrate a vapor pressure driven pump for propellant delivery in zero-G and a thruster experiment to demonstrate the micropropulsion operation in space. Software and electronic development currently include revamping the flight computer to control both experiments during the flight. The existing software requires several additions, including a data-smoothing algorithm and a smarter decision-making algorithm. The physical board is undergoing its fourth and final design cycle, with minor improvements based on test results and as launch requirements change.

The flight computer software consists of a custom scripting language called Exp built with a C backend. While Exp greatly simplifies sensor interfacing and testing, the lack of convenient features limits its use cases. Implementing the above features to the custom scripting language will ensure the proper operation of the flight computer relative to the rocket flight timeline. Concurrently, sensor verification is being completed with research focused on verifying the sensors with the fourth iteration of the flight computer. This includes testing and debugging to ensure accurate sensor measurements for values such as pressure and temperature. Once complete, all components will be integrated with the experiment engineering test unit for system operation environmental testing in a vacuum chamber.

Mentor(s):

Katherine Fowee Gasaway, Aeronautics & Astronautics, College of Engineering

Steven Pugia, Aeronautics & Astronautics, College of Engineering

Alina Alexeenko, Aeronautics & Astronautics, College of Engineering

Anthony Cofer, Aeronautics & Astronautics, College of Engineering

Honors College

De novo design of a SARS-CoV-2 spike binder protein using a multiplayer online game

Author(s):

Kyle VandeWalle, College of Science

Abstract:

SARS-CoV-2, the virus that causes COVID-19, infects human cells by using a spike protein that attaches to the ACE2 receptor on the cell. A binder protein could be designed that attaches to the spike protein, preventing its binding to ACE2. Designing novel proteins requires finding an amino acid sequence that will fold into the desired structure, of which there are exponentially many. We used the protein design software Foldit to determine the lowest-energy conformation for an amino acid sequence that could bind to the SARS-CoV-2 spike protein's receptor binder domain (RBD) with a higher affinity than ACE2. Predicting protein structures from scratch is computationally challenging for computers because there are an exponential number of plausible conformations for each amino acid sequence. Therefore, we used the online program Foldit, which combines the powers of protein prediction algorithms with human spatial-visual skills, to design a novel binder protein. Starting from two alpha-helices of the ACE2 enzyme, which have the most interaction with the spike protein's RBD, the position of the binder protein and its sidechains were modified, proving effective early on by creating more hydrogen bonds between the binder protein and the SARS-CoV-2 spike protein. The two alpha-helices were maintained during the design process, but the residues were modified to contain hydrophilic sidechains sticking out and a hydrophobic core near the spike. The alpha-helices were also oriented to create additional hydrogen bonds between the spike and the binder protein. By making these changes, the Rosetta energy of the protein rose over 13000.

Mentor(s):

Zahra Tehrani, Honors College

Poster Presentation Abstract Number: 430 :: Life Sciences

College of Health and Human Sciences

Trends of pesticide-related poisonings in the past 20 years in the United States

Author(s):

Brittney Vetter, College of Health & Human Sciences

Abstract:

Pesticides have been used in the United States since the 1940s. Pesticide use can result in acute poisoning, but the trends are not well described. The objective of this research is to describe the trend of pesticide-related poison control calls in the past 20 years, comparing pesticide class and demographics of the population affected. The American Association of Poison Control Centers (AAPC) collects data from each poison control center call in the United States. Data for 2000-2020 were abstracted for this project. Descriptive statistics were calculated for 2000-2020 and per year; trends over time were also assessed. Pyrethroid class pesticides had the highest number of average calls per year (mean = 19854, standard deviation = 3586) followed by warfarin-type anticoagulant pesticides (often used in rat poison) (10665; 4738). Even though pyrethroid pesticides had the highest number of calls over the entire period, there was a substantial decrease in pyrethroid-related calls since 2000. Calls related to pyrethroid class pesticides have increased since the 2000s but showed a slow decrease in 2019. Other pesticide classes associated with a high number of poison control center calls include organophosphates (7437; 3370), pyrethrins (5379; 661), and carbamates (2117; 763). This analysis suggests that certain pesticide classes should be evaluated further for acute poisoning. A limitation of the data are that the AAPCC data relies on self-reporting, creating the possibility of bias. Due to this drawback, larger studies with more ascertainment are recommended.

Mentor(s):

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

College of Health and Human Sciences

Chronic conditions and mortality: Moderation by self-rated health

Author(s):

Lauren Voss, College of Health & Human Sciences

Abstract:

Chronic conditions become more common with age and greater numbers and severity of chronic conditions, in turn, increase the risk of mortality. However, individuals with similar disease burden often have different mortality rates. The purpose of the present study is to examine potential explanations for divergent mortality outcomes. Self-rated health (SRH), or perceptions of one's own health, consistently predicts mortality. Thus, we hypothesized that participants' SRH would modify the association between chronic conditions and mortality. Data were from the second wave of the Midlife in the US (MIDUS study, N=5,524). Mortality data were collected through 2018. Chronic conditions were measured in two different ways. To assess disease severity, each chronic condition was weighted by its propensity to cause disability; these were then summed. The second was a count of chronic conditions, a common measure in many studies. SRH was measured on a scale of 1-5 (1 = poor, 5 = excellent). Results from logistic regression models showed probability of mortality increased significantly with greater disease burden (measured both as counts and severity of conditions) and decreased with higher ratings of SRH. Importantly, compared to lower ratings, higher ratings on SRH were associated with lower probability of mortality at the same levels of disease severity. In fact, participants who rated their health as excellent showed no increase in probability of mortality with increasing number or severity of conditions. Overall, this study suggests that even in the context of chronic diseases, positive perceptions of health predict greater longevity.

Mentor(s):

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

Elizabeth Teas, Purdue University

Poster Presentation Abstract Number: 432 :: Life Sciences

Purdue Polytechnic Institute

Should you tip or not?

Author(s):

Ethan Wakal, Polytechnic Institute

Abstract:

The question of whether or not someone should have to leave a tip or not, has always been a popular question around the world. A tip, also known as gratuity, is a sum of money given by a customer to certain workers for the service that they have performed, in addition to what the customer has already paid. In the United States, tipping is not usually mandatory for a customer, but everyone has their opinion on whether you should have to tip. The goal is not to make the reader of this move in one direction or the other, but to help to give the reader a stronger opinion on how they feel about whether tipping should be mandatory or not. So, how do people feel about leaving tips? YouGov developed a survey to be taken by 1292 adults ages 18 and up. This survey was named "Tipping Gratuity America Survey", and it was taken from November 6th to 7th of 2019. These adults were then asked to take the online interview survey, in which they had to answer questions about tipping etiquette and the way they tip. This research will explore data from the year 2019, Tipping Gratuity America Survey to answer the questions of whether customers feel more compelled to tip for different services and what the impact of COVID-19 had on tipping.

Mentor(s):

Vetria Byrd, Computer Graphics Technology, Polytechnic Institute

Poster Presentation Abstract Number: 433 :: Physical Sciences

College of Science

Groundwater Flow Processes Inferred from Springs in the Colca Canyon, Peru

Author(s):

Andrew Wanstall, College of Science

Abstract:

Groundwater flow processes in the upper and middle reaches of the Colca Canyon, Peru remain poorly quantified, yet this information is critical to the semiarid region. Districts in the region are heavily dependent upon surface flow from the Rio Colca and groundwater from springs to support needs for potable water, agriculture, and tourism. Residents observed that springs emerging in the northeastern portion of the study area are desiccating, while springs in the southwestern portion are not. Here, we seek to quantify why these changes are occurring. Purdue University students sampled 15 springs in Maca and Yangue (southwestern portion) and Callali (northeastern portion) in 2019 for a variety of chemical data. Southwestern springs tend to be more geochemically evolved. Chalcedony geothermometry showed these springs are supported by deeper flow paths. This inference was supported by seismicity patterns in the regions. A two end-member stable isotope mixing model showed that southwestern springs are primarily recharged by an isotopically light source of water resembling snow and glacier melt. In comparison, northeastern springs are recharged primarily from snow and rain, and do not appear to be supported by deep groundwater flow paths. We infer that deep circulation in the southwestern region is enhanced by tectonic activity. Springs are less responsive to both seasonal variations in precipitation and recharge and longer time scale changes associated with climate change. The northeastern springs are more responsive to these variations, and more likely to desiccate. These findings have implications for long-term sustainability of water resources in the region.

Mentor(s):

Marty Frisbee, Earth, Atmospheric, and Planetary Sciences, College of Science

College of Science

Labeling Glycolytic Endogenous Enzymes with ORANGE to Determine how Glycolysis Provides Metabolic Support for Synaptic Function

Author(s):

Alexandra Ware, College of Science

Abstract:

Synaptic dysfunction is an early hallmark of neurodegeneration. Glycolysis acts as metabolic support for this process. Subcellular clustering of glycolytic enzymes into a metabolon has enhanced ATP production in bacterial and cell-free systems.

It remains unclear if glycolytic metabolons form in firing nerve terminals to synthesize ATP on-demand. Previously, investigation into regulation of glycolysis in nerve terminals was hindered by small dimensions and a lack of tools for labeling endogenous enzymes. To overcome these barriers, our goal is to apply super-resolution microscopy (live STORM imaging) to localize glycolytic proteins within terminals. This technique relies on the expression of specific fluorophores, however, overexpression of tagged enzymes could cause mislocalization.

To label endogenous glycolytic enzymes, we leveraged ORANGE, a CRISPR/Cas9-method for genomic integration of epitope tags in post-mitotic neurons. Here, we provide proof-of-concept for insertion of a GFP tag in the endogenous genomic locus of the glycolytic enzyme, aldolase-A, in dissociated hippocampal neurons. We utilized an ORANGE CRISPR/Cas9 knock-in template vector pOrange containing Cas9, a U-6 driven expression cassette for gRNA, a donor sequence containing GFP, gRNA, and PAM sites for genomic integration.

We constructed the plasmid through standard cloning using gRNA sequences from the target genes and delivered to primary cortical neurons via transfection. Immunostaining with anti-GFP antibody revealed successful integration and expression of the GFP tag. Later, fluorophores compatible with STORM imaging will replace GFP to facilitate subcellular localization of endogenous glycolytic enzymes. Ultimately, this work will determine how compartmentalization of glycolysis provides metabolic support for synaptic function.

Mentor(s):

Ghazaleh Ashrafi

College of Health and Human Sciences

Heterocyclic aromatic amines induce aggregation of alpha-synuclein in SH-SY5Y Cells

Author(s):

Hannah Welp, College of Science

Abstract:

Heterocyclic aromatic amines (HAAs) are toxins formed during high-temperature meat cooking. HAAs are created in a heat-dependent reaction between amino acids, sugars, and creatine. PhIP (2-amino-1-methyl-6-phenylimidazo[4,5-b] pyridine) has been extensively studied and the most abundant HAA in most meats. HAAs can cause cancers in the breast, colon, liver, and many other organs. Currently, the role of HAAs in neurodegenerative diseases is being studied. Our lab has shown that PhIP can produce dopaminergic and cholinergic neurotoxicity of potential relevance to Parkinson's diseases (PD) and Alzheimer's diseases (AD), highlighting known mechanistic and neuropathological overlaps between these diseases. In the present study, we tested the hypothesis that PhIP would promote aggregation of alpha-synuclein, a protein that aggregates in PD. Galactose-supplemented human SH-SY5Y neuroblastoma cells were used for the study. SH-SY5Y cells were transduced with adenovirus containing the construct α-synuclein-mvenus. After 48 hours, the cells were treated with PhIP for 24 hours. Preliminary data indicates that HAAs increased aggregation and phosphorylation of alpha-synuclein in SH-SY5Y cells. Our study indicates that HAAs increased aggregation of alpha-synuclein in SH-SY5Y cells by promoting phosphorylation of alpha-synuclein/ For future studies we will be testing whether neuromelanin ameliorates HAA induced aggregation of alpha-synuclein. Collectively, out study suggests a potential link between HAAs and alpha-synuclein pathology in PD.

Mentor(s):

Tauqeerunnisa begum Syeda, Health Sciences, College of Health & Human Sciences

Jason Cannon, Purdue University

Poster Presentation Abstract Number: 436 :: Life Sciences

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College of Engineering

An Analysis and Annotation of PhiRho Genes 4 - 48

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Author(s):

Logan Williams, College of Engineering

Daniela Alvarez, College of Engineering

Samuel Spence, College of Engineering

Abstract:

In partnership with the SEA-PHAGES program, undergraduates at Purdue discover and annotate the genomes of new bacteriophages. Bacteriophages, which will be labeled phages from now on, are viruses that infect bacteria and use them to reproduce. Due to a general lack of research, there is a lack of understanding when it comes to how various phages interact with their surroundings, along with how they function. To help correct this, this group was assigned genes 4 to 48 of the phage PhiRho to analyze and annotate.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Abigail Ekeigwe, Purdue University

Lauren Novak, Purdue University

Taylor Sorrell, Purdue University

College of Engineering

Dashboard Implementation Design and Visualization for Home Health Nursing Administrators

Author(s):

Mitchell Witt, College of Science

Miranda Chai, College of Science

Aidan Anastario, College of Engineering

Hanna Ertel,

Jack Knox,

Jay Kee,

Kaushik Karthik,

Abstract:

The purpose of this project is to assist the home health industry by providing administrators an easier method of monitoring their nurses. The home health industry serves to assist patients with specific needs when the best course of action does not include attending the emergency room. Specialized and equipped nurses attend these patients at their homes several times a week, for a certain period of time until these patients are equipped enough to live on their own. Oftentimes however, this system becomes unorganized and can lead to an inefficient allocation of nurses and supplies, which is the challenge that our team is attempting to solve. To attack this issue, we are first using UI Design techniques and software in order to design and implement a website that will allow the nurses' administrators to monitor these nurses effectively, as well as possessing numerous other functionalities such as a mapping, messaging, and scheduling system. This is to be designed using Dash Python, and on the backend the data will be stored using Google Firebase. The map system will use a Google Map API, and the messaging will consist of SMS. Ultimately, this project will have lasting implications for the home health industry, allowing these incredible nurses to spend their time more efficiently, and having more people in need be helped more effectively.

Mentor(s):

Nan Kong, Biomedical Engineering, College of Engineering

Nicole Adams, Purdue University

College of Engineering

Hybrid Shielding Materials and Radiation Effects on Electronics

Author(s):

Elliot Wong, College of Engineering

Abstract:

Increasing space exploration and operations necessitate improved radiation shielding for equipment and personnel safety. Electronic devices are key to a successful mission and can experience failures in space due to ionizing radiation originating from the three primary sources including the Van Allen Radiation Belts, solar particle events from solar flares, and galactic cosmic rays (GCR), which are the strongest and most damaging source. Regardless of the source, radiation can penetrate materials and just one charged particle can damage a semiconductor, making proper shielding critical to ensure electronics reliability.

The current study uses the Monte Carlo simulation tool, "Stopping and Range of Ions in Matter" (SRIM/TRIM), to assess various material's effectiveness of shielding 100% 1-GeV hydrogen ions with a particle rate of 10,000 (m-2s-1). A moderate two-layer shield can be made by selecting a dense material like tungsten as an outer layer to considerably reduce the ionizing energy and a light material like aluminum as an inner layer to absorb the remaining energy. This composite shield is 12.8% lighter than tungsten-only and 48% thinner than aluminum-only. An even lighter shield can be made using a light/light material combination but sacrificing thickness. Compared with tungsten/aluminum, an iron (III) oxide/graphite shield is 30% lighter although twice as thick.

A two-layer material implementation is found to be a feasible solution for protecting electronics from ionizing space radiation and outer/inner-layer material selection and sequence is important to making an optimal weight and size shield.

Mentor(s):

Peter Bermel, Electrical & Computer Engineering, College of Engineering

Allen Garner, Purdue University

College of Science

Using DNN to study SUSY model

Author(s):

Ming Yuan Adrian Wong, College of Science

Ivan Yang, College of Science

Gabriel Skowronek, College of Science

Ricardo Xie, College of Engineering

Abstract:

The purpose of this study is to use deep neural networks (DNN) to classify particle collider events depending on whether they can be explained by the Standard Model(SM) of Particle Physics or not. The Standard Model has been successful in predicting the existence of various subatomic particles and their interactions; however, it fails to explain dark matter, mass of Higgs boson, and mass of neutrinos. Super Symmetry (SUSY) is a proposed extension to the Standard Model which predicts that each standard model particle has a supersymmetric counterpart, doubling the total particle count. Theoretical calculations predict a statistically significant difference in the distributions of angular variables between hadron jets produced during SM and SUSY events. We use tensorflow software package to train the neural networks. We opt to fine tune the hyperparameters of the model to increase prediction accuracy, such as learning rate, activation function, and the depth and width of the neural network. SUSY has not been experimentally detected until now, so an accurate neural network to distinguish SUSY events from SM events using the experimental data is of great use. Once we are able to verify that the occurrence rate of collisions matches with our SUSY prediction, we can provide solid proofs to support the model. Our study and effort could pave the way toward the next big discovery in the Physics world.

Mentor(s):

Abraham Koshy, Physics & Astronomy, College of Science

Andreas Jung, Purdue University

College of Science

The onset of depressive like symptoms relating to glucose dysregulation

Author(s):

Courtney Woodruff, College of Science

Abstract:

Type 2 diabetes and major depressive disorder are highly comorbid. Data demonstrate shared pathways in the development of both and suggest common underlying mechanisms that occur with glucose dysregulation in the pre-diabetic state. The goal of this study was to identify when diet-induced glucose dysregulation begins and its early influences on depressive-like behaviors (DLB). A high fat high sugar (HFHS) diet was used to induce glucose dysregulation. Adult rats were divided into 2 weight-matched dietary groups: laboratory chow or HFHS and chow. Prior to gaining access to the diets, baseline fasting glucose levels and DLB were assessed. DLB was assessed through the forced swim test (FST), which models despair. Rats had ad libitum access to their assigned diets. Their food intake and body weight were recorded daily, and fasting glucose levels were measured weekly. When fasting glucose levels showed differences between dietary groups, the rats underwent weekly FST. Glucose levels were not consistently different, and FST results did not vary significantly between diet groups. The baseline $R2$ value and experimental $R2$ value indicated little correlation between fasting glucose levels and DLB. This is likely due to low levels of fasting glucose. Future studies will include combining chow with the HFHS diet rather than providing access to only one diet, which may induce glucose dysregulation more profoundly, after which DLB could be assessed. Understanding the progression of the connection between DLB and glucose dysregulation will increase understanding of these conditions and how to treat them.

Mentor(s):

Kimberly Kinzig, Psychological Sciences, College of Health & Human Sciences

College of Engineering

Probabilistic Computing for NP Problems and Parallelization

Author(s):

Zhengxiang Xie, College of Engineering

Abstract:

Over the past half century, the extreme miniaturization of transistors has enabled us to go from room-sized computers to today's smartphones. As we now approach some fundamental size limits, we are at risk that without additional innovations, classical computing capabilities will start to plateau. One approach is artificial intelligence to accelerate and streamline data analysis. Another approach is quantum computing, which theoretically can be hundreds of millions of times faster than today's fastest supercomputer, but also requires extreme conditions that may be challenging to satisfy. Our study focuses on a computing paradigm that combines the advantages of the two, called probabilistic computing, which relies on the probabilistic bits built with unstable magnets. Last semester, we showcased the wide range of problems p-bits computing can solve with high efficiency. This semester, we present two new research thrusts. First, we show that probabilistic computing can be used to solve additional NP-hard problems. Second, we explore possibilities to migrate the parallelized algorithm from classical computing that can execute multiple sub-tasks simultaneously. This could help further decrease the amount of time needed for solving problems and pave the way for future applications of p-bit computing. In this presentation, we will explain the principles of probabilistic computing, show our initial discoveries on parallelization, explain our expectations for performance, and finally the results of our new test problems.

Mentor(s):

Peter Bermel, Electrical & Computer Engineering, College of Engineering

College of Health and Human Sciences

Hunting(ton) for the Correct Differentiation: The Validation of a Striatal GABAergic Differentiation Protocol

Author(s):

David Yi, College of Health & Human Sciences

Lunden Friberg, College of Health & Human Sciences

Abstract:

Huntington's disease (HD) is an autosomal, dominant, neurodegenerative disorder caused by an expansion of the polyglutamine (CAG) repeat in the Huntingtin gene. Its neuropathology is characterized by the decline of the neural striatum, prominently affecting medium spiny neurons (MSN)—the cell that represents 95% of neurons in the striatum. The origins of this selective vulnerability remain unknown. Human induced pluripotent stem cell (hiPSC)-derived MSN cultures represent a powerful tool to study HD pathology and personalized medicine. In this MSN differentiation protocol, both Wnt pathway inhibitor DKK-1 and the ventralizing morphogen SHH agonist purmorphamine were added from day 2 to day 31. The neurogenic factors BDNF, GDNF, cAMP, and IGF1 were used in media formulations from day 15 onwards. To validate the efficacy of this protocol, gene expression profiles of the MSNs were compared to those of hiPSC-derived cortical glutamatergic neurons, floorplate dopaminergic neurons, and pancreatic islet cells. Each lineage was derived from two healthy control cell lines and two HD patient cell lines. Gene expression profiling was accomplished by characterizing cells in culture via reverse transcription quantitative polymerase chain reaction (RT-qPCR). This study attempts to reproduce a previous publication's differentiation protocol to generate hiPSC-derived striatal GABAergic MSNs to model a genetic neurodegenerative disorder in vitro.

Mentor(s):

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

Hyunjin Kim, Purdue University

Poster Presentation Abstract Number: 500 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Nutrition Label Image Data Extraction

Author(s):

Adhil Akbar, College of Engineering

Rohan Joshi, College of Engineering

Adam Piaseczny, College of Engineering

Jingyuan Liu, College of Science

Aarini Panzade, College of Science

Jiarui Xie, College of Science

Abstract:

The purpose of our project is to develop an android application that utilizes image-based machine learning to positively help impact an individual's health. A healthy diet is essential for a good healthy lifestyle and helps protect against many chronic non-communicable diseases. The application we are creating, will allow users to set a health goal and take a photograph of a nutrition label. After doing so, the image will be uploaded to a Purdue based server, where an image-based machine learning algorithm will be used to extract the data from the label. This extraction will make use of image segmentation, cropping and a variety of pixel manipulation algorithms. The data extracted will consist of key nutritional information such as calories, fats, cholesterol, sodium, etc. This data will then be analyzed and measured using a health check algorithm to determine if the selected food is healthy for the user based on their goal. The Harris-Benedict formula and Mayo Clinic health guidelines will be incorporated within this algorithm. After determining this, the user will be notified whether the item they scanned is healthy for them. In a time when the population is plagued by diseases such as cancer, diabetes, and heart disease, we hope that this application can help individuals lead a healthier lifestyle.

Mentor(s):

Carla Zoltowski, Electrical & Computer Engineering, College of Engineering

Edward Delp, Purdue University

Poster Presentation Abstract Number: 501 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Simulating Thermal Tuning Efficiency of Etched vs Non-Etched Integrated Silicon Photonic Heaters

Author(s):

Fahad Aloufi, College of Engineering

Alice Dragnea, College of Engineering

Abigail Roy, School of Management

Abstract:

Silicon photonics involves creating photonic circuits on a high-purity silicon wafer fabricated in a Complementary Metal Oxide Semiconductor (CMOS) facility. Today, silicon photonic devices are regularly used, most notably in data centers for short-reach high-bandwidth interconnect applications. Unlike CMOS electronics, silicon photonic devices use light as the information carrier. It is common for silicon photonic devices to have fabrication imperfections that are often corrected by the addition of thermal heaters. However, thermal heaters are generally power-hungry, and it is difficult to localize their effect on the chip; thus, thermal crosstalk is a significant challenge in scaling up the silicon photonics platform. Here, we investigate the use of integrated thermal heaters that seek to keep the temperature changes localized on the chip and reduce the necessary applied electrical power. Specifically, we are examining the use of etched heater geometries having air trenches, instead of the silicon dioxide cladding, to isolate the generated heat. Simulations of this geometry and comparisons with non-etched structures will be performed in Lumerical's Heat Solver to examine the thermal tuning efficiency of these geometries. This thermal tuning efficiency is usually measured in mW/FSR which is the amount of power needed to shift the phase of the light by one full optical cycle, or a 2π phase shift. Subsequent simulations will then be performed with Lumerical's MODE solver to examine the effects of these heater geometries on the induced optical losses in the silicon waveguide.

Mentor(s):

Lucas Cohen, Electrical & Computer Engineering, College of Engineering

Andrew Weiner, Purdue

College of Science

Investigation of Sequential Post-Translational Modifications in Photosynthetic Cyanobacteria Cyanothece 51142

Author(s):

Lauren Anderson, College of Science

Abstract:

Cyanothece 51142 is a unicellular photosynthetic organism in the cyanobacteria phylum with unique metabolic attributes that allow them to adapt to varying environments. These bacteria have attracted attention from researchers due to their unique ability to temporally separate photosynthesis during the day and nitrogen (N2) fixation during the night within a single cell. Understanding molecular mechanisms that enable them to perform these incompatible biological processes is important to engineer them for renewable energy sources. Many proteins involved in these processes function through post-translational modifications (PTMs) and protein-protein interactions. However, such information is very limited in cyanobacteria, particularly in Cyanothece. Expressed proteins can form complexes within metabolic pathways, which may indicate their ability to survive in altered environments. Our group has recently mapped ~1,300 Cyanothece 51142 proteins, with ~800 being putative complexes. The amounts of proteins undergoing post translational modifications and how such modifications impact protein complex formation are still being investigated. Simultaneous phosphorylation and N-glycosylation may permit an assessment of the potential for cross-talk between these two vital PTMs and their roles in cellular regulation. In this study, we were interested in developing a method that allows sequential purification of protein phosphorylation and N-glycosylation in Cyanothece 51142 at the same time. Cultures were grown for 5 and 12 days under N2 non-fixing conditions (medium containing nitrate). Cells were lysed for protein extraction and digested into peptides using trypsin and LysC proteases before purification of phosphorylated peptides using the PolyMAC Phosphopeptide Enrichment Kit and N-glycosylated peptides using Glycoprotein Enrichment Resin. Peptides were subsequently analyzed using LC-MS/MS. In both 5 and 12 day sample sets, we identified 38 proteins that underwent glycosylation as determined by deamination sites, and 23 proteins that underwent phosphorylation as determined by phospho STY sites. Only 9 proteins were found to undergo both phosphorylation and glycosylation. Modified proteins were identified to be involved in the regulation and maintenance of photosynthesis and central metabolism, specifically proteins cpcA, cpcB, and cpcG1 which are proteins within the phycobilisome, a light-harvesting antenna protein complex. It is likely that these antenna proteins need to undergo both modifications and to facilitate photosynthesis. Future studies will further optimize enrichment methods and focus to investigate the cross-talks and interdependency between these two important PTMs.

Mentor(s):

Uma Aryal, Faculty, Purdue University

Rodrigo Mohallem, Purdue University

Purdue Polytechnic Institute

Functional Analysis and Genomic Study of YemiJoy2021 Mycobacteriophage Histidine Triad Nucleotide Binding Protein Gene

Author(s):

Brianna Arinze, College of Pharmacy

Arya Shembekar, College of Science

Rajesh Balasamy, College of Engineering

Abstract:

The histidine triad nucleotide binding protein is part of the histidine triad (HIT) superfamily, which has recently been found to contain signal relaying properties and may act as tumor suppressors. The histone triad nucleotide binding protein may also be involved in programmed cell death by binding and hydrolyzing certain nucleotides. In the mycobacteriophage YemiJoy2021, we have identified this as the function of the gene starting at 6,280 bp. Mycobacteriophages are a type of virus found in mycobacterium hosts. Mycobacterium YemiJoy2021 with host Mycobacterium smegmatis mc2155 was isolated from a soil sample on Purdue University grounds in September 2021. This mycobacteriophage has a lytic life cycle and is apart of the myoviridae morphotype. Procedures such as serial dilutions, titer and amplification, transmission electron microscopy (TEM), and DNA isolation were implemented in the Fall of 2021 to isolate, characterize, and purify the phages DNA in order to prepare it for Illumina DNA sequencing at the Pittsburgh Bacteriophage Institute.

The ABE 227 class was tasked with archiving, sequencing, and annotating these genes in order to determine their function. We were assigned genes 4-48 of YemiJoy2021 to annotate and call using various bioinformatics tools such as, DNAMaster, Phamerator, NCBI BLAST, GeneMark, and PECAAN. In this project, we plan to further analyze this gene through mutational analysis, protein folding, and phylogeny research. Upon analysis through these methods, we expect to see minimal mutations when comparing it to phages with high BLAST results, have a better understanding of genomically related phages, and possible active sites.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Honors College

Classroom Seating Choices

Author(s):

Mae Artang, College of Engineering

Dale Morris, Exploratory Studies

Abstract:

The arrangement of students in lecture halls have been studied extensively from their academic performance, to the social groups that they form. Understanding how and why students select which seat they do helps to understand the various ways that humans approach learning and what can affect that process. The purpose of this research is to observe general trends in how students arrange themselves in a lecture hall. Six lectures belonging to two separate courses were observed throughout the week of February the 14th, 2022. In each class, attendance was recorded by hand on a paper map of the hall. Students were found to be 61.07% more likely to sit in the front half of the classroom and 36.77% more likely to select a seat closer to an aisle. Therefore, students prefer to sit in the front of the classroom, closer to the lecturer, and closer to the aisles of the seating.

Mentor(s):

Sarah Huber, Libraries

Thom Gerrish, Purdue University

Tom St. Pere, Purdue University

Honors College

De novo design of minibinder protein to SARS-CoV-2 spike receptor binding domain

Author(s):

Maansi Asthana, College of Engineering

Abstract:

It has quickly become an immediate need to develop therapeutic interventions to prevent the infection of SARS-CoV-2. Previous studies have characterized the SARS-CoV-2 spike protein receptor binding domain (RBD) to bind directly to the angiotensin-converting enzyme 2 (ACE2) receptor to enter the host cell. This interaction has demonstrated that targeting the spike protein RBD can effectively occupy the spike protein RBD and thus inhibit its interaction with ACE2 receptor, thus evading host cell entry and infection entirely. Computational protein modeling can be conducted to design a de novo protein that can securely bind to the spike RBD. While artificial intelligence algorithms are often used to design de novo proteins in these cases, the machine-learning algorithms still lack the spatial reasoning and analysis that humans possess. In this study, a novel spike RBD binder protein was designed using FoldIt to out-compete the ACE2 affinity, a protein design program. FoldIt has an intergraded point system, which was used to benchmark the de novo binder protein folding stability. A score greater than 13,500 was targeted to optimize protein folding. The binder protein designed has increased stability with the addition of variable secondary structures. Additionally, R-groups were intentionally selected for stable tertiary interactions, including seven to eight hydrogen bonds and 4 disulfide bonds. This novel design can now be developed molecularly to function as an antiviral treatment for those infected with SARS-CoV-2.

Mentor(s):

Zahra Tehrani, Honors College

College of Engineering

Characterizing Features of Genes with No Known Function in Bacteriophage JimJam

Author(s):

Jason Barahona Rosales, College of Engineering

Lily Kabat, College of Engineering

Rebecca Mold, College of Engineering

Abstract:

As genetic engineering technology continues to develop, scientific interest in bacteriophages grows. These bacteria hunting viruses have many synthetic biology applications in fighting antibiotic resistant bacteria, preserving food safety, supporting water treatment, and more. As a part of the Howard Hughes Medical Institute's SEA-PHAGES (Science Education Alliance - Phage Hunters Advancing Genomics and Evolutionary Sciences) program, bioinformatics tools were used to analyze various genes from novel bacteriophage JimJam. By investigating genes with no known annotated function (NKF), and comparing them with genes with known functions, a better qualitative understanding can be developed of how NKF genes can be further investigated to determine their functions. First, various computer modeling programs were used to visualize the protein products of these genes. This allowed for comparison of their key structural features, including secondary structure, charge, and other interesting characteristics. This analysis can be used to support a known functional call and provide additional insights into unknown genes. A comparison of the types of mutations found in genes with known and unknown functions provided a better understanding of the evolutionary differences between the two types. The kinds of mutations found in known and NKF genes were notably different, indicating that there are differences in how their amino acid sequences change. Additionally, phylogenetic trees were created to predict the evolutionary relationships between the proteins investigated and similar proteins in other phages. This analysis allows for hypotheses about genetic changes to be developed, giving a fuller understanding of the proteins.

Mentor(s):

Kari Clase, Faculty, Purdue University

Taylor Sorrell, Purdue University

College of Science

Characterization of Neutrophil Subtypes and Their Response Towards Inflammation

Author(s):

Jennifer Beckman, College of Science

Abstract:

As the first responders to infection and injury in the immune system, neutrophils show functional plasticity to defend the host organism from harm. Neutrophils are the most abundant type of granulocytes, and they exist in heterogeneous populations with various levels of maturity and age. However, it is not very well understood how neutrophils of differing maturity respond to injury. Thus, the aim of this research project is to utilize the zebrafish model to determine how mature and immature neutrophils respond to primary inflammation and how emergency granulopoiesis affects the course of inflammation in secondary infection. In this project, the timer protein is used to indicate the maturity of neutrophils with the fluorescence going from green to red over a 24-hour period. Timer protein does not affect normal neutrophil function, so the fish are functionally like wild-type. Starting on day 2, neutrophils are produced, and overtime, the red fluorescence indicating maturity gets more intense, peaking at day 7. It is hypothesized the immature and mature neutrophils respond differently upon secondary infection due to the role of emergency granulopoiesis and priming. While utilizing a CuSO4 assay for neuroblast injury, it was discovered that neutrophils converged on the wound more quickly than they did without priming. However, it was found that emergency granulopoiesis does not guarantee a better survival rate for the fish. The next step is to perform RNA sequencing to determine differences in gene expression. These results will help us understand neutrophil response mechanisms and potential therapeutic applications for inflammatory diseases.

Mentor(s):

Ramizah Mohd Sabri, Biological Sciences, College of Science

Qing Deng, Purdue University Professor

Poster Presentation Abstract Number: 508 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

2022 IEEE Autonomous Unmanned Aerial Vehicles (UAV) Competition

Author(s):

Ranjan Behl, College of Engineering

Leonard Jung, College of Engineering

Sundhar Sangeetha, College of Engineering

Abstract:

A student university team sponsored by Purdue University UAV Research and Test Facility (PURT) is competing in the 2022 IEEE UAV Competition. The competition consists of tracking and following a mobile ground target using an unmanned aerial platform with a variety of sensors in a simulation and physical testing stage. The simulation portion of the competition consists of a simulated quadrotor and rover in a Gazebo-ROS environment. The hardware portion consists of physical testing in the PURT Hangar 6. The team has approached the problem with two main research thrusts. The first research thrust is utilizing the px4 avoidance package, specifically local planner with a custom object detection model, and having it run on an intel NUC. The main research contribution is an open source Robot Operating System (ROS) wrapper allowing for extension into robotics hardware utilizing the pose information. The second research thrust is integrating the open source Fast-Tracker algorithm with MAVROS and PX4 flight controller systems. The end result is a physical quadrotor platform with highly optimized Pose Estimation models running on the intel NUC in real-time and active control using the Pose information.

Mentor(s):

James Goppert, Aeronautics & Astronautics, College of Engineering

Riley Franklin, Purdue University

Arpit Amin, Purdue University

College of Engineering

Autonomous Motorsports Purdue

Author(s):

Nicolas Berlier,

Bazim Azeem,

Joshua Koshy,

Caitlin Heinowitz,

Mason Burgess,

Abstract:

Cars, the mode of travel for most people in the world. In most of the world, but especially in the US, it is hard to live a normal life without having a car. Basic needs such as going to work, going grocery shopping and visiting family members would be hard without having a car. However, cars contribute to ten of thousands of deaths and a third of the total US greenhouse gas emissions. Autonomy would be the way to help fix this issue. The end goal of the AMP team is to develop an electric autonomous formula one car to capture solutions to challenging problems in the real world. For now, AMP is trying to reach that end goal in parts. This leads to our part in helping them reach their end goal which is our project. The idea of our project is to change how libraries adapt and grow, with a process of refactoring that makes updating coding aspects faster and more up-to-date than ever before.. This fulfills our overlying goal, to present a safe future with autonomous electronics. Our team consists of four members of varying years. We hope to have an implementation that will benefit the AMP team in their quest for pure autonomy in racing and real world accessibility.

Mentor(s):

Aly El Gamal, Faculty, Purdue University

Shreya Ghosh, Purdue University

College of Engineering

Robotic Arm Implementation for Lunabotics

Author(s):

Jaden Beveridge, School of Management

Bora Kaya, School of Management

Wesam Sidani, School of Management

Dalton Webber, College of Engineering

Chris Pontious, School of Management

Abstract:

As a part of the Lunabotics team our group is a part of the robotic arm team. Throughout the semester we are continuously researching ways to implement a robotic arm on the robot for future use. Eventually NASA will change the requirements and require a robot arm to be used. It is my team's job to do the research now on the best way to go about this so when NASA comes out with a new set of rules and regulations, we are ready. So far, we have learned how the kinematics of this arm might work. We have been shown how these calculations might be found and which computer programs to use to find these values that we need. It is our job to report to the Lunabotics team and club our findings and our suggestions for future implements of a robotic arm. When we are researching ideas for the arm there are a few things we must keep in mind. First, we must consider where on the robot the arm will be added and what we might have to remove for the arm to be effective. Next, we have to consider the prices of each part of the arm, and we must make sure that the parts are affordable and reasonable. Third, we have to research how to create the arm. Our ideas and research now will allow the future teams of Lunabotics to have a strong start when implanting a robotic arm.

Mentor(s):

Prabhpreet Dhir, Aeronautics & Astronautics, College of Engineering

College of Agriculture

Analysis and Genomic Study of Mycobacteriophage Maby2021

Author(s):

Arka Bhattacharya, College of Engineering

Rhutuja Patil, College of Engineering

Joshua Grams, College of Pharmacy

Abstract:

Mycobacteriophages are viruses that infect bacterial hosts and use the host's systems to reproduce themselves. They have a close relationship with their hosts and provide deeper insights into the genetics and physiology of the mycobacteria. This course is a part of the SEA-PHAGES program and Maby2021 will be annotated and researched further in this course. Maby2021 with host Mycobacterium smegmatis mc²155 was isolated in Fall 2021. The research for this phage was further split up into three different projects. The Band-7-like membrane protein chosen by our team from Maby2021's genome to analyze further.

The Phylogeny project analyzes the different evolutionary relationships between protein sequences in different phages. After comparison of the phylogeny trees made from the programs of PhyML and Splitstree, it was concluded that phages from the C1 clusters have the strongest evolutionary relationship with a confidence level of 100%. The protein folding project examines the relationship between the structure and the function of bacteriophage proteins. PyMOL is used to identify the secondary structure, and/or the different components of the secondary structure of the protein. Furthermore, the Mutation analysis project consists of analyzing the mutations when two similar genes are compared. The phages FrayBell and Maby2021 from the C1 cluster were compared and it was found that there were more mutations present in the known function protein.

Every new phage that is found provides new information to the world. Thus, the overall goal is to annotate the entire Maby2021 genome and to understand the genes and what protein they code for using different bioinformatic software.

Mentor(s):

Lauren Novak, College of Engineering

Poster Presentation Abstract Number: 512 :: Life Sciences

College of Engineering

Analyzing the Function of a Gene in a Phage Genome: Using mutation analysis, protein structure, and phylogenetic information to draw conclusions

Author(s):

Caitlin Birthright, College of Science

Alyssa Klipsch, College of Engineering

Halle Von Ah, College of Engineering

Abstract:

Bacteriophages are biological organisms that infect and replicate within host bacteria cells. Bioinformatics programs can be used after the genome has been sequenced to determine gene properties and potential protein functions to add to the growing body of knowledge behind phages. In this project, protein structure, mutation analysis, and phylogenetic relationships were used to draw conclusions about the function PnuC-like Nicotinamide Riboside Transporter of the gene in the base pair range 136148-136450 in the Maby2021 phage genome. In order to compare the function of the gene to the overall structure of the gene, two programs, Phyre2 and PyMOL, were used. To understand the mutations for this gene, code was written to track the number of mutations, type of mutation, and the effect that the mutation had on that amino acid. To observe the evolutionary relationships between genes of clusters and phages, the programs phyML, SplitsTree, and MEGA were used to generate phylogenetic trees. Based on the results of the comparison between this gene's protein structure and another structure with the same function, the function determined is correct. The code allowed us to see different mutational relationships with different genes in the same cluster and that transitions were the more common mutations. Based on the resulting phylogenetic trees from the programs, interesting relationships within the cluster, between clusters, and with different proteins can be concluded. The information gained from the project above can be used to increase knowledge of phages as a whole and support potential applications in many areas.

Mentor(s):

Lauren Novak, College of Engineering

Taylor Sorrell, Purdue University

Abigail Ekeigwe, Purdue Univeristy

Yemi Oduniyi, Purdue Univeristy

Honors College

Usage of Silent and Collaborative Study Spaces: Observing Hourly, Daily, and Weekly Trends

Author(s):

Caitlin Birthright, College of Science

Amanda Pawlecki, College of Pharmacy

Benjamin Dierolf, College of Agriculture

Abstract:

A usage study measuring the occupancy of silent and collaborative spaces at a large university was conducted. The study sought to answer the research question: "How can the daily and weekly usage of silent study space compared to open, collaborative spaces provide insight into the type of study spaces that should be implemented at a large university?"

The study was conducted by recording occupancy in four spaces: two silent study spaces and two collaborative study spaces in two libraries at a large university. The total number of seats within each space and the number of seats occupied in each space was recorded three times throughout the day, 10:30am, 1:30 pm, and 5:00 pm, for one academic week, Monday through Friday.

The percent occupancy data for each location, time of day, and day of week was used to determine trends in the study preferences of college students. Trends show that the more updated, centrally located library had the highest percent occupancy overall. Inverse trends between the usage of the collaborative and silent spaces in each library were noted, with one library experiencing higher occupancy in the silent area while the other experienced higher occupancy in the collaborative area.

The trends observed in the study can be used to suggest future construction of study spaces on university campuses. Because the updated, centrally located library experienced greater occupancy in both the collaborative and silent spaces, universities should consider construction of new study locations with similar characteristics.

Mentor(s):

Sarah Huber, Libraries

Thomas Gerrish, Purdue University

College of Engineering

Phylogeny, Protein Folding, and Mutation Analysis of Bacteriophage JimJam

Author(s):

Maya Bjerke, College of Engineering

Zilin Xianyu, College of Engineering

Alessandro Paz Hernandez, College of Engineering

Abstract:

Today, bacteriophages occupy a majority of all organisms in the biosphere. However, phage genome characterization still has a very far way to go as they are one of the largest reservoirs of unexplored genes. This research will focus on the phylogeny, protein folding, and mutation analysis of the bacteriophage JimJam to further expand the knowledge available to the scientific community. Protein sequences were analyzed to observe the clustering of phage genetics among clusters B1, BE2, C1, and E. The programs PhylML tree and Splitstree were then used to predict the evolutionary relationships between phages in different clusters based on a specific protein. In order to observe the relationship between structure and function in the bacteriophage's proteins, visualization programs were used to predict the structure of a protein based on its amino acid sequence. Specific elements such as secondary structures, polar pockets, and hydrophobicity were identified that in turn helped develop patterns that explain and predict function. A code was then developed that can identify mutations when comparing two sequences of the same length. When comparing bacteriophage JimJam to other bacteriophage genomes, certain mutations were identified which add to genetic evolutionary patterns between soil environments where phages are discovered. Mutations with molecular relevance at the nucleotide level such as transitions and transversions were identified through this analysis along with mutations at the amino acid level with protein functionality significance. Although this research is currently ongoing, it will draw into sharper focus bacteriophages genetics as more aspects of the genome are analyzed.

Mentor(s):

Lauren Novak, College of Engineering

Abigail Ekeigwe, Purdue University

Taylor Sorrell, Purdue University

Yemi Oduniyi, Purdue University

College of Science

In Vivo Imaging of the Auditory Cortex

Author(s):

Alec Booth, College of Engineering

Abstract:

Advances in fluorescence microscopy utilize calcium imaging to record larger brain areas with finer time resolution. With appropriate techniques and analysis, large neuronal networks can be visualized to understand the basis of cognitive processing. In particular, the auditory cortex of the brain is a challenging area to study in this fashion due to its atypical location and orientation. The technological advancements in surgical procedure and imaging in my study provide a rare opportunity to look at the cortical dynamics of the auditory system in mice. In my study, structural images were obtained via an injection of viral GFP protein with subsequent in vivo two-photon Ca2+ imaging in awake mice. Also, through viral injections of GCaMP6s and tdTomato genetically-encoded fluorescent indicators, functional and structural images were obtained through in vivo two-photon Ca2+ imaging in the primary auditory cortex of awake mice. This presents a novel framework for functional and structural imaging of neuronal networks in the auditory cortex.

Mentor(s):

Laura Roa, Biomedical Engineering, College of Engineering

Krishna Jayant, Purdue University

College of Liberal Arts

Using Satellite Imagery to Monitor Heritage Sites in Conflict Areas

Author(s):

Grace Bowling, College of Science

Abstract:

This project aims to monitor archaeologically significant sites, including medieval and early modern churches, mosques, and cemeteries, affected by the Armenian and Azerbaijan conflict. During the Fall of 2020, ethnic tensions between Armenia and Azerbaijan over disputed territories in Nagorno-Karabakh erupted into war. This project will compare both past and current satellite imagery using GIS software to determine affected sites and is part of a collaborative project with archaeologists at Cornell University. Current satellite imagery will be collected with a satellite specifically tasked for this project. Sites that are affected by the conflict can be reported to organizations, such as UNESCO, to protect the sites against future damage and preserve the archaeological record in Nagorno-Karabakh. This project will also contribute to larger conversations about the use of heritage monitoring in building trust and peaceful resolutions in conflict zones. This will expand the archaeological record in the area and allow for an increased knowledge of the area's history, using satellite imagery and GIS software. Changes are monitored and reviewed by archaeologists and new satellite imagery is regularly obtained. The Caucuses Heritage Watch website tracks these changes and provides regular reports on the findings which are shared via social media platforms. The findings show a clear pattern of targeted destruction to Armenian cultural heritage sites in Nagorno-Karabakh perpetrated by Azerbaijan. The data supports the idea that to preserve Armenian cultural heritage in Nagorno-Karabakh, immediate action needs to be taken on the part of governments and international organizations.

Mentor(s):

Ian Lindsay, Anthropology, College of Liberal Arts

College of Science

Genetic Similarities between Autoimmune Disorders: Rheumatoid Arthritis, Type 1 Diabetes, Vitiligo

Author(s):

Josie Bryant, College of Science

Grace Reynolds,

Abstract:

Autoimmune diseases occur when there is a failure in the body's self-tolerance mechanisms. These heterogenous disorders trigger self-attacking autoantibodies in affected individuals. Previous studies have shown that autoimmune disorders are often comorbid, thus they share genetic loci. This is especially true in the human leukocyte antigen (HLA) locus. Here, we perform case-case GWAS (ccGWAS) analysis with the cases of correlated autoimmune disorders. We used the tool ReAct and summary statistics data to explore genetic differences. The initial disorders we tested are Rheumatoid Arthritis (RA) vs Type 1 Diabetes (T1D) and Vitiligo Early Onset (VITE) vs Vitiligo Late Onset (VITL). Common SNPs between VITE and VITL were found in one loci in the HLA region between HLA-DQA1 and HLA-DRB1. RA and T1D were highly correlated, even after removing the HLA region (RAvsT1D: rg=0.53, p=2.67x10-5). From the ccGWAS we identified 56 significant loci for RA vs T1D, 35 of them were ccGWAS specific. For both cases, ccGWAS specific genes were involved in immune related processes. In conclusion our analyses identified loci with differences among the cases of the two correlated disorders. The genetic loci that we identify could be potential targets for better diagnoses and disorder-specific treatment.

Mentor(s):

Peristera Paschou, Biological Sciences, College of Science

Apostolia Topaloudi, Purdue University

College of Engineering

Computer Vision Approach to Lane Detection

Author(s):

John Bullock, College of Engineering

Pume Tuchinda, College of Engineering

Karsten Hilgarth, College of Engineering

Anthony Pei, College of Engineering

Aryan Jain, College of Science

Abstract:

With the prevalence of autonomous vehicles, the vision algorithms utilized for autonomous driving must be robust and accurate enough to assess road features through captured images. In our previous work, a neural network model was constructed according to the YOLO network architecture using a Dilated Darknet backbone and a path aggregation network decoder. The model also utilized a novel transformer-based Bidirectional Feature Pyramid Network. The model was then trained on the BDD100k dataset to give keypoint predictions of where lanes are in an image. This semester, we have switched to a computer vision approach to lane detection as a more explainable solution to designing a lane detection algorithm. Our computer vision approach to lane detection begins with an image preprocessing step, which filters out image colors that could not belong to lane lines. Then, a Hough transform is applied to the road image to detect prevalent linear features in the image. A 2-dimensional non-maximum suppression (NMS) algorithm is then applied to the Hough transform output to select multiple distinct lines in the image that are the most pronounced. Lastly, an active contour model is initialized around each distinct lane line from the NMS output, and the active contours are then optimized to fit around the shape of the lane lines and create a bitmask of lane line locations. An Intersection over Union metric will then be calculated between our lane line bitmasks and ground truth bitmasks from the BDD100k dataset to evaluate our algorithm's performance in lane line detection.

Mentor(s):

Carla Zoltowski, Electrical & Computer Engineering, College of Engineering

Edward Delp, Purdue University

Poster Presentation Abstract Number: 519 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Business Card Reader

Author(s):

Mason Burgess, College of Engineering

Harsh Ranawat, College of Engineering

Wenhui Yang, College of Engineering

Siddharth Singh, College of Science

Joseph Huang, College of Engineering

Tanon Chokkhanchitchai, College of Engineering

Abstract:

Purdue University hosts several career fairs each year, with all of them resulting in several thousands of business cards being printed. The goal of the Business Card team to develop a mobile application which can take a picture of a business card by camera or upload a business card image from one's smartphone storage, extract useful information from it, and store it into the contact list of the user's phone. This reduces the overall need for paper usage at career fairs and other business-related events. The project team is structured into two sub-teams. While one sub-team is working on application and server development, the other works on the image processing algorithm. For the interface sub-team, the primary goal is to develop a mobile application in Android Studio that communicates with an external server to run the other team's image processing algorithm. On the other hand, the algorithm team is working on developing an algorithm to extract characters from images of business cards. The methods implemented include traditional signal processing techniques such as 2-dimensional convolution as well as more recent algorithms such as machine learning.

Mentor(s):

Edward Delp, Electrical & Computer Engineering, College of Engineering

Carla Zoltowski, Purdue University

College of Engineering

Radiation Effects on ZTJ Space Solar Cells in the Science and Relay Orbits of NASA's MAVEN Spacecraft

Author(s):

Bethany Buro, College of Engineering

Abstract:

Radiation within the space environment can greatly impact the performance and life expectancy of a broad range of critical satellite electronics, including solar cells that provide electric power. With multiple missions being planned for Mars, understanding the potential performance of solar cells is crucial for success. Therefore, this study aimed to better understand the Martian radiation environment and the effect on solar cells by studying the radiation effects on 3rd Generation Triple Junction (ZTJ) space solar cells in the science and relay orbits of NASA's Mars Atmospheric and Volatile Evolution (MAVEN) spacecraft. The science orbit of MAVEN served to collect data on the Martian environment, while the relay orbit transitioned MAVEN to serve as a data-relay satellite for NASA's Perseverance Rover. The coordinates for a one-year mission in both orbits were generated using the Space Environment Information System (SPENVIS). Based on these coordinates, the expected total proton fluence during the solar maximum was calculated using the Solar Accumulated and Peak Proton and Heavy Ion Radiation Environment (SAPPHIRE) model. The displacement damage dose method was used to determine the expected solar cell degradation in both orbits using proton fluence data, experimental data on the performance of the ZTJ solar cell as it relates to proton fluence, and the non-ionizing energy loss (NIEL) curves that describe the solar cell. The results for both orbits were then compared to determine how the change from MAVEN's science orbit to the relay orbit will impact the performance of ZTJ solar cells.

Mentor(s):

Peter Bermel, Electrical & Computer Engineering, College of Engineering

Allen Garner, Purdue University

Charles Grey, Purdue University

College of Engineering

Program Analysis as A Service

Author(s):

Aneesh Chakravarthula, College of Science

Brooklynn Cox, College of Science

Neha Priyadarshini, College of Science

Cecilia Jiang, College of Science

Abstract:

The goal is to help computer science courses in multiple universities teach the students how to write secure code. This is best done with the incorporation of a new grader, which automatically incorporates the code that we write in order to help the student understand the security vulnerabilities that the student's code has. We will incorporate fuzzing techniques in order to understand what security vulnerabilities are common, and how they are being done. Then, we will write code in order to help the grader catch these vulnerabilities, which will ultimately help the student understand his/her problems and fix them. The fuzzing techniques that we use will help us identify what the bugs are, as it basically just injects random data into the code in an attempt to break it. That way, we will understand what the biggest problems are, and how big these security vulnerabilities are. This can help us identify big problems, and at the same time, teach other students about what these problems are.

Mentor(s):

Aravind Machiry, , College of Engineering

Akhil Guntur, Purdue University

Daniyaal Rasheed, Purdue University

College of Liberal Arts

Elucidating modern medical conditions (osteoarthritis) through paleopathology

Author(s):

Sarah Coon, College of Liberal Arts

Abstract:

High rates of physical activity in modern populations have been linked to medical conditions in the skeleton, such as osteoarthritis, that can impact quality of life. In recent years, attention has been drawn to cam lesions of the proximal femur, beginning in adolescence and often seen in teenagers and young adults with high rates of physical activity during periods of growth, such as competitive sports. Due to the connection with sports-related activity, it has been suggested that cam lesions are unique to modern populations. Recent studies indicate that some ancient populations demonstrate individuals without cam deformities. Here, we evaluate the skeletal collection from Tombos, Sudan to identify cam lesions in ancient populations dating from the Egyptian New Kingdom and Third Intermediate Period (~1400-700 BCE). These remains represent Egyptians living in the administrative colony at Tombos and indigenous Nubians during and after Egyptian occupation, and demonstrate diverse cultural practices. We selected intact proximal femora from the Tombos collection and photographed them using two views; measurements were taken of the alpha angle to analyze the anterior juncture of the femoral neck and head. Through this data, we have established the presence of cam lesions in the Tombos population and can consider the effects on prevalence of related osteoarthritis and daily wellbeing.

Mentor(s):

Michele Buzon, Anthropology, College of Liberal Arts

College of Engineering

Computer Vision: Point Cloud Data Processing for Autonomous Vehicle

Author(s):

Herbert Alexander de Bruyn, College of Engineering

Abstract:

Sensors has never had greater role in society. With all spheres of life relying on technology, the need for effective machine – environment interactions have risen. While machine need sensors and software to process the information sensed into meaningful data, society requires machines. Extrapolating to the three-dimensional realm, this research procures to develop a more efficient 3D data processing program. The program intakes point clouds – cluster of data points representing 3D objects - captured by sensors in an autonomous vehicle (e.g., LiDAR), which are then filtered with voxel downsample, registered with point-to-point ICP, segmented, and reconstructed. Still under development, the program utilizes the languages C++ and Python, with Point Cloud Library and Open3D respectively, comparing the efficiency and utility of both open-source libraries for point cloud and 3D geometry processing. This study aims to provide a 3D data interpretation tool, and the initial results point towards Point Cloud Library as the more effective program.

Mentor(s):

Song Zhang, Mechanical Engineering, College of Engineering

Poster Presentation Abstract Number: 524 :: Social Sciences/Humanities/Education

<div align="center">

College of Health and Human Sciences

An Integrated Conceptual Definition of Cultural Awareness

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Author(s):

Asher Denny, College of Health & Human Sciences

Abstract:

The development and demonstration of cultural awareness is important for workers in most fields, especially those focused on providing services to diverse clientele and involving interaction with diverse teams. Yet, cultural awareness has been conceptualized and defined in a wide variety of ways in the multidisciplinary literature. As a result, the literature is fragmented, and there is a lack of consensus regarding what cultural awareness is--and what it is not. To advance theory and practice, a clear, precise, and comprehensive conceptualization of cultural awareness is needed. The purpose of this study is to produce an integrative conceptual definition of cultural awareness that can meet this need. We conduct a multidisciplinary integrative conceptual review of the cultural awareness literature. In so doing, we analyzed and coded literature related to cultural awareness from several disciplines—including psychology, nursing, and education . By analyzing conceptual definitions and measures, we identify and define unique dimensions of cultural awareness and differentiate cultural awareness from other constructs. We propose an integrated conceptual definition of cultural awareness that unifies disparate literatures and provides a basis for comprehensive assessment.

Mentor(s):

Melissa Roberson, Psychological Sciences, College of Health & Human Sciences

College of Engineering

An Evolutionary Analysis of ThyX-like Thymidylate Synthase in Mycobacteriophages

Author(s):

James Derloshon, College of Engineering

Crystal Jiang, College of Engineering

Mallory Motz, College of Engineering

Abstract:

The purpose of this study is to annotate and investigate mycobacteriophage YemiJoy2021 in the genome region from 16451 to 53531 bp. This phage was discovered following the SEA-PHAGES Program in 2021. Genome start site and function annotation were carried out using DNAMaster and PECAAN. Further investigation of YemiJoy2021started with constructing a phylogenetic tree. Based on this, the phages' protein structures and gene sequences were compared in order to analyze possible evolutionary differences that correlate with the branches in the tree. We focused on thyX-like thymidylate synthase–which makes thymidine–and compared its mutations and structures between YemiJoy2021 and phages of the same cluster, different cluster, as well as a singleton. We found that the thymidylate synthase from the phage in subcluster C1 was very similar at 99.47% and all mutations were synonymous, meaning that the amino acid sequence did not change. The predicted structures had similar topologies and secondary structure compositions. Looking at the phage in the different clusters, the similarity was much lower, with nonsynonymous mutations indicating different amino acid sequences. The structure predictions matched this, as the 3D structures had many more differences. This study reveals the evolutionary history of YemiJoy2021 based on what regions of the phage genomes contain more mutations proportional to varying phylogenetic distance. It additionally illustrates how random mutations are or are not selected against based on their importance to protein structure and function. Finally, this study demonstrates a process integrating protein modeling, phylogeny construction, and mutation analysis to view the effects of evolution.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Lauren Novak, Purdue University

Yemi Oduniyi, Purdue University

Abigail Ekeigwe, Purdue University

College of Engineering

Purdue Lunabotics Robot Arm Design

Author(s):

Mehul Dhillon, College of Engineering

Austin Jewett, College of Engineering

Tyler Cole, College of Engineering

Alice Dinh, College of Engineering

Abstract:

The competition for the Lunabotics program is expected to change heavily next year. To better prepare for this change, our team has been tasked with coming up with potential solutions to meet these new criteria. The purpose of our project has been to research and develop a robotic arm for the Lunabotics team. We conducted our research by initially looking for potential pre-existing robotic arms that could be implemented into the team's design. We did extensive research on the requirements and the limitations of each arm to better assess their compatibility with the robot design. We also had to try and come up with possible applications of the arm so that we knew the limitations it must overcome.

To refine our arm requirements and design, we learned about robot arm design which included topics like homogeneous transformation matrices, forward and inverse kinematics, and the Newton-Raphson algorithm. From our research, we have concluded that the optimal arm will have six-axis of rotation and weigh under 15kg. We have decided that the robot arm needs to be able to have a reach of 0.75 meters and a payload capacity of 1.75 kg. The end effector of the arm can be customized based on the actual rules released by the Lunabotics competition next year. These results that we have determined allow us to design an arm that has flexibility to be able to adapt to any possible applications that might be set for the Lunabotics competition.

Mentor(s):

Prabhpreet Dhir, Aeronautics & Astronautics, College of Engineering

College of Engineering

Mutation, Phylogeny, and Protein Folding Analysis of Gene 208 (bp 117833-118951) of Mycobacteriophage Maby2021.

Author(s):

Brittany Drevalas, College of Pharmacy

Mezna Alhabshi, College of Science

Luke Mercer, School of Management

Abstract:

Bacteriophages are viruses that infect bacterial hosts. Phages are studied to combat multidrug resistant bacterial strains that impact many industries, including medicine and agriculture. This project contributes to bacteriophage data collection by the SEA-PHAGES program. Mycobacteriophages, bacteriophages that infect Mycobacterium smegmatis, were isolated from the environment, characterized, and annotated. The information gathered is then publicly accessible to researchers.

This project demonstrates some of the analytical application of annotated genes by analyzing the phage gene Maby2021_208 (117833 - 118951bp). The gene encodes a RecA-like DNA recombinase, an enzyme used in homologous genomic repair. The protein's mutations, phylogeny, and folding were analyzed. In mutation analysis, different nucleic and amino acid sequences of similar genes in different phages were aligned through python to reveal the impact of nucleotide differences on the translated products. In phylogeny analysis, phylogenetic tree programs, such as PhyML and Splitstree, were used to analyze the evolutionary relationships between RecA-like DNA recombinase genes in several phage clusters. In protein folding analysis, the structure and function of protein sequences were analyzed to learn how the relationship between the two leads to the success and proper utilization of the amino acid sequence. Visualization programs PyMol and I-Tasser were used to predict the structure and compare the predicted structure with crystal structures found in nature.

This project aims to characterize Gene 208 of Maby2021 through mutation, phylogeny, and protein folding analysis and determine how the function of this gene relates to the larger overall genome.

Mentor(s):

Lauren Novak, , College of Engineering

Honors College

The Fusion of Human Creativity and Foldit's Artificial Intelligence

Author(s):

Nicole Dubish, College of Health & Human Sciences

Abstract:

The SARS-CoV-2 spike protein latches itself onto healthy cells through the human ACE2 receptor. Once inside, it hijacks healthy cells and then begins infection. A binder protein that attaches to the spike protein's receptor binding domain (RBD) may be able to detract the virus, thus, blocking coronavirus infection and potentially leading to a new candidate therapeutic drug. Can we design a brand-new binder protein that could possibly neutralize SARS-CoV-2 and treat early COVID-19 infection in humans? One of the biggest challenges of designing de novo proteins is finding an amino acid sequence that folds into a proscribed structure as well as the lowest energy conformation of the amino acid sequence. FoldIt is a game where you can design and fold proteins, and it brings together human creativity and intuition and fuses it with artificial intelligence. The Rosetta algorithm is not perfect, and it does not always take as many "risks" as a human might to design the lowest energy structure. Here, a novel binder protein with a Rosetta energy score of >13,000 is presented. My protein has multiple beta sheets. I moved them closer together in a parallel fashion in order to maximize the amount of hydrogen bonding within my protein. I interchanged residues at the binding interface, core, and the surface of the protein to increase stability. Part of my fragment was a part of the ACE2 receptor. If I can increase my protein's score, it could be used as a possible therapy drug after testing.

Mentor(s):

Zahra Tehrani, Honors College

College of Agriculture

The role of R-loop homeostasis in aging and neurodegeneration

Author(s):

Alyssa Easton, College of Engineering

Abstract:

Redacted.

Mentor(s):

Hana Hall, Biochemistry, College of Agriculture

Poster Presentation Abstract Number: 530 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

5G Wireless Radio

Author(s):

Samuel Elkin, College of Engineering

Matthew Waldren, College of Engineering

YaLing Tsai, College of Engineering

Abstract:

The objective of this project is to design a 5G wireless radio for the SoCET team's latest microprocessor tapeout. This radio operates at a frequency of 28 GHz with a bandwidth of 850 MHz for lower signal latency and faster data upload and download speeds. The components were designed using Cadence Virtuoso with a 22nm Silicon-on-Insulator Process Design Kit (PDK). The radio architecture uses a direct conversion receiver with an antenna array enabled through phase shifting of the local oscillator (LO). The transmitter was designed to achieve a saturated output power of 23 dBm to allow the range between the transmitting antenna and base station to reach 200 m. Linearity and power efficiency are also important specifications for the transmitter, which are dominated by the performance of the power amplifier. In the receiver, a downconversion mixer will reduce the input signal's frequency from 28 GHz to the baseband frequency, within range of the chip's Analog to Digital Converter. Relevant criterion for the mixer include amplitude and phase mismatch, as well as conversion gain. The local oscillator that feeds into the downconversion mixer will be generated from a voltage-controlled oscillator (VCO), which contains a phase-locked loop (PLL). This project will allow the SoCET team and its sponsors such as Crane Naval Base to build a chip that can effectively and efficiently send and receive data and lays the groundwork for future developments in wireless capabilities.

Mentor(s):

Mark Johnson, Electrical & Computer Engineering, College of Engineering

Sutton Hathorn, Purdue University

College of Engineering

Teensy Breakout PCB

Author(s):

Seth Feickert, College of Engineering

Abstract:

The goal of this project is to find a way to make the various pins of a Teensy 4.1 microcontroller board more accessible for use in a lunar mining robot, and to also make the Teensy 4.1 easily replaceable if needed. This goal was addressed through the design of a printed circuit board that a Teensy 4.1 microcontroller board can be plugged into. This printed circuit board was constructed through the use of Altium Designer. The current breakout PCB features a 31-pin panel connector, 5 connectors dedicated for motor controller communication, support for a weight sensing cell, support for up to 4 5V encoders, and multiple connectors for the input communications to the Teensy, in order to provide redundancy. This project is important because it provides easier access to the capabilities of the Teensy 4.1 microcontroller, and, since the Teensy 4.1 is not soldered to the board, makes the microcontroller easily swappable if need be.

Mentor(s):

Nichole Ramirez, , College of Engineering

College of Engineering

SoCET – ML/AI Benchmarking

Author(s):

Aidan Fisher, College of Engineering

Oliver Krefta, College of Engineering

Adam Zurek, College of Engineering

Abstract:

This project is based around benchmarking AI applications on System-on-Chip Extension Technologies' (SoCET's) AFTx06 System-on-Chip (SoC); we also plan to develop AI applications using the AFTx06. The AFTx06 has built-in sparsity optimizations, which makes it a great fit for AI applications. Sparsity optimizations reduce the amount of redundant calculations by skipping calculations that guarantee a result in zero. Hence, we are utilizing the AFTx06 SoC to see how well it performs on said AI applications in a benchmark setting. Various methods of machine learning will be tested on the AFTx06 using the TensorFlow Lite framework. These methods are graph neural networks, convolutional neural networks, and recurrent neural networks. The models will be trained offline on a separate machine and will then be imported onto the AFTx06. The models will first be run without the sparsity optimizations; then, they will be run with the sparsity optimizations. Both trials will focus on the computation time to run test data on the given models. The results will then be compared to determine how effective the sparsity optimizations are for each method and machine learning in general. By testing the SoCET chip's sparsity optimizations in this way, we will be able to evaluate how well these optimizations improve efficiency in real world edge computing applications. We will also be able to evaluate the chip's overall suitability for edge machine learning, an area that has many potential applications in situations requiring faster and more efficient ML inference.

Mentor(s):

Mark Johnson, Electrical & Computer Engineering, College of Engineering

Cole Nelson, Purdue University

Poster Presentation Abstract Number: 533 :: Innovative Technology/Entrepreneurship/Design

<div align="center">

College of Engineering

VISORS: Virtual Super-Resolution Optics Using Reconfigurable Swarms

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Author(s):

Rishikesh Gadre, College of Engineering

Hasnain Daudi, College of Engineering

Erik Zabalegui Lopez, College of Engineering

Eddie Kon, College of Engineering

Evgeniia Vorozhbit, College of Engineering

Abstract:

VISORS is a space mission that will deploy two 6U CubeSats to obtain high-resolution images of the Sun's corona to determine why the corona exhibits exceedingly high temperatures. The project is a collaborative effort between a NASA facility and various institutions. Purdue VISORS focuses on the thermal modeling and analysis of the CubeSats.

The satellites are the Detector (DSC) and the Optics Spacecraft (OSC). The OSC holds the optical system (photon sieve) of the telescope and serves as a shade to the detector inside the DSC. When aligned, the OSC and DSC create a distributed telescope to gather information. The components of the DSC and the OSC include a propulsion system, an avionics board stack, a Compact Spectral Imager Electronics (CSIE) board stack, the door mechanism, and the laser range finder.

The thermal analysis is performed to develop a thermal model of both satellites and predict the temperature ranges of the components for different working regimes. The thermal models account for all sources that affect the temperatures of the satellites, such as the sun, albedo, etc. Various test cases with variations in beta-angle and orientation of the satellites are modeled to identify the working regimes for the mission. Analyzing the results helps the team identify which components will not survive the space environment. The satellite models are being updated with modified components to account for potential errors. The team is seeing promising results as most of the components are within their operational temperatures.

Mentor(s):

Alina Alexeenko, Aeronautics & Astronautics, College of Engineering

Petr Kazarin, Purdue University

College of Health and Human Sciences

The Gummy Flavor Game: Gamifying Vegetable Flavor Exposure to Increase Liking

Author(s):

Neyven Garal, College of Health & Human Sciences

Abstract:

Both adults and children report that unpleasant flavor is a common reason for avoiding vegetables. However, repeated exposure to flavors, even unpleasant vegetable flavors, improves acceptability. Yet, increasing exposure to vegetables is difficult, as vegetables are often less convenient to consume and less available than other foods. We propose to address this barrier to repeated exposure through use of a game, challenging players to identify flavors in vegetable flavored gummy candies. We collected sensory ratings of pureed and chopped target (exposed in game) and non-target (not exposed in game) vegetables. Participants then completed a 2-week game phase, where they played the game once per day, with sensory evaluation of the pureed/chopped vegetables repeated at the beginning, middle, and end of the game phase. Participants were randomly assigned to a control group (non-vegetable flavors) or a vegetable group (vegetable flavors). While data analyses are ongoing, as the first wave of participants is just finishing the game, we expect the vegetable group to show improved sensory ratings for the target vegetables, with lesser/no changes in ratings for the non-target vegetables. Additionally, we expect to see no or minimal changes in any sensory ratings for the control group. These data will indicate whether this game might be useful for helping people improve their diets. Future work will build on this, using the game in tandem with approaches to improve access to vegetables and preparation skills.

Mentor(s):

Cordelia Running, Nutrition Science, College of Health & Human Sciences

Lissa Davis, Purdue University

Poster Presentation Abstract Number: 535 :: Innovative Technology/Entrepreneurship/Design

Honors College

Wi-Fi Speeds Across Purdue's Academic Campus

Author(s):

Akanksha Garg, College of Engineering

Lorraine Zaumu, College of Engineering

Sherman Moser, College of Science

Dhirodaatto Sarkar, College of Engineering

Brian Dodd, College of Engineering

Trevor Owens, College of Engineering

Abstract:

The objective of this project is to find an effective way to identify and map Wi-Fi speed distribution across academic buildings on Purdue University's campus for use by Purdue students and staff. Previous research studies indicated a correlation between high user density and lower Wi-Fi speeds (Ott & Kutscher, 2004). The Wi-Fi speeds of different locations within six different buildings at three different time intervals representative of differing student densities (low-traffic, mid-traffic, and high-traffic times) were recorded using a program designed to collect upload and download speeds. From this data, we calculated averages of the measured download and upload speeds for each location to account for instantaneous deviation, which demonstrated a tendency for Wi-Fi speeds to increase with higher floor levels. Our initial goal was to create an interactive heat map that displayed Wi-Fi speed distribution by building, floor, and time of day, but due to time limitations, we were unable to create an interactive map. Our collected data was used to create a prototype of this initial model: a heat map that demonstrates the Wi-Fi download speed distribution across the main floors of the surveyed buildings at high-traffic times. Future work can involve recording user density by location, increasing the frequency of data collection, increasing the number of locations surveyed per building, and using one controlled device for data collection for the sake of consistency.

Mentor(s):

Daniel Froid, Honors College

Cynthia Wan,

Poster Presentation Abstract Number: 536 :: Social Sciences/Humanities/Education

Honors College

Analyzing Trends in Active Shooter Motivations

Author(s):

Evan Gold, College of Science

Abstract:

Active shooter events have garnered increased media attention in recent years, and the media tends to treat all active shooters as having similar motives and life experiences. However, research demonstrates that there is no one-size-fits-all active shooter profile. Previous research from 2012 indicates that active shooters fall into three main categories based on their motivations: autogenic shooters, victim-specific shooters, and ideological shooters. The purpose of this study is to use a 2018 Federal Bureau of Investigation (FBI) database of active shooters in order to classify recent shooters into the three aforementioned categories. Two newspaper articles were chosen for each active shooter from the FBI database, and a combination of deductive and inductive coding was used to classify each shooter. Contrary to previous research, the majority of recent active shooters are autogenic shooters who commit attacks due to their internal psychological issues rather than due to a specific grievance or ideological belief. Our results indicate a significant shift in active shooter motivations. These findings will be useful to law enforcement officers and threat assessment professionals who can devote more investigative and preventative resources to individuals who exhibit characteristics of autogenic shooters.

Mentor(s):

Jason Ware, Honors College

Did not submit one

Preferences: Meat substitutes vs. vegan protein

Author(s):

Connor Hall, College of Engineering

Celine Maduwuba, College of Science

Ben Kaplan, College of Science

Alison Fung, College of Engineering

Abstract:

The purpose of this research analysis was to track and understand the preferences and habits of the current Purdue student population pertaining to food selection, specifically in the range of vegetarian options around the partiality to "faux meat" products. Our investigation followed the Windsor dining court, known for its vegetarian options, over the course of three days to gather data on the different options, student tendencies, and possible reasons for each preference. Between normal meat and its vegan counterpart (ex. fish or "vegan" fish), we discovered that only ~8% more students chose normal meat over the vegan option. In addition, students who were interviewed about their experience commented that the vegan option tasted better. Furthermore, when comparing normal vegetarian options to meat substitutes, ~70% of students preferred the "faux meat". Overall, students preferred meat substitutes over vegetables, and real meat over both. With these results in mind, dining courts could employ the serving of more vegetarian substitutes over normal leafy greens such as soy based products and protein rich alternatives like quinoa. Health benefits of these applications range from reducing fat and caloric intake to lowering risk of heart disease.

Mentor(s):

Emily Staub, Biological Sciences, College of Science

Thom Gerrish, Purdue University

Sarah Huber, Purdue University

College of Engineering

SoCET Design Flow

Author(s):

Jongkyu Hwang, College of Engineering

Hansoo Kim, College of Engineering

Samantha Dreussi, College of Engineering

Abstract:

The Design Flow team provides and opportunity to engage in the complex process of transforming design constraints to chip fabrication on silicon. Using the Cadence software tool, the team synthesizes high level system Verilog and system Verilog into a mapped list, and physically layout the design. The team specifically focuses on creating placement and routing, and on verifying the results of the PnR stage. In the placement stage, the team decides on how to place all the digital components within the restricted chip area. Using optimization methods and considering the tradeoffs of decisions, the team strives to achieve maximum performance. After placement is done, the design flow team decides on how to supply clocks to the flip-flops within the design, and how to interconnect wires between the digital instances. The goal of our team is to study how to correctly simulate AFTx06, and suggest necessary changes to improve performance of the chip. As a team, we will support participating in the Google skywater challenge to see the actual tape-out of the chip our team has verified.

Mentor(s):

Mark C Johnson, Electrical & Computer Engineering, College of Engineering

Raghuraman Kottaiyur, Purdue University

College of Engineering

Design and Implementation of Digital-to-Analog Converter using Delta-Sigma Modulation

Author(s):

Ishmam Iqbal, College of Engineering

Abstract:

Redacted.

Mentor(s):

Mark Johnson, Faculty, Purdue University

Sutton Hathorn, Purdue University

College of Engineering

PCB design utilization in autonomous vehicles.

Author(s):

Brad Jeon, College of Engineering

Joseph Freck, College of Engineering

Abstract:

The main goal of this VIP team is to assist Autonomous Motorsport Purdue (AMP) student group building an autonomous go-kart. The primary focus of this VIP team is to work with printed circuit boards (PCB). However, as all the members of this VIP group are new to the team and have no prior experience with PCB, our primary focus is to learn creating new PCBs utilizing Kicad software. Since the previous semester PCB model does not function correctly certain input voltages, we are building a new PCB while making it slimmer and more energy efficient. Some components used in previous model are outdated and no longer in production, requiring us to find replacements. Also, to help future AMP and VIP members, we will be documenting all the footprints and components that have been soldered into our new PCB.

Mentor(s):

Aly El Gamal, Faculty, Purdue University

Shreya Ghosh, Purdue University

College of Engineering

Study Spot Availability Tracker

Author(s):

Byeongchan Jeong, College of Engineering

Youngjoo Moon, College of Engineering

Juhyung Kim, College of Engineering

Aaron Fritz, College of Engineering

Abstract:

Purdue University has now seen the largest incoming class for Fall 2021 with more than 10,000 freshmen enrolling. Due to the added volume of people, it is becoming increasingly time-consuming for students to find places to study, even though there are plenty of vacant spaces around the West Lafayette campus.

We propose the 'Study Spot Availability Tracker', a system that monitors seat occupancy in buildings that have a place to study. The tracker will detect the availability of each seat and display its occupancy through a web environment and mobile friendly site. Developments that our team has made over the Spring 2022 semester were to utilize detection with the combination of multiple sensors, such 1) Ultrasonic with passive infrared (PIR) sensor and 2) infrared thermal sensor with PIR sensor. By modifying the conditions from the previous design, we expect to have improvements in accuracy. Furthermore, to make this possible, we will implement our solution by producing hardware, including custom PCB design for sensor circuits and 3D printed casing that will fit the sensors and electrical components. Our website will be hosted by Purdue and developed using the Vue framework, with a python based back-end, and a MySQL or real-time database. It will interact with the constellation of detectors to gather and display occupancy data in a user-friendly and visually appealing website.

Mentor(s):

Xiaokang Qiu, Electrical & Computer Engineering, College of Engineering

College of Engineering

Lunabotics Autonomous Systems

Author(s):

Adhiksit Kalra, College of Engineering

Jerry Wang, College of Engineering

Matthew Rines, College of Engineering

Natalie Keefer, College of Engineering

Niharika Narra, College of Engineering

Nikita Ravi, College of Engineering

Abstract:

This semester the Autonomous Systems sub-team of the Lunabotics VIP team hopes to identify and implement the best global path finder algorithm for the lunar rover. There are several sub-projects each member of the autonomous systems sub-team is focusing on to achieve the goal of implementing the best path finder algorithm this semester.

To connect the hardware elements of the robot with the researched algorithms, we would require a simulated model of the robot that can be tested in the environment, which is where creating a URDF model becomes a necessity.

Another sub-project that the team is looking into is making the lunar rover autonomous through either computer vision or the rover's motion planning. The goal is to have the rover make a capable decision of navigating on unfamiliar terrain based on machine learning algorithms.

In addition, the team would be researching and implementing an object detection and object tracking algorithm that would allow for the robot to avoid obstacles.

Furthermore, the team will also use optimization algorithms for motion planning to make the robot's navigate the shortest path.

Finally, the last task is the assembly of the robot that will be used as a testbed for the algorithms we will implement. This includes the building of the robot frame, localization of the numerous devices required to run the robot, such as a depth-sensing camera, lidar, jetson nano, and motor. This team is also working on setting up the jetson nano with ROS to run the algorithms previously mentioned.

Mentor(s):

Preet Dhir, Aeronautics & Astronautics, College of Engineering

Nichole Ramirez, Purdue University

Carla Zoltowski, Purdue University

College of Engineering

Design and Sensitivity Analysis of Silicon Photonic Strip-to-Slot Mode Converters

Author(s):

Scott Kenning, College of Engineering

Abstract:

In silicon photonics, strip-to-slot and slot-to-strip mode converters are commonly used to take advantage of two types of waveguides. Strip waveguides confine light inside the silicon waveguide thus enabling low-loss routing across a chip, while slot waveguides have higher loss but are more useful for allowing nonlinear effects on-chip as the modal field can be confined outside of the silicon, possibly inside a material with stronger nonlinear properties. We will explore these converters and modify existing designs from the literature to incorporate a stripload. The stripload is a necessary modification to incorporate these mode converters into modulator designs. Of particular interest will be utilizing adjoint methods in finite-difference time-domain simulations to efficiently tune the design parameters. The results of this design and analysis will guide future fabrication runs.

Mentor(s):

Andrew Weiner, Electrical & Computer Engineering, College of Engineering

Luke Cohen, Purdue University

Honors College

Assessing the Knowledge of Structural Competency Among Medical Students in the United States

Author(s):

Mansoorah Kermani, College of Health & Human Sciences

Abstract:

The aim of this study was to examine the level of understanding of structural competency among American medical students. A survey was administered to 86 medical students from four different medical schools across the country regarding their perceived level of structural competency. These questions were designed to assess how prepared American medical students are to treat patients in underprivileged communities with diseases such as diabetes that are suspected of being influenced by socioeconomic status and background. 36% of respondents felt they had not received enough training in treating or preventing illnesses associated with structural factors in medical school. This was largely due to superficial instruction in the area and a lack of practical experience. Participants were also asked how they would like to see improvements in structural competency training in medical schools. 32% of respondents indicated that they were willing to take mandatory courses as part of their curriculum in order to develop the skills necessary to treat patients with diverse backgrounds and conditions, as well as advocate for public policy. Based on these findings, students may be better prepared to address health disparities with improved structural competency training, but further research with a larger sample size is needed to validate these findings.

Mentor(s):

Lindsay Weinberg, Honors College

College of Engineering

DMA Controller

Author(s):

Jagan Krishnasamy, College of Engineering

Victor Le, College of Engineering

Abstract:

The purpose of this project is to design, develop, and implement a DMA Controller for a RISC-V SoC. In the current iteration of the SoC, memory and I/O operations are very slow because the CPU wastes a significant amount of cycles stalling the pipeline while waiting for I/O and memory operations to complete. Modern CPUs must stall on the scale of hundreds of cycles to do a single memory operation, and many I/O devices can take on the scale of thousands of cycles to fulfill an I/O operation. In order to improve these operations, we've developed a DMA Controller for the AFTx06 SoC. The CPU configures the DMA controller by providing the source address, destination address, and size of the transfer. The DMA controller design consists of three main components: control registers, read control unit, FIFO, and write control unit. The control registers allow the DMA controller to be configured. The read control unit reads data from the source address and places it in the FIFO. The write control unit takes data out of the FIFO and writes it to the destination address. Part of the DMA Controller integration also includes the development of a low-level DMA driver in C to aid with future software development involving the DMA, as well as the implementation of DMA trigger support in the SPI peripheral to allow the SPI to directly initiate a DMA transfer without CPU involvement.

Mentor(s):

Cole Nelson, Electrical & Computer Engineering, College of Engineering

Poster Presentation Abstract Number: 546 :: Social Sciences/Humanities/Education

Honors College

Observing University Residents' Response Rates to QR Codes

Author(s):

Ethan Labianca-Campbell, College of Engineering

Rachel Koeiman, College of Engineering

Aaron Boes, College of Science

David Sixon, College of Engineering

Erica Long, College of Agriculture

Philip Voronin, College of Engineering

Suryatej Bhamidipati, College of Engineering

Abstract:

The Quick-Response (QR) code, first developed in 1994, was adapted for general use in identification marks on commercial products and for relaying announcements to the public. Much of previous research has found QR codes in public areas to be ineffective at spreading information to groups of people. For example, when librarians posted informative QR codes around a library to assist patrons, people opted to not use them and instead ask workers. (Henry et al.)

Hillenbrand Residence Hall at Purdue University uses both QR codes and weekly email updates to relay information to its residents. Based on our prior review of literature and experience living in Hillenbrand, we believed that QR codes were an ineffective method to share public announcements, and therefore wanted to research this topic with Hillenbrand Hall as our sample to better understand how Resident Assistants and Administration can better relay information to residents.

QR codes linked to a quick survey were posted for one week on every floor of Hillenbrand Hall to gather simulated response rates to announcements. Data gathered contained frequency of responses, timestamps, and whether individuals understood the information listed. When comparing the total number of responses to the number of residents in Hillenbrand, we found an approximate retention rate of 30%. Response rates to QR codes were dependent on the environment they were posted in. Approximately one-third of the sample population responds within one week of an announcement QR posting, and two-thirds of those responses will happen on the first day of the posting.

Mentor(s):

Daniel Froid, Honors College

Max Hellrun, Purdue University

Poster Presentation Abstract Number: 547 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Real-Time Mental Workload Assessment in Robotic-Assisted Surgery: Predicting Model Accuracy

Author(s):

Iris Layadi, College of Engineering

Abstract:

Increased complexity of robotic assisted surgery (RAS) may lead to operator cognitive overwhelming, subsequently increasing potential for medical errors. As a result, there is a need for precise and continuous assessment of operator mental workload states during RAS and for appropriate interventions to aid in avoiding task overload and help surgeons maintain optimal performance. However, mental workload measures are currently subjective and often discompose surgical workflow. To overcome this limitation, we proposed a neural network model integrated with eye-tracking and electroencephalogram (EEG) activity monitoring sensors to measure real-time mental workload. The purpose of this study is to conduct experiments to test the model's accuracy on unseen people in RAS. Three tasks of increasing difficulty were performed by the user using the robotic surgical system: baseline, peg transfer, and suturing – mental workload is automatically estimated and measured using the proposed model throughout the exercise. Workload indices obtained from testing were further analyzed as time-series to prove efficacy and accuracy of the computational testing model in predicting user workload.

Mentor(s):

Denny Yu, Industrial Engineering, College of Engineering

Jing Yang, Purdue University – HEAL Lab

Jingkun Wang, Purdue University – HEAL Lab

College of Veterinary Medicine

Understanding the Bond: The Current State of Human-Animal Interaction Research

Author(s):

Marjorie Leblanc, College of Science

Abstract:

Since the creation of the first center specializing in Human-Animal Interaction (HAI) in 1977, the interdisciplinary field evaluating the bond between humans and animals has grown significantly. In light of this growth, Purdue University's Center for Human-Animal Bond (CHAB) sought to bring together HAI experts to foster conversations regarding new ideas in the field by hosting two conferences for center directors, once in 2006 and again in 2016. In 2021, a third conference invited the newly established and previously invited centers from around the world to a virtual discussion. Of the 26 centers invited, 85% (n=22) completed an online survey regarding key information about their program and research. Results of the survey suggest that experts studying the human-animal bond represent a wide range of interdisciplinary backgrounds, from human and veterinary medicine to public health and psychology. Although the most researched topics were animal welfare and animal-assisted therapies, centers have also researched a wide breadth of topics from animal cognition to the effects of companion animal ownership; these topics were mostly studied in those with psychological disorders and typically developing populations. While companion animals, namely dogs, cats, and horses, remain the primary animal of interest, various centers also study the human-animal bond in wild and zoo, agricultural, or laboratory animals. Lastly, most centers reported involvement in education, including degree-granting programs such as master's and doctorate programs as well as HAI-related courses. These findings contribute important data regarding the growth and current state of human-animal interaction research from institutions around the world.

Mentor(s):

Maggie O'Haire, Comparative Pathobiology, College of Veterinary Medicine

Leanne Nieforth-Bomkamp, Purdue University

College of Engineering

Bacteriophage Function Analysis and Annotation Process

Author(s):

Kenny Lee, College of Engineering

Avery Dorsch, College of Engineering

Kayla Hinton, College of Engineering

Abstract:

Bacteriophages are a diverse and populous group of viruses that can target and kill specific bacteria. They are either lytic or temperate. Lytic phages insert their DNA into the bacteria cell and replicate until they kill their bacteria host, while temperate bacteriophages can lay dormant in the bacteria cell until external conditions permit them to kill their host cell. In the Biotechnology Laboratory I course in the Fall of 2021, the phage YemiJoy2021 was isolated and sequenced. In the subsequent Biotechnology Laboratory II course, we used a variety of databases and bioinformatics software to annotate the genome and assign possible protein functions to genes. The annotation process began with the search of a start site for a gene that was being analyzed. We thoroughly searched through coding potential, compared with other gene start sites within other phages of the same pham, and used blast results from the NCBI database to confirm a start site. Then the function analysis began with a comparison of different genes within the cluster along with running the gene through our programs and available databases to gain blast results. The databases were then closely inspected to determine the highest probability of a gene function based on the results.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Yemi Oduniyi, Purdue University

Abigail Ekeigwe, Purdue University

Lauren Novak, Purdue University

College of Engineering

Using Human Neurological Reactions to Predict Workload Variations

Author(s):

Eugene Lee, College of Engineering

Sitong Chen, School of Management

Kevin Davis,

Abstract:

Understanding what affects a person's performance is important for the success of the system the person is involved in. Furthermore, one of the known sources which could influence performance is workload. Therefore, controlling workload in a center range is essential to maintaining a person's performance. Ensuring that workload is accurately measured is a vital factor which makes the workload controllable. Therefore, the purpose of this study is to see if human functions measured via Electroencephalography (EEG), eye tracking, and heart rate variability data can help measure different workload variations accurately. The study uses game simulations for data measurement as it allows for configuration of workload difficulties, allowing the team to easily compare amongst the different levels for analysis. Users are put through two different simulations. In the first simulation, the user drives around the map to different checkpoints. Each checkpoint will present a set of arithmetic or verbal questions and the user must answer as many questions in 30 seconds. In the second simulation, participants must diffuse a bomb in 5 minutes. Measurements of body functions such as brain activity, heart rate, and eye movement will be used to observe how the body responds to different workload difficulty levels while the users participate in the simulations. In conclusion, the study is looking to draw conclusions about the data and see which combination indices from EEG, eye tracking and heart rate variability data could measure workload in the most accurate way.

Mentor(s):

Jingkun Wang, Industrial Engineering, College of Engineering

Jingkun Wang, Purdue University

Poster Presentation Abstract Number: 551 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

How has cultural globalization appeared on Netflix in the last 4 years?

Author(s):

Sangin Lee, Polytechnic Institute

Abstract:

The theater industry has been significantly impacted by the pandemic. From 2019 to 2020, total box office gross decreased from 11 billion dollars to 2 billion dollars. Theater goers opted for different video platforms for entertainment like Netflix, Disney plus, Hulu, and amazon prime videos instead. These platforms have become significant factors for trendsetting since they started making their own contents. Netflix is one of the biggest platforms among these platforms. This is evidenced by Netflix's net income increasing from 1.8 billion dollars to 2.7 billion dollars between 2019 and 2020. What vision does Netflix have? If you are a Netflix user, you most likely have recognized an increase in foreign content, like anime, K-drama, and Bollywood to Netflix's catalog. According to "What's on Netflix.com", the number of foreign subscribers continues to increase over time. Also, according to an official investor letter of Netflix written on January 19, 2021, Netflix have increased the amount of investment for foreign contents. This research will explore how fast the portion of foreign contents is increasing among the whole Netflix contents between 2018 and 2021. The goal of this research is to inform decision making practices regarding Netflix's continued growth. Furthermore, this research will explore the reason for this phenomenon, and build excitement and enthusiasm for foreign content.

Mentor(s):

Vetria Byrd, Computer Graphics Technology, Polytechnic Institute

College of Health and Human Sciences

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

Author(s):

Anna Lehman, College of Health & Human Sciences

Abstract:

While radiotherapy is critical for the treatment of intracranial tumors, it can lead to a range of radiation-induced brain injuries (RIBI) that ultimately decrease the quality of life for survivors. Loss of cerebral volume, a notable aspect of RIBI, occurs at least 6 months post-treatment and has been shown to relate to cognitive impairment in this population. Our goal was to evaluate whether a mini-pig model of RIBI can reproduce this cerebral volume loss. Two adolescent mini-pigs were irradiated in a manner consistent with pediatric brain tumor patients. A single-fraction 15 or 25 Gy dose was given to the left hemisphere with the right hemisphere left unirradiated. MRI scans were then acquired at 1 week, 3 months, and 6 months post-irradiation. The MRI scans were evaluated for temporal changes in hemispheric and total brain volume. Slices of the brain were taken 6 months PIR and stained for immunogenic markers. Our results show that the irradiated hemisphere is smaller than the unirradiated hemisphere across all time points, which is consistent with what is seen in brain cancer survivors. Microglia, immature neurons, and astrocytes were found in larger quantities in the left hemisphere while the same was found for mature neurons in the right. The number of the immature neurons in the left hemisphere could be attributed to stem cells being released to combat the damage done by the radiation. Future investigations will confirm these findings and determine the dose-response relationship of the mini-pig brain with regards to cerebral volume loss.

Mentor(s):

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

Whitney Perez, Purdue University

College of Engineering

Analysis of Gene of Unknown Function in Bacteriophage JimJam

Author(s):

Alexis Lowe, College of Engineering

Hannah Slabach, College of Engineering

Morgan Gyger, College of Engineering

Abstract:

Bacteriophages are currently piquing the interest of researchers and scientists for the myriad of diverse applications within the agricultural and medicinal fields. Over the past semester, we have analyzed the genome of a Streptomyces bacteriophage named JimJam discovered by fellow students in Evansville, Indiana on the University of Evansville campus in 2019. We utilized various programs and databases to further the analysis, including DNAMaster, PECAAN, Phamerator, and the SEA-Phages Guide. MATLAB was used to create code to complete DNA mutational analysis by comparing two similar gene sequences. SplitsTree and Phylogeny.fr were utilized to create phylogenic trees to determine evolutionary relationships with other genes to further the understanding of the function of the gene. Phyre2 and PyMOL were used to complete protein structural analysis to further the understanding of the function. Overall, the annotation of JimJam is split among numerous groups meaning that no concrete conclusions can be drawn at the moment. Our group will be focusing on analyzing gene 77, which has no known function, to expand upon what is known about this phage.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Taylor Sorrell, Purdue University

Allison Ayers, Purdue University

Poster Presentation Abstract Number: 554 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

The Evolution in the Gaming Industry

Author(s):

Caio Mansur, Polytechnic Institute

Abstract:

There is a noticeable increase in sales and technology in the Games industry. Every year that passes, the quantity of people that joins this Gaming world increases. Even with people with more age that were not used to this industry when younger is starting to be interested in this topic. This research is going to study and analyze how the Gaming industry developed throughout the years and what could be the future of this industry that have also been innovating itself with new technologies. It is important to try analyzing this topic since the increased number of people that is into this Gaming world. Data suggests that this trend will continue to increase. With that in mind, companies that create games are trying to be more inclusive and trying to create games where every person can identify with. The expected outcome in this project is that it will show an increase in games sales and in the game industry. This research will inform how the Gaming industry develops throughout the years.

Mentor(s):

Vetria Byrd, Computer Graphics Technology, Polytechnic Institute

College of Science

Plant Leachates Impact Amphibian Infection with a Fungal Pathogen

Author(s):

Emily Martin, College of Science

Abstract:

Changes to the natural world, including the anthropogenic spread of invasive species to vulnerable areas, are increasingly concerning, especially within aquatic ecosystems. For example, invasive plant species can introduce novel leaf litter into freshwater habitats which can alter water conditions and impact ecological interactions. Leaf litter can directly affect aquatic organisms by releasing chemical compounds into the water (i.e., creating "leachate"). However, the effects of leachates on infectious disease outcomes remain relatively unexplored. Within aquatic systems, the emergence of the fungal pathogen, Batrachochytrium dendrobatidis (Bd), has contributed to global amphibian declines and extinctions. We tested if leaf litter leachates from native and invasive plants affected Bd infection due to the effects of leachates on Bd growth and tadpole infection severity. American bullfrog (Lithobates catesbeianus) tadpoles were individually exposed to Bd in leachate solution from one of six plant species (three native, three invasive) for seven days. We then quantified infection status and infection load and measured tadpole mortality, growth, and development across treatments. When compared to native leachates, our results show that invasive leaf litter caused increased probability of infection and more severe infection. These findings indicate a need for further insight on the role of plant material in freshwater disease.

Mentor(s):

Catherine Searle, Biological Sciences, College of Science

Spencer Siddons, Purdue University

Paradyse Blackwood, Purdue University

College of Engineering

Development of Image Analysis Calibration Procedure for In-Situ Crystal Size Measurement

Author(s):

Madeline Mills, College of Engineering

Abstract:

Crystallization is a process commonly used in industries such as pharmaceuticals and agriculture, and the formation of crystals of a specific morphology, such as a certain length, are often crucial to the formation of products. Offline measurements via image analysis or laser diffraction are methods to accurately measure the crystal sizes. However, the infrequency of sampling and sample handling can disturb the dynamics of the crystallization system. A non-invasive solution to address data scarcity in particle size is to obtain crystal length by an in-situ camera known as a Particle Vision Monitor (PVM), followed by image analysis algorithms to obtain a length distribution. However, particles frequently overlap or are of different morphologies, leading to inaccuracies in the current algorithm. In order to improve the image analysis of crystal length for a specified crystal system, a recirculation loop was devised alongside a new algorithm utilizing MATLAB in conjunction with ImageJ. Once the images have been obtained, the process screens parameters such as the minimum area, the background subtraction, the minimum aspect ratio, and the circularity parameter to remove unnecessary noise. Once a new distribution of the particles is obtained from the chosen parameters, it is compared to an offline measured distribution as a way to calibrate the parameters to fit the offline measurement. An objective function, which quantifies the absolute error of the obtained distribution compared to the offline one, is calculated. New parameters values are then selected in order to minimize the error of the objective function. Currently, various relationships between concentration of the crystal system and each parameter are being derived in order to create a system that can output a more accurate length distribution for a selected concentration.

Mentor(s):

Zoltan Nagy, Chemical Engineering, College of Engineering

Wei-Lee Wu, Purdue University

Honors College

Big Ten University Demographics and COVID-19 Policies

Author(s):

Kathryn Moran, College of Science

Charlotte Moss, College of Engineering

Umar Mian, College of Engineering

Austin Lu, College of Science

Abstract:

Over the past two years, the COVID-19 pandemic has impacted everyone's daily lives. Policies for limiting the spread of COVID-19 have been highly controversial in the United States. We researched whether student and regional demographics impacted Big Ten Universities' Fall 2021 semester policies. We collected data online from the websites of Big Ten Universities (n = 13) about their student residency and COVID-19 policies. We also collected data about the universities' respective state and county political leanings based on 2020 presidential election results. Universities had an average of 8.97% of their students being international students, 36.70% being out-of-state students, and 54.33% being in-state students. Over half of the universities (n=8) were in Democratic-leaning states, and all were in Democratic-leaning counties. Examining the data with graphs, we found no significant correlation between neither student residency status proportions nor regional politics with the Big Ten universities' COVID-19 policies. While our results do not indicate any association between regional and university demographics and university, future research could be done considering more United States universities and by researching other semesters.

Mentor(s):

Thomas Gerrish, Libraries

Sarah Huber, Purdue University

Patrick Petersen, Purdue University

College of Engineering

A Bioinformatic Approach to Determine the Functional and Evolutionary Properties of Gene 28 of Bacteriophage Maby2021

Author(s):

Evelyn Nonamaker, College of Engineering

Aditi Lohar, College of Science

Hannah Reinbrecht, School of Management

Abstract:

Introduction:

Bacteriophages are viruses that infect and replicate within a host bacteria. Millions of species of bacteriophages exist with a wide variety of potential engineering applications, including as a viral vector for gene therapy. Determining which bacteriophages are useful for a particular application can be determined by examining the properties of different genes using a bioinformatic approach. Here, the research team investigated the evolutionary, mutational, and structural properties of Gene 28 of the bacteriophage Maby2021, which was annotated to have a function of 'band-7-like membrane protein'.

Methods:

The start site calls for the chosen genes were made using bioinformatic tools such as DNA Master, GeneMark, Phamerator, and BLAST. The function calls were made using Phamerator, BLAST, HHPred & SOSUI as it is a membrane protein.

Protein Bioinformatics:

The Phyre2 program was used to create the predicted model for the protein product of Gene 28 of Maby2021 based on the alignment of similar phage proteins in the Phyre2 database. The predicted structure from this program was then downloaded into the PyMol program to visualize its specific 3D structure more clearly and connect the structure to the function of the band-7 membrane protein.

This can be compared to the PDB protein structure from the HyRo phage Gene 31 protein, and the similarities and differences of the 3D structures between the two proteins from the phages can be visualized and analyzed using the Phyre2 and PyMol programs. Moreover, the Phyre2 results for intensive and normal search for each phage gene were analyzed according to the percent identity, alignment and confidence rates. The two structures of the phage proteins can also be superimposed onto one another using PyMol in order to see the structural similarities and analyze it based on the RMSD, global alignment and local alignment scores. The HyRo protein was used as the crystal structure and the Maby2021 Gene 28 protein was taken from Phyre2 predicted structure, and then these structures were superimposed in PyMol.

Mutational Analysis:

To determine the presence of mutations on Gene 28 of Maby2021 and the effect of these mutations on the gene product, a MATLAB code was created to count the number of transition and transversion mutations and evaluate whether these produced synonymous or nonsynonymous mutations in the amino acid sequences. The DNA sequence of Gene 31 of HyRo was used as a baseline for comparison. A transition mutation was considered to be where a pyrimidine nucleotide was replaced with another pyrimidine or where a purine nucleotide was replaced with another purine. A transversion mutation was considered to be where a pyrimidine

nucleotide was replaced with a purine nucleotide or vice versa. Synonymous mutations were recorded as mutations within the DNA sequence that did not produce a change in the amino acid sequence. Nonsynonymous mutations were recorded as mutations within the DNA sequence that did produce a change in the amino acid sequence. In addition to reporting the number and location of these mutations, the program also calculated the percent similarity of the DNA sequences, the transition to transversion ratio, and the nonsynonymous to synonymous ratio.

Phylogeny and Evolution:

With the objective of discovering the evolutionary relationship of the band-7-like membrane protein associated with Gene 28 of Maby2021, a number of software programs were used. In order to understand the evolution of band-7-like membrane protein, it had to be compared to other genes containing the protein. Phamerator and PhagesDB were used to identify multiple genes within different clusters containing the protein. Using the amino acid sequences located within PhagesDB, a FASTA file was created containing the sequences of all the genes being considered. The FASTA file was entered into the programs PhyILM and Splitstree to create two different phylogenetic trees. The trees were then used to draw conclusions on the evolutionary relationship of band-7-like membrane protein. To further understand the protein and how it has changed in evolutionary time, two more proteins were investigated using similar clusters. The additional two proteins included minor tail protein and RusA-like resolvase. The process of finding multiple genes within the clusters was the same as before. The FASTA file of all three proteins was entered into the programs PhyML and MEGA. These trees were used to draw conclusions based on each protein then the three proteins combined.

Results:

Protein Bioinformatics:

Both the proteins were run through Phyre2 in order to get the 3D Pymol PDB structures, and at the end of the Phyre2 search for both the proteins, it could be seen that both of the proteins from HyRo and Maby2021 have the same 2D structure and function in coding for a transmembrane protein. This is even more evident when they were compared through PyMol when superimposed.

When the proteins for Genes 28 and 31 from Maby2021 and HyRo are superimposed to each other it could be seen that they had high structural similarity although they came from two different phages. This was visualized in PyMol. This can be attributed to the fact that they have the same function and thus this relates to the structure.

From superimposition, the RMSD score is at 9.589 which is above 1 which is due to the fact that the HyRo structure is derived from a different phage. There were constraints on finding a proper crystal structure for the HyRo phage protein which could have affected these results and the overall alignment.

Characteristic to its function of serving as a membrane protein, when visualized in PyMol, the Gene 28 of Maby2021, has a lot of alpha helices in its structure. Moreover, the normal and intensive searches from Phyre2 corroborate for this protein being coded as a membrane protein, and this can be evident even from the template hits which have a 100% confidence rate which means that there is high similarity index in the homologous structures of the proteins, hence it is confirmed that Gene 28 of Maby2021 has a function of a band-7 membrane protein.

Mutational Analysis:

The results of the MATLAB program indicated 25 mutations and an overall similarity of 97.354% in the DNA sequence of Gene 28 of Maby2021 when compared to Gene 31 of HyRo. Of these 25 mutations, 17 were transition mutations and 8 were transversion mutations, yielding a transition to transversion ratio of 2.125. These base-pair mutations produced 10 nonsynonymous mutations and 12 synonymous mutations when the DNA sequence was converted into the resulting amino acid sequence. These results led to a nonsynonymous to synonymous ratio of 0.833.

Phylogeny and Evolution:

The multiple phylogeny software programs helped to validate the results found between the multiple phylogenetic trees created. When looking only at the phylogenetic trees associated with the band-7-like membrane protein it was clear that there was a close evolutionary relationship between the genes in clusters M and C1. However when comparing the phylogenetic trees associated with all three of the proteins the focus changed. It was more difficult to compare and contrast these trees because not all the same clusters were used for each protein. It was concluded that cluster C1 is clustered closely together for every protein. The same observation was made with cluster DU. The clustering of the genes leads to the assumption that there is a horizontal co-transfer of genes but because cluster C1 and DU are presented on different branches of each tree it is believed there are evolutionary differences between clusters DU and C1.

Conclusion:

After investigating the evolutionary, mutational, and structural properties of Gene 28 of Maby2021, the research team was able to draw conclusions regarding the gene and its functional annotation of band-7-like membrane protein. Observations from the mutation analysis indicated 25 mutations in the DNA sequence of Gene 28 of Maby2021 and a high degree of similarity with Gene 31 of HyRo. Gene 28 of Maby2021 is part of cluster C1 and the high degree of similarity discovered supports the connections made from the phylogeny and evolutionary investigation. From the phylogenetic approach, it was discovered that the genes of cluster C1 annotated with the band-7-like membrane function were grouped together to display they were closely related in evolutionary time resulting from a horizontal co-transfer of genes. This is additionally evidenced from the protein structure analysis where the results proved that the overall function for Gene 28 in Maby2021 and Gene 31 in HyRo code for a membrane protein, and hence have similar structures. Thus, this further supports how these genes from different phages belong to the same cluster C1.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

College of Engineering

SoCET/Analog Design Team

Author(s):

Myung Sun Park, College of Engineering

Minjun Song, College of Engineering

Abstract:

The Analog design team provides opportunities to be engaged in many skills, such as analog design, mixed signal design, physical design, software skills for fabrication, and analytical skills based on such designs. The team involves some tutorials for the beginners such as gm/id tutorial and Analog Layout tutorial. The tutorials provide the general understanding of parameters of MOSFET such as frequency, channel length, and gain. It also gives an insight of the overall flow of Analog and RF design which includes schematic and layout design processes. The on-going projects of Analog design team consists mostly of parts of a transceiver which includes SAR Analog to Digital Converter, Rail to Rail Digital to Analog Converter, Automatic Gain Control Amplifier, Power Amplifier, Mixer for 5G, Delta Sigma Digital to Analog Converter, All Digital Phase Locked Loop, and Low Dropout Regulator. The team is moving toward building a full wireless transceiver with all the different parts connected. The general process of a full wireless transceiver is that a signal is received from the antenna through the LNA and mixer which eliminates the noise of the signal and amplifies it to be processed. The amplitude of the signal is adjusted automatically with the AGCA to be processed in the ADC. The signal is then converted into a digital form. Once the digital processing is done, the DAC converts the signal into an analog signal which will be passed through the mixer and the PA so the signal will have enough power to be transmitted through the antenna. The optimal future goal for the team is to finish designing all the different parts of a transceiver which leads to building a full wireless transceiver.

Mentor(s):

Mark Johnson, Electrical & Computer Engineering, College of Engineering

Sutton Hathorn, Purdue University

John Peterson, Purdue University

Poster Presentation Abstract Number: 560 :: Social Sciences/Humanities/Education

<div align="center">

College of Health and Human Sciences

Developing, Implementing, and Evaluating a Campus-Wide Pharmacy Vending Machine Program

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Author(s):

Sophia Patel, College of Science

Haley Sidorowicz, College of Science

Abstract:

Background: In 2021, four Purdue Pharmacy Vending Machines (PhVM) were placed on Purdue University's campus to increase access to affordable and dependable 24/7 sexual health items, cold/flu remedies, and other popular over-the-counter pharmaceuticals. In January 2022, a survey was conducted where results highlighted consumer satisfaction of vending machines and their convenience.

Objective: In our research, we evaluated the success of the campus-wide PhVM program, which was an interdisciplinary collaboration across students, faculty, and staff in the College of Health and Human Sciences and College of Pharmacy.

Methods: A web-based survey was emailed to 5,000 undergraduate and graduate students for baseline information (n=349). Additional distribution occurred informally through social media to further reach students, alumni, and Purdue affiliates. Sales data for the four PhVMs was analyzed from the past year, indicating the most purchased items.

Results: Outcomes of this work will be used to make decisions, in collaboration with the Purdue University Pharmacy, on implementing new products into PhVMs, placing new machines in high-traffic buildings on campus, and increasing awareness of the PhVMs. The outcome of this project is to increase access to affordable and reliable sexual health, personal hygiene, and other health-related items at Purdue University.

Conclusions: Survey findings offer practical recommendations to increase awareness, use, and program expansion of the PhVM program. Reflecting consumer needs via diversified product offerings and machine placement is a priority for increased PhVM use. Promoting PhVMs requires messaging to target audiences via social media and flyer placement in high-traffic areas on campus.

Mentor(s):

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

Nicole Noel, Purdue University, College of Pharmacy

Poster Presentation Abstract Number: 561 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Lunar Robot Suspension Design

Author(s):

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Nicky Gianchandani, College of Engineering

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Drake Hagerman, College of Engineering

Abstract:

Our VIP (Vertically Integrated Projects) team was tasked with determining a suspension type that could be implemented into the design for the current and future Lunabotics rovers. The Purdue Lunabotics team is a club here at Purdue that participates in a NASA lunar mining competition every year. The suspension system will be used to reduce shock loads and vibrations on the robot. In order to determine what designs would be best, we began considering multiple factors, including but not limited to space, weight, cost, and integration constraints. We took these design constraints and applied them to the suspension types that we had considered in a decision matrix, these included the rocker bogie, leaf spring, double wishbone, and MacPherson strut. We were then able to eliminate the rocker bogie, due to the large number of alterations we would have to make to the frame, as well as the leaf spring, due to the limited length we could run the suspension. This left us with the double wishbone and the MacPherson strut. We then decided to mainly focus on the MacPherson strut as this would require the least number of alterations and consisted of the most static parts, which we believed would create less points for system failure. After this we began considering possible connection points and parts that we would be able to use for this system. To implement this design we will use Solidworks to model our suspension and how it interacts with a robot chassis. We will use the FEA (Finite Element Analysis) component of Solidworks to make sure that all the components of the suspension will work as intended.

Mentor(s):

Nichole Ramirez, , College of Engineering

Carla Zoltowski, Purdue University

Prabhpreet Dhir, Purdue University

College of Health and Human Sciences

Using Immunofluorescence to Investigate the Effects of Manganese on Insulin/IGF Signaling and AKT Phosphorylation in STHdhQ7/Q7 cells

Author(s):

Caroline Puch, College of Health & Human Sciences

Abstract:

Manganese (Mn), an essential metal in numerous biological processes, in excess levels in the brain can lead to neurotoxic effects known as Manganism. The disorder is characterized by Parkinsonian-like effects such as impaired voluntary motor function, muscle spasms and tremors. Additionally, Mn has been shown to activate many of the same metabolic kinases as insulin and insulin like growth factor 1 (IGF-1), work synergistically with insulin and IGF-1 receptors, promote downstream AKT phosphorylation, and increase glucose uptake. Currently our lab predominantly utilizes Western Blot assays to investigate this topic. Previously, our lab developed immunofluorescence protocols for human induced pluripotent stem cells differentiated down a cortical lineage. Here we test the hypothesis that an immunofluorescence protocol for murine striatal cells, STHdhQ7/Q7, can be another assay to further elucidate the effects of Mn on insulin/IGF-1 signaling and AKT phosphorylation. To answer this question we performed a 1 hour serum deprivation followed by exposing STHdhQ7/Q7 cells to either 1 nM of IGF and 500 µM Mn or media containing no IGF for 2 hours. To stain the STHdhQ7/Q7 cells we tested a range of dilution factors, from 1:50 µL to 1:800 µL for pan and phosphorylated versions of AKT and S-6 antibodies and imaged using an inverted widefield Nikon Eclipse Ti2 microscope. These images show immunofluorescent signals, but further optimization is needed to identify the final dilution. In the future we aim to establish a reliable staining protocol for STHdhQ7/Q7 cells to ask further scientific questions.

Mentor(s):

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

Xueqi Tang, Purdue University

Poster Presentation Abstract Number: 563 :: Life Sciences

College of Science

Stage fright? Sequence and timing of infection with different parasite life stages impacts host-parasite life history

Author(s):

Bailey Pyle, College of Science

Abstract:

Coinfection with multiple parasites can alter parasite success and host life history events when compared to single infections. These effects are further complicated by the timing of each parasite's arrival, host immune system, and interspecific interactions between coinfecting parasites. In this study, we examined how the arrival order of two parasites may influence host and parasite ecology. We exposed Biomphalaria glabrata snails to both Schistosoma mansoni miracidial and Echinostoma caproni cercarial parasites. Hosts were exposed to E. caproni cercariae at distinct time points relative to their exposure with S. mansoni miracidia: before miracidial exposure (PRE), simultaneously with miracidial exposure (SIM), and after miracidial exposure (POST). We subsequently measured the effects of coinfection on snail reproduction, snail mortality, infection prevalence, and infection intensity (S. mansoni cercarial output and E. caproni metacercarial cysts). Overall, we found no differences in snail reproduction. However, snails infected only with S. mansoni and snails infected first with S. mansoni followed by E. caproni both shed more cercariae than snails exposed to both parasites simultaneously. We also saw significant differences in survival with snails exposed to both parasites simultaneously and snails exposed to S. mansoni followed by E. caproni both having significantly lower survival than uninfected snails, due to S. mansoni infection prevalence. Thus, there are significant impacts of E. caproni metacercariae on S. mansoni establishment and reproduction, but survival patterns are driven by S. mansoni alone. These findings support the importance of considering the community of parasites within hosts when exploring infection outcomes and disease dynamics.

Mentor(s):

Dennis Minchella, Biological Sciences, College of Science

Trevor Vannatta, University of Minnesota

Grace Schumacher, Purdue University

College of Liberal Arts

Integrating Chimpanzee Research With Wildlife Conservation and Management at Niokolo-Koba National Park, Senegal

Author(s):

Diana Quintero Bisono, College of Liberal Arts

Isabelle Adnson, College of Liberal Arts

Abstract:

Longitudinal research is a proven method for wildlife conservation because the presence of researchers deters the illegal extraction of protected species in the area. We leverage this causal relationship to synchronously generate basic and applied streams of research on chimpanzees (Pan troglodytes) in Niokolo-Koba National Park, Senegal. Our basic research aims to understand how chimpanzees adapt to an extremely hot and dry savanna landscape. At the same time, we collect scientific data on mammals to aid the park's ecological monitoring program. Here, we present the results of ecological monitoring from 2020-2021. The field research team used reconnaissance and vigil methods to locate chimpanzees, chimpanzee night nests, and other mammals. We estimated nest age with a nest decay rate and reported frequencies for nests estimated to be 1-7 days old (i.e., fresh and recent nests). Chimpanzees were directly observed 19 times and we located a total of N=616 nests (55% fresh, 45% recent). We recorded 18 mammal encounters representing 30 distinct species. Chimpanzees and other mammals were commonly encountered. Findings will be shared with the park system and international stakeholders, including the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Union for Conservation of Nature. Moreover, our study strengthens a petition to remove the park from the list of UNESCO World Heritage Sites "In Danger", as we evidenced capacity for scientific monitoring of emblematic species.

Mentor(s):

Stacy Lindshield, Anthropology, College of Liberal Arts

Papa Ibnou Ndiaye, Cheikn Anta Diop University

College of Science

Linearly Paired Variational Autoencoders as a Generative Method of Maximizing the Observational Value of Spectroscopic Measurement of Transients

Author(s):

Jack Reynolds, College of Science

Abstract:

We propose a novel implementation of Variational Auto Encoders (VAE) using contrastive learning to maximize the value of observationally expensive spectroscopic measurements of optical transients. The novel system introduced by this work, a Linearly Paired Variational Auto Encoder (LP-VAE), demonstrates the ability of machine learning algorithms to ingest a variety of supernova spectroscopic observations and using a data driven approach predict both future and past epochs of those events. This is done by "pairing" multiple VAEs and providing a linear loss to the implicit latent space each VAE produces, with only the maintained deep feature of the VAE changing. The linear loss acts to have each transient event follow a linear path through the high dimensional latent space. The initial implementation utilizes 392 supernova events ranging 3767 spectroscopic measurements gathered from the Open Supernova Catalogue publicly available data. We produced 9 spectroscopically completed supernova over the trained types as examples to show effective predictions for peak, pre-peak, and post-peak observations as well as including fitted photometric light curves for additional reference. This implementation of the novel LP-VAE will also be available for the community to complete and test more spectroscopic events though Github. We argue that systems that augment spectroscopic observation and maximize value, such as the presented LP-VAE, act to make the best use of previous observations and act as a valuable data enrichment for spectroscopic transients in the era of all sky surveys.

Mentor(s):

Danny Milisavljevic, Physics & Astronomy, College of Science

Poster Presentation Abstract Number: 566 :: Social Sciences/Humanities/Education

<div align="center">

College of Health and Human Sciences

Personality Vs. Taste

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Author(s):

Samuel Richman, College of Health & Human Sciences

Sonya Kraft, College of Science

Pavit Hooda, College of Engineering

Frank Qiao, Exploratory Studies

Abstract:

Mentor: Mario Perez-Ahuatl (mperezah@purdue.edu - College of Agriculture, Biochemistry - Student Mentor)

Researchers: Sonya Kraft (krafts@purdue.edu - College of Science, Mathematics - 2025), Sam Richman (sirichma@purdue.edu - Biomedical Health Sciences- 2025), Pavit Hooda (phooda@purdue.edu Aeronautical and Aerospace Engineering - 2025), Frank Qiao (qiao51@purdue.edu - Exploratory Study - 2025)

The purpose of our research was to see if there was a correlation between an individual's personality traits, in regards to introversion or extroversion, and preference of sweet or bitter taste. This was accomplished by surveying a significant sample size with two Richter scales. The first one asked the participant to rank their personality from one to five, one being introverted, and five being extroverted. The second scale asked participants to rank their preference for either sweet or bitter. This scale had one being sweet and five being bitter. After taking a sample of 210 students at Hillenbrand dining court, we found that the personality graph had a normal distribution, whereas the taste preference graph is skewed right. When compared to each other, we see that across all personality types, sweet-tasting food has been the largest preference. This implies that there is no strong correlation between one's personality type and taste preference.

Mentor(s):

Mario Perez-Ahuatl, Biochemistry, College of Agriculture

College of Liberal Arts

Exposure to Conflicting Accounts in News Media Makes Democrats More Susceptible to Disinformation

Author(s):

Shye Robinson, College of Health & Human Sciences

Abstract:

It has been well-established that Republicans are more likely than Democrats to view and interact with online political disinformation that traffic in partisan conspiracies. However, little is known about why this asymmetry exists. This study proposes a concept of epistemic cacophony – exposure to conflicting accounts from conflicting authorities in a given knowledge domain – to examine the degree to which partisan asymmetries in susceptibility to political disinformation are driven by uneven exposure to conflicting accounts in news. To do this, I conducted two survey experiments on Amazon Mechanical Turk (Mturk). In experiment 1, Republicans were more open to partisan conspiracies at baseline but exposure to epistemic cacophony made strong Democrats more open, eliminating this gap. In experiment 2, the effect of epistemic cacophony is weaker but still contributed to closing this gap. Additionally, ideologically heterogenous media diets were associated with increased openness to partisan conspiracies among Democrats. Together, these experiments show that exposure to epistemic cacophony makes strong Democrat partisans more open to partisan conspiracy narratives while this effect is not observed among Republicans. Implications of epistemic cacophony are discussed for research on political polarization and disinformation as well as non-political knowledge domains.

Mentor(s):

Marcus Mann, Faculty, Purdue University

Poster Presentation Abstract Number: 568 :: Life Sciences

<div align="center">

College of Science

Analysis of Mechanistic Understanding in Biofilm Data

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Author(s):

Gabrielle Rump, College of Science

Abstract:

An important goal in undergraduate biology education is for students to be able to construct and reason about mechanistic explanations of biological phenomena. However, literature shows that these skills are challenging for students. Therefore, it is important to evaluate how students organize their ideas and build connections when describing biological phenomena. In this qualitative research project, we interviewed nine underclassman students majoring in varying fields of biology, asking them to describe a particular biofilm development transition point, using a provided diagram. Their descriptions, or 'mechanistic models' (MMs), were then challenged with a perturbation question, where something within the cell would be affected. The students were then tasked to describe how the transition point, and subsequently their MMs, would change. Their responses to the perturbation question were analyzed using inductive coding, in which we categorized the data based on trends that emerged during analysis. We found high variance in what students believed would happen as a result of the perturbation, such as differing cell behaviors. Students either clearly provided a specific point of change to their original MM (7/9) or did not (2/9). Additionally, some students (5/9) made modifications to their original MM such as changing the order that events occur. All students were able to reason appropriately through their MMs based on the perturbation, although the variance in answers demonstrates that while many of the students take the same biology courses in their undergraduate careers, the way that they approach and respond to biological issues varies greatly.

Mentor(s):

Sharleen Flowers, Biological Sciences, College of Science

Stephanie Gardner, Purdue University

College of Engineering

A brief genomic analysis of the Streptomyces Phage JimJam (Genes 241-254)

Author(s):

Saaniya Rupani, College of Engineering

Abstract:

Streptomyces Phage JimJam was isolated from an enriched soil sample in Evansville, Indiana in the year 2019. It is one of 20 phages in the BE2 cluster and is currently being annotated. The group was assigned genes 241-254, and these genes were annotated and analyzed using bioinformatics tools including DNA Master, PECAAN, Phylogeny.fr, Splitstree, Phyre2, and PyMOL. As a draft phage, it is important to annotate every gene in order to have a better understanding of the phage genome itself, as well as the overall DNA sequence and function in other similar bacteriophages. This study aims to learn more about the JimJam genome through comparisons in evolutionary history, gene function, and protein structure in order to contribute to overall phage research for future applications in biotechnology.

A unique discovery in this genome involves gene 245 in Jim Jam, annotated and called as a ParB-like nuclease domain protein, which is the only gene with a function of the ones annotated so far. After further inspection using phylogenetic trees, it was observed that only 2 other phages within the BE2 cluster, Starbow and Birchlyn, shared this specific gene and gene function. A ParB-like nuclease domain protein is involved in chromosome separation and cleaves single-stranded DNA. Phyre2 called the function as DNA binding protein and ParB, both called with higher than 95% confidence, which gives significant evidence that this gene does in fact have a function that affects DNA. Future analysis will be conducted on the JimJam genome.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Taylor Sorrell, Purdue University

Garret Manquen, Purdue University

College of Engineering

Data Mining Functions in Earth History Visualization

Author(s):

Vishrant Saagar, College of Engineering

Mason Burgess, College of Engineering

Ching Chia Huang, College of Engineering

Abstract:

TimeScale Creator is a free Java program that enables you to explore and create charts of any portion of the geologic time scale from an extensive suite of global and regional events in Earth History. The program uses a database of over 20,000 biologic, geomagnetic, sea-level, stable isotope, and other events. Our team's goal this semester was to add more features to the program's data mining settings. We continued using the Java programming language on this program to add the features without changing the overall functionality of this program. The data mining features include an option to have two curves overlay on each other. This allows the user to see correlations between data for given times. For example, a user could overlay past temperature history with past carbon dioxide levels. Another feature to the data mining settings would be a statistical correlation for two curves using a sliding window. For example, a user can deduce if there were times in the past when an increase in carbon dioxide did not cause an increase in global or regional temperature.

Mentor(s):

James Ogg, Not a Purdue West Lafayette Employee, Not a Purdue West Lafayette Employee

Aaron Ault, Purdue University

College of Engineering

Jaywalking Behavioral Study

Author(s):

Kian Schifferdecker, College of Engineering

Nishka Awasthi, College of Health & Human Sciences

Zhaoqi Wang, College of Pharmacy

Abstract:

Students jaywalking is a prevalent issue on college campuses across the US. This paper focuses on jaywalking in a large midwestern university, and seeks to answer the question: "How do various factors such as apparent gender, phone usage, or mode of transportation influence students as they cross traffic intersections?"

Two major intersections were chosen out of the major intersections at the campus on the basis of a generalized number of jaywalkers. and were observed for jaywalkers as well as the number of cars crossing in a one-hour interval. Variables recorded included apparent gender, active and passive use of phones, whether cars were actively driving across the road, and whether the student was in a group or walking alone. Each variable was marked with either a yes or a no.

Data were extrapolated into percentages to be interpreted, with a 'yes' or 'female' marked as one and vice versa. The data suggest that these factors do not necessarily deter students from jaywalking, and some, such as walking in a group, may, in fact, encourage it.

It is vital to investigate further into other factors that influence jaywalking on college campuses, including time and motivation. Such investigations can help to create better legislation or regulations to protect the students and drivers on campus.

Mentor(s):

Thomas Gerrish, Faculty, Purdue University

Sarah Huber, Purdue University

Krannert School of Management

The Importance of Marketing to College Town Businesses

Author(s):

Rishi Shah, School of Management

Abstract:

Redacted.

Mentor(s):

Gerald DeHondt, Faculty, Purdue University

Krannert School of Management

A Natural Language-Based Phishing Detection and Risk Prevention System

Author(s):

Elena Shen, School of Management

Christine Zhou, College of Science

Ya-Fei Lin, College of Health & Human Sciences

Abstract:

We researched and developed a natural language-based phishing detection and risk prevention system that allows one to accurately predict if an email is phishing email. The motivation for this work is the rise in cyber-attacks via malware or ransomware, particularly against company's environments. Our approach provides an extension app that alerts the user when a particular email shows signs of phishing risks. Users have the ability to report the email. With the data gathered, the app is able to predict similar phishing emails and warn users ahead of the time. The more data gathered, the higher the accuracy of the prediction rate. We achieved 97.31% AUC. This work was presented in the recent Crossroads Classic Analytics challenge among Butler University, Indiana University, Purdue University, and the University of Notre Dame where we won first place in the undergraduate division.

Mentor(s):

Matthew Lanham, Quantitative Methods, School of Management

College of Engineering

Identifying the Purpose and Significance of the Band-7 Membrane Protein in Bacteriophage JimJam

Author(s):

Jagroop Singh, College of Engineering

Sebastian Wojcik, College of Engineering

Alicia Zeh, College of Engineering

Abstract:

The study of bacteriophages is important as phages have many applications such as food safety, phage therapy, and cancer treatment. The use of phages is prohibited for these purposes until the function of the genes within the phage and other relevant information is well understood. The purpose of this study was to annotate a bacteriophage gene to see how it functions and what purpose it serves. The gene located at base pairs 90741 to 91607 from bacteriophage JimJam was chosen to be annotated. From the annotation, this gene appeared to be a membrane protein, more specifically a band-7 like membrane protein. PyMol and Phyre2 were used to analyze the function of the protein in relation to its structure, the phylogeny was studied using SplitsTree and PhyML, and self-developed python code performed mutation analysis between the JimJam bacteriophage and the genome of other bacteriophages. Protein structure results concluded that the gene was encoded for a SPFH membrane protein which is in the band 7 domain implying that its function is similar to others in this domain. The SplitTree concluded that the gene in JimJam shares a common ancestor with the other two genes in its Cluster BE, implying that these genes are highly similar in structure and function. Mutational Analysis with highly similar genes within the pham showed that there are few mutations, implying that the mostly conserved sequence may be necessary for its proper function. This study is still ongoing so final conclusions and implications have not been drawn.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Taylor Sorrell, Purdue University

Lauren Novak, Purdue University

College of Engineering

Testing and Integration of Flow Controller for Leakage Emulation on Resilient Extra-Terrestrial Habitat Institute's Cyber-Physical Testbed

Author(s):

Shantanu Sinha, College of Engineering

Abstract:

The future exploration of space will rely on Earth-independent habitat systems. The habitat systems should function under various challenges, including health management during long crew absences (dormant states) and catastrophic situations. Safety and resilience to a wide range of anticipated—and unanticipated—conditions represent a multidisciplinary engineering and scientific challenge. The NASA-funded Resilient Extra-Terrestrial Habitat Institute is building knowledge toward developing such systems. To evaluate unique design alternatives, each needs to be tested in a harsh environment. To this end, a multi-physics cyber-physical testbed is under development at the Ray W. Herrick Laboratories at Purdue University. When completed, the testbed will be capable of simulating a breadth of hazardous conditions, including exposure to extreme temperatures and structural collisions. An airtight dome is under development to integrate a set of systems required to simulate lunar conditions (e.g., thermal management, pressure management, command and control, robotic agents). The airtight dome will interact with a thermal transfer system to establish proper boundary conditions between cyber and physical components. An essential part of the dome is a series of flow controllers that will enable the emulation of habitat leakage scenarios. The result of this study is essential to establish this cyber-physical testbed that will pave the way for experiments on the safety and resiliency of future habitat designs.

Mentor(s):

Davide Ziviani, Mechanical Engineering, College of Engineering

Amin Maghareh, Purdue University

Jaewon Park, Purdue University

Mahindra Rautela, Purdue University

College of Science

Characterization of Drug Candidates as Lowe Syndrome Therapeutics

Author(s):

Lisette Skiba, College of Science

Abstract:

Lowe syndrome (LS) is an X-linked disorder with a poor prognosis. Most patients do not survive past late adolescence, usually due to progressive renal failure. LS is caused by mutations in the OCRL1 gene that lead to dysfunction of the encoded inositol-5-phosphatase, Ocrl1. No cure exists at this time. Current therapeutics are intended manage the various resulting clinical manifestations, which include chronic issues with the eyes, brain, and kidneys. The purpose of this study was to characterize the action of selected drug candidates that target the defective enzyme, and to evaluate whether these candidates are capable of rescuing Golgi complex fragmentation and defects in ciliogenesis in cells expressing mutant Ocrl1. We identified candidates LC9, LC10, and LC13 as effective in rescuing these phenotypes. Further studies are needed to confirm that phosphatase activity is rescued in addition to cellular phenotypes. Additionally, further analysis of mutant structures will be required to determine potential drug binding sites.

Mentor(s):

R. Claudio Aguilar, Biological Sciences, College of Science

Jennifer Lee, Purdue University

College of Engineering

Mutational, Phylogenetic, and Protein Function Analysis of Gene 172 in YemiJoy2021 Phage

Author(s):

Britney Smitley, College of Agriculture

Bram Rasmussen, College of Agriculture

Anjana Narayanan, College of Health & Human Sciences

Abstract:

The purpose of this poster is to display the evaluations of the start site and function of gene 172 in phage YemiJoy2021. Furthemore, the poster will display the protein structure, genetic mutations, and a comparison of evolutionary relationships between YemiJoy2021 gene 172 and genes of other phages within the same cluster. The function of gene 172 was found to have two functions, the first function being a D-Ala-D-Ala carboxypeptidase and the second function being a minor tail protein . YemiJoy2021's auto annotated gene 172 matched with both Abrogate_330 and Alsfro_36 phages gene 172. Other genes of D-Ala-D-Ala carboxypeptidase function and second function being a minor tail protein function were found through PhagesDB and were evaluated based on strengths of evolutionary relationships. Phages in clusters A, C, F, and D will be tested to see whether they have strong relationships with gene 172. Mutation analysis of gene 172 will be compared to other genomes where we will be able to identify the location of the mutation. Identifying the DNA as a transition or transversion, identifying the conversion of DNA to amino acids, and identifying the DNA as synonymous or nonsynonymous will be done using a python code. This will allow us to compare gene 172 to other genes similar in function and identify if the mutations in gene 172 line up with mutations in other DNA sequences.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Krannert School of Management

Returns to institutional investors in emerging markets (China and India) in IT, AI and Healthcare sector

Author(s):

Nanditha Srinivasan, School of Management

Abstract:

Over the last decade emerging markets have taken strides toward becoming worldwide powerhouses. Countries that were once only looked at for low-cost labor and production have now become leaders in innovation and technology. Their capital markets played a key role by channeling a substantial amount of resources to companies in AI, IT, and healthcare industries. I focus on China and India to show that native companies raised more than $130 B in initial public offerings (IPO) over the last decade, compared to $3 B ten years before. The high and positive returns one year after the IPO indicate the market perceives these companies to create value, as opposed to white elephants, common to previous government-driven investments in emerging markets.

Mentor(s):

Fabrício d'Almeida, Faculty, Krannert School of Management, Purdue University

College of Education

Mobile Assistive Technology in a Non-Traditional High School Setting: A Case Study

Author(s):

maya steinhart, College of Education

Abstract:

As mobile technology becomes more available, it's potential as an assistive technology has greatly increased. This project focused on staff perceptions of mobile assistive technology's (MAT) impact on student self-determination at an adult high school. The aim of this project was to determine staff perceptions of these technologies and their potential impacts on students in order to improve MAT programming at the participating school. Data was collected using a semi-structured interview format. Staff perceived read aloud features as having the most potential benefit. They perceived MAT features that support student coping and communication skills, ELA skills, goal tracking, reminders, redirection, and ELL support features as having potential benefits. They perceived resources and a lack of knowledge about MAT as the largest barriers to accessing it. Findings indicate that staff would benefit from professional development in identifying and using MAT that is aligned with student needs, as there was high variability in responses. Recommendations for types of professional development as well as existing MAT that meet staff perceptions of student needs are given. These recommendations are intended to empower staff members to develop an improved MAT program for their students.

Mentor(s):

Mandy Rispoli, Educational Studies, College of Education

Poster Presentation Abstract Number: 580 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

FPGA Emulation of AFTx06 Processor

Author(s):

Albert Sun, College of Engineering

Grant Goldenberg, College of Engineering

Abstract:

Field-programmable gate arrays, commonly referred to as FPGAs, are programmable devices capable of performing hardware emulation for RTL designs at the gate level. FPGA emulation can provide significant benefits compared to software simulation including significantly reduced execution time and peripheral integration. Our project intends to integrate FPGA emulation into SoCET's silicon design flow for their AFTx06 RISC-V processor. The RTL FPGA wrapper for the AFTx06 both instantiates external memory through on-FPGA M9K memory blocks (of which the loading/dumping of memory contents can be automated through Altera scripting utilities) and integrates on-board peripherals through memory mapping. Drivers written in C will provide the necessary framework to interact with these memory mapped peripherals and will also provide a foundation for communication with the FPGA through interfaces such as UART. These communication interfaces will be critical in order to develop more complex software for AFTx06, to complete benchmarking using the Embench suite, and to gather other important runtime data. Providing a physical platform for emulation before physical chips are available through tapeout allows for parallel software development, which can be further streamlined through C drivers, Python wrappers, and TCL scripts.

Mentor(s):

Mark Johnson, Electrical & Computer Engineering, College of Engineering

Cole Nelson, Purdue University

College of Liberal Arts

The Repo Pandemic: Cars, Collection, and the Socioeconomic Fallout of COVID-19

Author(s):

Abigail Taylor, College of Health & Human Sciences

Abstract:

Tens of millions of Americans are newly unemployed, facing unprecedented financial hardships, and numbers expecting to grow due to the consequences of the COVID-19 pandemic. Automobiles are U.S. households' most valuable piece of movable property and is also essential to households' income-earning capacity. This constitutes a paradox: when people do not pay their bills, their vehicles are repossessed, which creates a new obstacle to financial solvency. Since previous research has not documented or analyzed repossession, and existing literature on the subject is limited, Dr. Headworth's research seeks to address the paradox, gathering social scientific evidence about the repo process and its consequences. Three primary questions this research aims to answer are: (1) How are new technologies shaping repossession? (2) How does repossession affect present and future socioeconomic disadvantage? (3) What can vehicle repossession teach us about the socioeconomic fallout of the COVID-19 pandemic, and how can those findings inform preparations for and responses to future crises? This study documents vehicle repossession in the Midwestern U.S. in two phases: ethnographic observations, semi-structured, qualitative interviews, and field research with both repossession agents (phase one) (1), and qualitative interviews with repossession targets (phase two) (2) (3) with subsequent data analysis drawing on applying broad index codes to identify major themes. This research is currently focused on phase two – involving qualitative, semi-structured interviews (2) (3). In terms of effect, this research offers important insights about what repossession means for living conditions and economic opportunity as people attempt to recover from the pandemic's impact.

Mentor(s):

Spencer Headworth, Sociology, College of Liberal Arts

College of Education

Analyzing the Economic Benefits of the Continuation of the Deferred Action for Childhood Arrivals

Author(s):

Tania Pliego Torres, College of Health & Human Sciences

Abstract:

The Deferred Action for Childhood Arrivals (DACA) was erected in 2012 under the president's Obama administration with the main goal to extend the benefits for undocumented students to pursue higher education by providing them with a temporary social security number that would allow them to build a normal life in the United States without the fear of deportation. DACA, however, was threatened under Donald Trump's presidency leaving millions of undocumented students vulnerable to deportation. With the future of DACA hanging by a thread, the economic benefits of DACA and its ability to allow undocumented students to pursue higher education is imperative in order to produce an argument for DACA to remain functioning permanently and allow this rapidly growing demographic to actively participate within our society. The economic benefits of allowing DACA to remain an active program in the United States include delivering billions of dollars in income and surplus taxes which can be used to improve conditions across various sectors. If DACA is eliminated entirely, the United States risks losing billions of dollars, contributing to poorer conditions in communities. The analysis of the economic impact of the immigrant community will be in the form of a synthesis of the literature.

Mentor(s):

Dr. Christine Kiracofe, Educational Studies, College of Education

College of Agriculture

Characterizing novel regulators of plant seed size and weight

Author(s):

Arianna Uribe-Melchor, College of Agriculture

Abstract:

Previous research has been done using technology like CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) that can specifically change genes to improve agronomic traits like plant height, seed yield, etc. Our research uses a polymerase chain reaction (PCR) and gel electrophoresis to understand plant changes through the evolution of traits being gained or lost with Arabidopsis thaliana.To understand which genes specifically improve agronomic traits we used a polymerase chain reaction (PCR) to help amplify and make the target part of the DNA strand bigger for analysis. Then, using gel electrophoresis we were able to separate the DNA fragments to better understand where mutations occurred and how genes that connect to specific traits change based on the presence of specific genes. Following gel electrophoresis we compare the weight of 100 seeds between the mutants that were found and the wild-type seeds. It is important to note that wild-type seeds are those that have the normal phenotype. Comparing and analyzing seed weight allows us to select for the set of genes that are more favorable for a trait of interest. Overall, our goal is to understand novel regulators of plant seed size and weight.

Mentor(s):

Kranthi Varala, Horticulture & Landscape Architecture, College of Agriculture

Rajeev Ranjan,

College of Science

Neurotoxic effects of Per- and Polyfluoroalkyl Substances exposure on cognitive function in humans and neurotransmitter dysfunction in C. elegans

Author(s):

Mia Utayde, College of Science

Abstract:

Perfluoroalkyls substances (PFAS) are anthropogenic chemicals with ability to repel oil, grease, and water. Perfluorooctanesulfonic acid (PFOS) has been a dominant PFAS until voluntarily phased out in 2000. PFOS still poses an emerging health and environmental concern due to its long biological half-life. Increasing literature identifies PFAS as a potential neurobehavioral toxicant, though there is conflicting evidence regarding the associations of PFAS exposure with cognitive disorders. A widely studied potential mechanism for PFAS induced neurotoxicity is neurotransmitter dysfunction. Previous studies revealed selective vulnerability of dopaminergic neurons to PFOS. The extent to which cholinergic neurotransmitter systems become susceptible to PFOS-mediated neurotoxicity is largely obscure. This study aimed to elucidate the potential neurotoxicity of PFOS by examining PFOS exposure on behaviors in animal models and its association with cognitive function in humans. Caenorhabditis elegans were assessed for behavioral deficits after a 48 hour exposure to PFOS. Dopamine-associated behavior was ascertained through 1-Nonanol assays. The effects of cholinergic transmission and nicotinic acetylcholine receptors were examined through Aldicarb and Levamisole assays. Case studies for several human subjects at-risk for psychosis were reported, revealing PFAS exposure levels and consequent neuropsychological and symptomatic measures. The expected results will provide novel insights into the PFOS led neurotoxicity at mechanistic and clinical levels, contributing to the larger understanding about PFOS mediated neurotoxicity and its implications for neurodegenerative disease and cognition. Our next focus is to study the role of BH4 on PFOS led neurobehavioral affliction specific to dopamine and acetylcholine neurotransmitters.

Mentor(s):

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

Daniel Foti, Psychological Sciences

Shreesh Sammi, Health Sciences

College of Engineering

Characterization of In Vivo Murine Aortic Valve Dynamics Using Four-Dimensional High-Frequency Ultrasound

Author(s):

Aletea vanVeldhuisen, College of Engineering

Abstract:

The aortic valve frequently becomes diseased, with more than five million Americans being diagnosed with heart valve disease each year [1]. Currently, surgical intervention is the only effective treatment for calcific aortic valve disease, which often becomes ineffective within the patient's lifetime [2]. While several studies have examined disease progression in vivo, there is currently no method to adequately assess how ongoing calcification impacts leaflet dynamics. Using novel methods of four-dimension high-frequency ultrasound (4DUS) imaging, we have for the first-time extracted dynamic, volumetric data of in vivo murine aortic valves, reconstructing geometry of mouse aortic valves (AoV) at fully open and close states. As validation, we obtained high-resolution µCT images of ex vivo mouse AoV at the closed state and showed its consistency with the reconstructed in vivo mouse AoV geometry via ultrasound. Pulse-wave Doppler data was analyzed as well to characterize blood velocity in the aortic valve averaged across numerous cardiac cycles. Successful segmentation and surface reconstruction of the open and closed state of the aortic valve in three mouse subjects was completed, demonstrating the ability to use high-frequency 4DUS to reconstruct mouse AoV geometry in its natural state With further study, a more accurate picture of mouse AoV kinematics can be assessed, allowing for the possibility of longitudinal characterization of murine disease models in the future.

[1] V. T. Nkomo, J. M. Gardin, T. N. Skelton, J. S. Gottdiener, C. G. Scott, and M. Enriquez-Sarano, "Burden of valvular heart diseases: A population-based study," Mayo Clinic, 19-Jun-2015.

[2] C. F. T. van der Ven, P.-J. Wu, M. W. Tibbitt, A. van Mil, J. P. G. Sluijter, R. Langer, and E. Aikawa, "In vitro 3D model and MIRNA drug delivery to target calcific aortic valve disease," Clinical science (London, England : 1979), 01-Feb-2017.

Mentor(s):

Craig Goergen, Biomedical Engineering, College of Engineering

Daniel Gramling, University of California San Francisco

Xinzeng Feng, UT Austin

Michael Sacks, UT Austin

College of Engineering

Investigation into the Impact of Transversion Mutations on Amino Acid Expression and Conservation of Mutation Across a Pham

Author(s):

Stephen Verhoff, College of Engineering

Milo Anderson, College of Engineering

Ian Ophaug-Johansen, College of Engineering

Abstract:

Bacteriophages are viruses that target bacterial cells. They are abundant and genetically simple. These two traits make them a common choice for studies involving DNA modeling or protein analysis. Phage are prone to transition and transversion mutations. A transversion mutation is when the nucleotides of the DNA sequence change from a pyrimidine to a purine or vice-versa. Genomic information is contained within four unique base pairs, whose order determines which amino acids will be used to build the protein each gene codes. Three base pair long sections of the genome, called codons, are how this information is interpreted. Each codon represents an amino acid. Because there are only 22 amino acids, and 64 possible codons, many amino acids have multiple codons they correspond to. Mutations, however, still occur. We aim to answer how transversion mutations on different locations of the codon affect the shape of the protein and its descendants, and if this trait is conserved throughout the pham. One hypothesis is that mutations within the last bp of the codon will be the least likely to result in a change in the amino acid. Another is that the conservation of this trait within a pham will be based on how early in evolutionary time the mutation was introduced into the pham. New mutations will be less likely to be conserved, while older mutations will be more likely. The utilization of resources such as PyMol, SplitsTree, and Python will help to analyze JimJam's evolutionary history and mutations.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Taylor Sorrell, Purdue University

Allison Ayers, Purdue University

College of Liberal Arts

The Role of Printer's Marks in Early Modern European Print

Author(s):

Erin Walker, College of Health & Human Sciences

Abstract:

An important component of rare books printed in the 16th, 17th, and 18th century is the printer's mark. These marks were created by the printer, often combining unique images, symbols, and mottoes. Printer's marks served as an easy way for the reader to identify who produced the book, where it was printed, and prevented others from falsely claiming the work as their own. With a sampling of printer's marks with Latin mottoes from 21 books printed between 1590 and 1773, each was translated from Latin to English and the meaning of the associated image was considered in the context of the motto. Many of the mottos have biblical origins or historical, cultural, or literary significance, though some do not connect to the corresponding image in any clear way, leading to research on where these mottos have been used elsewhere in history and our current world. Additionally, the images themselves were traced, including components of the images like recurring symbols or mythical figures, to gain insight on where they have been used and for what purposes. Printer's marks have not been widely studied and the most recent, comprehensive review of the topic was published in 1893. This presentation of a few printer's marks from a collection of rare books on Purdue's campus will remind others about their use and importance in the context of Early Modern European Print.

Mentor(s):

Elizabeth Mercier, Faculty, Purdue University

College of Engineering

Arduino-DAC Box Development

Author(s):

Hyeonwoo Wang, College of Engineering

Abstract:

Quantum computers operated by qubits. Qubits are operated through a high precision microwave. And in order to test qubits to successfully build a quantum computer, high precision voltage is required. As the lab was growing, we realized that we needed multiple high precision voltages in order to proceed with testing. Hence, I was tasked with building DAC voltage converters in order to aid the lab's research. First, I used an Arduino in order to control the user input, as well as an ethernet shield and chord in order to remotely control the Arduino. Next, I used DAC boards that received input from the Arduino in order to execute the instructions, and output the voltage through BNC/SMB cable.

Mentor(s):

Ruichao Ma, Physics & Astronomy, College of Science

College of Liberal Arts

Methods for Populism: The Environment and Congressional Voting Patterns

Author(s):

Brandon Watson, College of Liberal Arts

Abstract:

The purpose of this project was to design a method for examining how populism shapes voting patterns for environmental policy in the US Senate. We first gathered ideology scores of Senators from GovTrack, which provides a score of 0-1 based on bill cosponsorship, with 0 being left-partisan, .5 moderate, and 1 right-partisan. We selected Senators who were in Congress from 2013-2020 and chose 4 Democrats and 4 Republicans for analysis. For each party, we selected 2 Senators who had stable scores across their terms and 2 who had significant variation in ideology. Within these categories, we further selected 2 Senators who were partisan and 2 who were moderate according to their 2020 score in order to have a wider view of populism's impact on different legislators. We then gathered these Senators' League of Conservation Voters environmental scores, which provides a score of 0-100 based on how pro-environment their voting patterns are. Finally, we adopted a rubric for populist rhetoric from Us and Them: Populism in the United States by Julia E. Pfau. We chose 8 speeches for each Senator for 2013-2020, and we assigned a score of 0, 1, or 2 to each speech: 0 being not populist, 1 being partially populist, and 2 being populist. This score was created using the aforementioned rubric and with manual hand coding. By utilizing and comparing these three scores, our work creates a viable framework through which the impact of populism on voting patterns can be examined and further researched.

Mentor(s):

Tara Grillos, Political Science, College of Liberal Arts

Poster Presentation Abstract Number: 590 :: Social Sciences/Humanities/Education

Honors College

The Impacts of COVID-19 on the Sense of Belonging of College Students

Author(s):

Elise Winn, College of Science

Abstract:

The COVID-19 pandemic has disrupted the way students communicate and develop communities amongst themselves. The purpose of this research study is to investigate the impact of COVID-19 on college communities, social media communities, and the sense of belonging at universities, specifically at Purdue University. As COVID-19 forced students to find new, virtual ways of communicating and interacting with others, this research looks at the impacts of this new way of interacting with others. Social media accounts, including comedy accounts, institution-affiliated accounts, and student organization social media accounts were investigated to observe students making connections with others in a virtual setting throughout the COVID-19 pandemic. The researcher looked for indications of a sense of belonging at the University, as well as formation of virtual communities during the 2020-2021 academic year. This research helps identify the experiences, traditions, and opportunities that continue to interest students to commit to and stay at Purdue University.

Mentor(s):

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

College of Agriculture

Characterization and Analysis of Phage Phabuloso, Gene 48 Through Protein, Mutation, and Phylogenetic Analysis

Author(s):

Taylor Wolt, College of Science

Iman Mevaa, College of Science

Bailey Czerkiewicz, College of Science

Abstract:

Bacteriophages are viruses that infect and kill bacteria. Phage applications extend far into looking for alternatives to antibiotics, engineering for drugs, along with emerging therapies to treat a variety of diseases caused by bacterial infections. In characterizing phages, their structures, mutations, and phylogenetic histories are analyzed. Visualizing protein structures establishes relationships between structure and function which is important for drug production and phage therapy engineering. Mutation analysis identifies differences in DNA sequences that may lead to adaptations. Phylogeny analyzes the evolutionary background of phage, shared features, and possible applications of unknown phage. Phage Phabuloso, gene 48 (tyrosine integrase) is analyzed with the above parameters, chosen due to its compatibility with analyzation methods. For the protein structure analysis, PyMOL and protein databases including RCSB are used to compare the structure of Phabuloso_48 (predicted by Phyre2) with the crystal structure of proteins with the same function. Comparison between Phabuloso_48 and genes of the same length is done to identify mutations using Python. Comparison of Phabuloso_48 is done using Phamerator and PhagesDB to select conserved genes among clusters which are then compared using phyML, Splitstree, and MEGA. Preliminary structural analysis showed an overlap of alpha-helices between Phabuloso_48 and a tyrosine recombinase. Mutational analysis shows 125 individual mutations when compared to Horus_48. The similarity is 88.6% and the transition to transversion ratio is 0.786. Most mutations occurred in the third position. Phylogenetic analysis revealed the conservation of Phabuloso_48 within cluster DN, but distant evolutionary relationships to clusters such as J and F.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Lauren Novak, Purdue University

College of Engineering

Managing Humidity in Electronics Using Water Vapor-Selective Membranes

Author(s):

Songhao Wu, College of Engineering

Allison Mou, College of Engineering

Abstract:

When water vapor enters an electronics enclosure and temperatures shift throughout the day rapidly in industrial applications, there is a risk of condensation, which could prevent the electronics from functioning and further damage the device. Traditionally, simple resistive heaters are employed to heat the enclosed air to avoid condensation, which can be energy-intensive and does not actually remove the water vapor. We have proposed a new concept that uses water vapor selective membranes to control the humidity inside electronics. Vapor selective membrane systems allow water vapor transport through the membrane while blocking air and have been employed in energy-efficient air conditioning applications. Similarly, they can be employed for removing humidity from electronics enclosures. The benefit is that, instead of constantly heating the device, the membrane can periodically remove the water vapor. In order to draw water vapor out, a difference in water vapor partial pressure must be applied. This can either be attained by using a vacuum pump or by heating the inside to raise the total pressure according to the ideal gas law. The objective of this research is to develop a simplified enclosure, that is representative of electronics enclosures, with integrated selective membranes and sensors for concept evaluation. Two designs including a vacuum pump and joule heating will be investigated. The expected results are testable prototypes with a reliable data acquisition system. In the summer, humidity removal performance tests will be conducted. Data acquired will be analyzed to benchmark prior modeling results.

Mentor(s):

David Warsinger, Mechanical Engineering, College of Engineering

James Braun, Purdue University

Andrew Fix, Purdue University

College of Agriculture

A Tri-Pronged Analysis of Phage Maby2021 for Identification of Novel Mechanisms for Anti-Cancer Therapies

Author(s):

Sara York, College of Agriculture

Hunter Smith, College of Agriculture

Ari Atlas, College of Engineering

Abstract:

Bacteriophages are viruses that reproduce through bacterial hosts by infection. Infection occurs through insertion of phage DNA into bacteria, copying itself within and lysing it, or inserting DNA, lying dormant, and surviving as genomic information until ready. Bacteriophages, as the name suggests, have been thought to have little-to-no effect on eukaryotic cells. However, evidence in recent years suggests there is use of phage therapy to influence cancer processes. Investigation of the phage genome evolution and how evolution play a role within structure and function of genes may reveal novel uses for phage-related cancer treatment. Analysis of the bacteriophage Maby2021's genome revealed a gene that has potential for clinical applications. Phylogenic, structural, and mutational analysis of Maby2021's gene 18 supports tumor suppressing functions which may be conserved across clusters. The potential of the gene was analyzed through family tree analysis by bootstrapping and familial closeness; structure-function analysis through PyMOL comparing proteins; and mutational analysis with MATLAB. There is conservation of gene 18 across other members of the C1 cluster, something that is not necessarily upheld in other clusters. The gene also showed 100% confidence with the HINT-family genes, since the crystal structure of a known protein when compared to Maby2021, had little variance from the known structure, having many conserved residues. The gene also showed low mutation counts with only one transversion and no transitions. This evidence supports our structure-function call and indicates that this gene may pose as a targeted mechanism for anti-cancer therapies.

Mentor(s):

Kari Clase, Agricultural & Biological Engineering, College of Agriculture

Lauren Novak, Purdue University

College of Engineering

Lab Localization with Deep Learning and AI Tracking

Author(s):

Timothy Zhou, College of Engineering

Benjamin Loshe, College of Engineering

Joseph Attardo, College of Engineering

Kaiwen Shen, College of Engineering

Ryan Boyd, College of Engineering

Shiqi Wang, College of Engineering

Abstract:

The purpose of this project is to enable the members of a lab to quickly get information about the usage of lab tools in a lab. This process will expedite the process of troubleshooting because users will have an easily accessible, detailed record of who used what equipment. Inputs for the project will be lab video recordings of the lab room as well as a designated areas of interest, drawn by a lab administrator. The outputs of the project will be a comprehensive database with tracking data for desired parameters and an interactive UI for easily viewable videos for desired zones/cameras/times. To produce the output, Tensorflow Object API will be used for human tracking and Flask framework will be used to develop the web application. Google Authentication and cloud deployment have been added for security of data.

Mentor(s):

Mithuna Thottethodi, Electrical & Computer Engineering, College of Engineering

Honors College

The Effect of Purdue's Raised Pedestrian Crosswalks on Yield Rates

Author(s):

George Ziavras, College of Engineering

Tristan Brideweser, College of Science

Benjamin O'Brien, College of Engineering

Shriansh Chari, College of Science

Abstract:

The ability to regulate traffic patterns and practices is essential to improving pedestrian and vehicular safety in high-population and urbanized areas. This study analyzes the impact of raised pedestrian crosswalks on the percentage of vehicles that yield to pedestrians at two intersections on Purdue University's main campus: the raised crosswalk at the Cordova Recreation Center and the standard crosswalk at North University Street and First Street. The percentage of cars that yielded at each intersection was counted, and the results were compared. Current results indicate that the presence of a raised crosswalk can increase the vehicular yield rate up to 27% on average. Further research is necessary to ensure that data is taken consistently across an adequate sample size. Despite the need for additional research, this data presents a necessary information base to begin improving pedestrian and vehicular safety in urban areas.

Mentor(s):

Daniel Froid, Honors College

RESEARCH TALKS

Talks sorted by session, room, and time. Spelling of names and titles as reported in conference submissions.
‡ - Denotes interdisciplinary project.　　　♦ - Denotes archival project.

SESSION 1: 9:40AM-11:00AM

ROOM: STEW 214A

9:40　Monon Neighborhood Livability Study
600　*Abigail Dimmick, Ryan Walter, Harris Collins*
　　　Mentors: Jason Ware

10:00　Probabilistic Computing for Graph Coloring Problem
601　*Haddy Alchaer*
　　　Mentors: Peter Bermel, Jie Zhu

10:20　Integrating a Vector Processing Unit into a RISC-V Microprocessor
602　*Owen Prince, Jing Yin See*
　　　Mentors: Cole Nelson

10:40　The Search for Mechanistic Explanations: Characterizing Biology Students' and Instructors'
　　　Connections Between Fundamental Biology Concepts
603　*Kal Holder*
　　　Mentors: Sharleen Flowers, Stephanie Gardner

ROOM: STEW 214B

10:00 ‡ The effect of Fatty Acid Synthase (FASN) depletion in pulmonary metastatic formation in breast cancer
　　　murine models
604　*Zilin Xianyu*
　　　Mentors: Eylem kulkoyluoglu, Michael Wendt

10:20 ‡ The Promise of Reversing Social Deficits in SCN2A Deficient Mice
605　*Benjamin Zirkle*
　　　Mentors: Muriel Eaton

10:40 ‡ Natural Language Processing for Discourse Analysis of Tweets About the COVID-19 Vaccine
606　*David Udo-Imeh*
　　　Mentors: Dan Goldwasser, Govanni Granados

ROOM: STEW 214C

9:40　Role of PP2A-B56a in KRAS-driven Transformation of Pancreatic Epithelial Cells and the Progression
　　　of Pancreatic Cancer
607　*Rebecca Shelley*
　　　Mentors: Brittany Allen-Petersen, Samantha Tinsley

10:00　Cortical circuits unifying bilateral space
608　*Chengyu Bi*
　　　Mentors: Scott Pluta, Hyein Park

10:20　Compressed sensing and the use of 3D UTE acquisition for high-resolution accelerated 23Na imaging
　　　at 3T
609　*Evan Pogue*
　　　Mentors: Uzay Emir, Deva Chan, Cameron Villarreal, Xin Shen

10:40   Using Magnetic Resonance Imaging and Magnetic Resonance Spectroscopy to Measure
        Neurochemicals Non-invasively in the Insula in Response to Pain.
610   *William Mahoney*
        Mentors: Uzay Emir, Nicholas Farley, Xin Shen

ROOM: STEW 214D

9:40   Momentary energy levels in healthcare professionals working with facility dogs
611   *Shania Sinha*
        Mentors: Clare Jensen, Marguerite O'Haire

10:00 ♦ Where did they come from, where will they go? The case of three invasive anurans
612   *Jackson Kirkwood, Addy Messerly*
        Mentors: Ximena Bernal, Andrew Mularo

10:20   Gender, Perceived Promotion Opportunities, and the Life Course: Patterns and Consequences
613   *Anna Szolwinski*
        Mentors: Kevin Stainback

10:40   Identifying Potential Pork-Barrel Legislation with Machine Learning
614   *Sunil Green*
        Mentors: Eric Waltenburg

SESSION 2: 11:00AM-12:00PM

ROOM: STEW 214A

11:00   Characterizing Occupant-Induced Pollutant Emissions in a Zero Energy and Emissions Building
615   *Reno Sarussi, Juan Pablo Novoa Benavides*
        Mentors: Nusrat Jung

11:20   Formation of Mars-like soils in southern Peru's hyper-arid Atacama Desert
616   *Faith Van Winkle*
        Mentors: Greg Michalski

11:40   Behavior and Fitness Consequences of Host Selection by Frog-Biting Mosquitoes
617   *Ethan Guardado*
        Mentors: Ximena Bernal, Katherine González

ROOM: STEW 214B

11:00 ‡ Assessment Of Skeletal Muscle Oxygenation During Exercise In Patients With Peripheral Artery
        Disease Using Near Infrared Spectroscopy: Impact of Skin Color And Adipose Tissue Thickness
618   *Byung Joon Pae*
        Mentors: Bruno Roseguini

11:20   The influence of a developmental lead (Pb) exposure on genetic risk factors of Alzheimer's Disease: a
        focus on Sortilin-related Receptor 1 (SORL1)
619   *Jenny Chen*
        Mentors: Jennifer Freeman, Keturah Kiper

11:40   Kanga: A Unified Controller Board For Thermoregulating And Monitoring Vitals In Premature Newborns
620   *Kevin Alessandro Bautista, Akio Fujita, Alyson Pickering*
        Mentors: Jacqueline Linnes, Orlando Hoilett, Sherri Bucher

ROOM: STEW 214C

11:00 Methylation-based Regulation of the Small GTPase, Ras, via Isoprenylcysteine carboxyl methyltransferase (ICMT)
621 *MaryClaire Cooke*
Mentors: Shalini Low-Nam, Ariana Cardillo

11:20 Comparing Work Environments in the Technology Industry Post-Pandemic
622 *Natalie Amodeo*
Mentors: Vetria Byrd

11:40 Presence of Copper Chaperone for Superoxide Dismutase (CCS) in Brain Choroid Plexus
623 *Vivian Hurn*
Mentors: Wei Zheng, Lara (Tianyuan) Sang, Luke (Luqing) Liu

ROOM: STEW 214D

11:00 Carboard as an Artistic Material: Its Uses and Complications
624 *Nicolas Dowling*
Mentors: Catherine Dossin

11:20 Genomic Diversity of SARS-CoV-2 on Purdue University Campus: Spring 2021
625 *Jack Dorman, Nicole Perry*
Mentors: Giovanna Carpi, Dennis Minchella

11:40 Optimization of Lipid Analysis for Anaerobic Digestion Feedstocks and Samples
626 *Kyra Keenan*
Mentors: Jennifer Rackliffe

SESSION 3: 1:20PM-2:00PM

ROOM: STEW 214A

1:20 Spectrophotometric Analysis of Synechococcus sp. Questions the Concept of the Q-cycle in Oxygenic Photosynthesis.
627 *Aaditya Prabhu*
Mentors: William Cramer

1:40 System on Chip Extension Technologies AFTx04 Post-silicon Validation using Printed Circuit Board
628 *Boon Kiat Julian Kang, Fan Jing Hoon, Pranav Srisankar, Roan Numa*
Mentors: Matthew Swabey, Mark Johnson

ROOM: STEW 214B

1:20 Toxicity of a "Forever Chemical" in an estuarine fish: does salinity mediate the toxicity of perfluorooctanesulfonic acid (PFOS)?
629 *Lucy Burcham*
Mentors: Tyler Hoskins, Elizabeth Allmon, Maria Sepulveda

1:40 Continual Monitoring of the Local Burying Beetle Prey Base on Nantucket and Block Islands
630 *Evan Kinnevan*
Mentors: Elizabeth Flaherty

ROOM: STEW 214C

1:20   Cost Model for Extra-terrestrial Habitat Evaluation
631   *Kathleen Martinus*
      Mentors: Shirley Dyke, Amir Behjat

1:40   Attitudes towards Mods
632   *Robert Hastidt*
      Mentors: Kathryn Seigfried-Spellar

ROOM: STEW 214D

1:20   Environmental Racism and Uranium Mining
633   *Aidan Andronicos*
      Mentors: Joshua Doyle

1:40   Investigating Manganese Transport through the Use of Small Molecules in an hIPSC-Derived Neuronal Model
634   *Kaitlin Stone*
      Mentors: Aaron Bowman, Anke Tukker

SESSION 4: 2:00PM-3:00PM

ROOM: STEW 214A

2:00 ‡ Light Curve Inversion for Robust Shape Reconstruction of Man-Made Space Objects
635   *Liam Robinson*
      Mentors: Carolin Frueh

2:20 ‡ SWARMS: Multi-Agent Control Simulation Platform
636   *Younggil Chang, Avi Dube, Konrad Kawnatra, Sully Cisco, Arjith Jegannathan, Jason Park, Jack Roy, Shashank Sridhar, Harrison Wongsonegoro*
      Mentors: Shreyas Sundaram, Tong Yao

2:40 ‡ A GUI for Measuring Cognitive Workload Stimulus in Human Robot Interaction
637   *Revanth Krishna Senthilkumaran*
      Mentors: Byung-Cheol Min, Wonse Jo, Ruiqi Wang

ROOM: STEW 214B

2:00   Optimization of Protein Analysis for Anaerobic Digestion Feedstocks and Samples
638   *Amanda Pisarczyk*
      Mentors: Jennifer Rackliffe

2:20 ‡ Towards the development of implantable biosensors with biocompatible adhesives
639   *Carl Russell III, Pei-Lun Chen*
      Mentors: Hyowon Lee, JongCheon Lim, Angel Enriquez

ROOM: STEW 214C

2:00   The Frog Giggers of Corydon: Exploration and Storytelling of Multispecies Relatedness between Humans and Frogs
640   *Saish Solankar*
      Mentors: Andrew Flachs

2:20 ♦ Metallographic and Portable X-Ray Fluorescence Analysis of Copper-based Metals from Fort
        Ouiatenon
641   *Samuel Bakeis*
        Mentors: Kory Cooper, Ian Lindsay

2:40   How Brain-like is your Artificial Neural Network?
642   *Aditi Anand*
        Mentors: Kaushik Roy, Sanchari Sen

ROOM: STEW 214D

2:00   Quantification of Folate Receptor Density as a Tool to Improve CAR T Cell Therapies
643   *Kenneth Rodriguez-Lopez*
        Mentors: Kevin Scrudders, Shalini Low-Nam

2:20   Macroscopic Resistance of Vanadium Dioxide during Metal Insulator Phase Transition
644   *Amit Rohan Rajapurohita*
        Mentors: Erica Carlson, Forrest Simmons

2:40   Methodological Changes in Global Food Security Studies during the Pandemic: Limitations and
        Recommendations
645   *Madeline Powers*
        Mentors: Nilupa Gunaratna, Ramya Ambikapathi, Morgan Boncyk

SESSION 5: 3:00PM-4:00PM

ROOM: STEW 214A

3:00   Antibiotic activity of Streptomyces Isolates
646   *Diane Santos*
        Mentors: Elizabeth Parkinson, Amir Alwali

3:20   Investigating the effects of an after-school program on the social well-being of urban youth
647   *Alexander Patton*
        Mentors: Jason Ware

3:40   Deviatoric Stress Driven Transient Melting Below the Glass Transition Temperature in Shocked
        Polymers
648   *Jalen Macatangay*
        Mentors: Brenden Hamilton, Alejandro Strachan

ROOM: STEW 214B

3:00   Modeling and Restoring Neurotypical Function in Scn2a Deficient Mice
649   *Jacob Paulaskas*
        Mentors: Muriel Eaton, Yang Yang

3:20   The reversibility of social deficits in adult SCN2A gene-trap mice
650   *Chau Phan*
        Mentors: Muriel Eaton

3:40   Discovery of a Novel Tunable SHP2 Covalent Inhibitor Scaffold by Fragment Screening

651   *Quyen Nguyen*
        Mentors: Zihan Qu, Zhong-Yin Zhang

ROOM: STEW 214C

3:00   Practical Implications for Great Saphenous Vein Closure Using a New Radiofrequency Ablation Catheter: A First Experience, Comparative Study

652   *Megha Gupta*
        Mentors: Oleg Sostin

3:20   The Great Chinese Famine and its Long-Term Health Consequences (1959-Present)

653   *Suhas Yernool*
        Mentors: Ray Douglas Hurt

3:40   Environmental Testing and Computational Modeling for NASA Solar Cruiser Sail Context Camera

654   *Becca Reinecke, Tasveen Chopra, Samantha Unger, Aleksey Urmanov*
        Mentors: Katherine Fowee Gasaway, Alina Alexeenko, Anthony Cofer

ROOM: STEW 214D

3:00   Needs, Challenges, and Coping Strategies of FEH in Tippecanoe County: A Providers Prospective

655   *Madeline Moser, Sophie Shank, Elinor Carmona, Shaulay Ward*
        Mentors: Yumary Ruiz, Carlyn Kimiecik, Natalia Rodriguez, Jason Ware

3:20   Structural determination of bacterial effector CteC

656   *Hannah Rondon*
        Mentors: Zhengrui Zhang, Chittaranjan Das

3:40   Chlorpyrifos and chlorpyrifos-oxon exposure leads to the dysregulation of basal glutamate release in human induced pluripotent stem cell derived glutamatergic neurons

657   *Adam Barmash Rubinchik*
        Mentors: Aaron Bowman, Anke Tukker

SESSION 6: 4:00PM-4:40PM

ROOM: STEW 214A

4:00   Effects of Novel Tumbling Application and Postmortem Aging on Cull Cow Beef Loin Tenderness

658   *Madison Romanyk*
        Mentors: Brad Kim, Mariah Nondorf

4:20   Agent-based modeling and game engines compatibility for human behavior analysis

659   *Siwen Hu, Bo Wu, Huihao Yin, Pelin Yu, Xinyou Chen*
        Mentors: David Barbarash

ROOM: STEW 214B

4:00   The Effects of Point Mutations on the Dimerization Domain of Ebola Virus Protein VP40

660   *Jacob Conarty*
        Mentors: Robert Stahelin, Souad Amiar, Olaf Wiest

4:20 ‡ The correlation between age and perspectives towards technology
661 *Evan Humphrey, Miyu Sumimoto, De'keva Tindal*
Mentors: Hayden Barber, Torsten Reimer

ROOM: STEW 214C

4:00 Structural and Functional Characterization of Phospholipase C β3 in Solution
662 *Kennedy Outlaw*
Mentors: Angeline Lyon, Isaac Fisher, Kaushik Muralidharan

4:20 Automated Data Processing: Making Community Indicators Possible for Lafayette, Indiana
663 *Jace Newell, Eli Coltin, Eric Flaningam*
Mentors: Jason Ware

ROOM: STEW 214D

4:00 Ethnic and Socioeconomic Disparities in Residential Proximity to Brownfields or Superfund Sites per Census Tract in Indiana
664 *Sharon Kulali*
Mentors: Ellen Wells

VIRTUAL RESEARCH TALKS | WATCH ON THE CONFERENCE WEBSITE

Developmental exposure to active herbicide ingredients in Roundup Ready Xtend products, glyphosate and dicamba, results in hypoactivity in the zebrafish
665 *Ryker Bond*
Mentors: Jennifer Freeman, Ola Wasel, Vasisht Sridhar

Airport Catchment Analysis Using Mobile Location Data
666 ‡ *Sitong Chen*
Mentors: Nicole Kong

The Role of Women in the Early UN
667 *Madilin Goodwin*
Mentors: Jennifer Foray

Avoiding Pitfalls in Mininet Software-Defined Networking
668 *Benjamin Hardin*
Mentors: Douglas Comer

Chiller Water Monitor
669 *Santiago Lopez*
Mentors: Alex Ruichao Ma

Fully Automated Microbrewery
670 *Jami Pryde, Carson Rohdes*
Mentors: Mia Skertich, George Pate

Coupling Metabolic Source Isotopic Pair Labeling and Genome Wide Association for Metabolite and Gene Annotation in Plants
671 *Abigail Sipes*
Mentors: Clint Chapple

On the Use of Live Drosophila Larvae for DNA Extraction Through Sonication
672 *Isabella Sirit*
Mentors: Stephen Cameron, Christopher Wirth

Data-driven Workload Prediction and Resource Planning for COVID-19 Preparedness
673 *Hang Wang*
Mentors: Pengyi Shi

Statistical Machine Learning and Decision Analytics for Global Supply Chain and Health
674 *Hui Zeng, Congyu Pu*
Mentors: Zhan Pang

Functional and evolutionary analysis of enzyme glycosyltransferase in mycobacteriophage PhiRho
675 *Madison Charnigo, Rachel Zheng, Madelyn Whitaker, Autumn Wuebben*
Mentors: Kari Clase, Taylor Sorrell

Understanding Phage Sequencing, from Mutations & Structural Impacts to Evolutionary Relationships
676 *Ellie Tanner, Michael Heraty, Jenna Hans*
Mentors: Kari Clase, Taylor Sorrell

Presentation Abstract Number: 600 :: Social Sciences/Humanities/Education

Honors College

Monon Neighborhood Livability Study

Author(s):

Abigail Dimmick, School of Management

Ryan Walter, College of Science

Harris Collins, College of Liberal Arts

Abstract:

This livability study is a comprehensive investigation into the Monon Neighborhood's well-being in order to support evidence-based decision making at the city level and by the Faith Community Development Corporation. We aim to provide a holistic picture of the livability of the Monon Neighborhood, located in Lafayette, Indiana, by understanding the factors that make up well-being for the residents of the neighborhood. Our chosen factors include housing, transportation, life/work/play, economic, and proximity to key resources. We have gathered data about each of these factors from sources including interviews with residents, oral histories, neighborhood and property condition surveys, census data, and others.

Presently, this livability study has highlighted several areas for necessary improvement, including the opportunity for planting new key resources and community assets in more centrally available areas. Additionally, the mapping of property conditions within the neighborhood has led to key insights about the zones in need of focused improvement for both private properties and public works. Some practicable goals set by the implications of this study include the generation of a neighborhood association, an increase in resident retention, and identification of physical improvement zones within the city. The present impacts of this project include the establishment of a community of multi-disciplinary researchers within the Purdue Honors College, as well as a livability study that will ideally become an asset for neighborhood development, allowing for improvements in each of the stated factors, subsequently improving the Monon Neighborhood as well as Lafayette, Indiana as a whole.

Mentor(s):

Jason Ware, Honors College

College of Engineering

Probabilistic Computing for Graph Coloring Problem

Author(s):

Haddy Alchaer, College of Engineering

Abstract:

The classical computer bit consists of two states, such as the two polarities of a stable magnet. By connecting bits in specific ways in one or more steps, we can solve many kinds of classical computational problems. However, a certain class of problems known as non-deterministic polynomial (NP) hard problems cannot be solved by classical computers in a reasonable amount of time, thus calling for new solution techniques.

Instead of looking to improve classical computing, this study focuses on a new type of computing that takes advantage of unstable magnets: probabilistic computing. These magnets have polarities that spontaneously switch from one direction to another in very short periods of time. The probabilistic bit (p-bit) takes advantage of this unique property to act as a simple hardware implementation of a random number generator with tunable randomness.

In this study, we will demonstrate the capability of p-bits for solving a popular NP problem: the graph coloring problem. By implementing a mathematical model that maps the optimal solution of the problem to a minimal-energy configuration of the network, the system should naturally converge to the most probable solutions. To help predict what would happen in a physical implementation, we will perform an accurate simulation of the p-bit circuit with a software tool called HSPICE. The results of this simulation will be presented and compared to the expected results to analyze its accuracy.

This work will contribute to the general understanding of probabilistic computing, which may one day solve certain NP hard problems more efficiently than classical computers.

Mentor(s):

Peter Bermel, Electrical & Computer Engineering, College of Engineering

Jie Zhu, Purdue University

Presentation Abstract Number: 602 :: Mathematical/Computation Sciences

College of Engineering

Integrating a Vector Processing Unit into a RISC-V Microprocessor

Author(s):

Owen Prince, College of Engineering

Jing Yin See, College of Engineering

Abstract:

Highly-intensive parallelizable programs like matrix multiplication are common and vital to many algorithms. Single-instruction, single-data (SISD) processors cannot take advantage of the parallelized nature of vector instructions. Vector processors aim to provide additional processing features in two ways: more efficient use of hardware and more processing units. The RISC-V instruction-set architecture adds the capability to handle vector instructions under the -V extension. This project covers the integration of the RISC-V -V extension into the AFTx06 processor developed by the Purdue SoCET team. We will demonstrate an implementation of this specification and the performance benefits it brings to the microprocessor. The core changes will include a larger register file, multiple "lanes" to operate on multiple data elements at the same time, along with extra vector-specific instructions like permutation and reduction. We utilize a set of benchmark programs that are programmed in a serial and vectorized manner to provide reference to the speedups gained with the vector processor. The benchmarks we have chosen are a basic matrix multiplication algorithm, mergesort, Jacobi-2D from the PolyBench test suite, and Particle Filter from the Rodinia test suite. These benchmarks fully cover all the possible functional units in the design and can be executed with varying vector sizes. We will show the leaps in performance that can be made with an implementation of the RISC-V vector extension in a microprocessor.

Mentor(s):

Cole Nelson, Electrical & Computer Engineering, College of Engineering

Presentation Abstract Number: 603 :: Social Sciences/Humanities/Education

College of Education

The Search for Mechanistic Explanations: Characterizing Biology Students' and Instructors' Connections Between Fundamental Biology Concepts

Author(s):

Kal Holder, College of Science

Abstract:

Processes in biology are often taught in isolation from other related phenomena, making it difficult for students to understand biological systems. Mechanistic reasoning can be utilized to help students build explanations of biological phenomena, but this is oftentimes challenging. This qualitative research study seeks to better understand the mechanistic reasoning of students and instructors at a large Midwestern public R1 university by answering the question "How do undergraduate biology students and instructors form connections between three fundamental biology concepts?"

For data collection, we conducted semi-structured interviews with 32 biology students and 12 biology instructors. We then performed inductive and deductive thematic coding to categorize the kinds of connections made in participant explanations describing different biological phenomena. Current results demonstrate that 7% of student responses qualified as a mechanistic explanation of process whereas only 5% of instructor responses qualified as a mechanistic explanation. Furthermore, 14% of student responses were coded as associative, meaning there is no causal reasoning to explain the connection between modules, whereas 25% of instructor responses qualified as associative.

These data show that student usage of mechanistic reasoning in explaining biological phenomena is very limited, suggesting that increased instructional support is needed to help develop mechanistic reasoning. Further, the low amounts of mechanistic and associative responses from instructors indicate that they are equipped to describe mechanisms but may not choose to produce such explanations, suggesting that explicit demonstration of causal, continuous mechanisms to students must become a regular and consistent practice.

Mentor(s):

Sharleen Flowers, Biological Sciences, College of Science

Stephanie Gardner, Purdue University

College of Pharmacy

The effect of Fatty Acid Synthase (FASN) depletion in pulmonary metastatic formation in breast cancer murine models

Author(s):

Zilin Xianyu, College of Pharmacy

Abstract:

Redacted.

Mentor(s):

EYLEM KULKOYLUOGLU COTUL, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Michael Wendt, Purdue University

Presentation Abstract Number: 605 :: Life Sciences

College of Science

The Promise of Reversing Social Deficits in SCN2A Deficient Mice

Author(s):

Benjamin Zirkle, College of Science

Abstract:

The gene SCN2A, which encodes for the NAV1.2 sodium ion channel, is critical for the brain's neuronal development. Reduced expression of this gene shows consequences in the form of neurodevelopmental disorders such as Epilepsy and Autism Spectrum Disorder. Goals of this study were to test pharmaceutical interventions using a pre-clinical mouse model. Stranger intruder tests were conducted before and after treatment using small pharmaceuticals (ketamine, clonazepam, and AZD7325) to gauge sociability in mice. Flippase-mediated gene therapy using FLPO and the use of the small pharmaceuticals were found to have increased sociability. Mechanistic studies using DREADD also revealed that the inhibiting of excitatory neurons led to increases in sociability. Downstream applications may include further research into pharmaceutical effectiveness or human trials designed around increasing SCN2A expression.

Mentor(s):

Muriel Eaton, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Presentation Abstract Number: 606 :: Mathematical/Computation Sciences

College of Science

Natural Language Processing for Discourse Analysis of Tweets About the COVID-19 Vaccine

Author(s):

David Udo-Imeh, College of Science

Abstract:

Social media platforms can provide important insight into public concerns about real-world events. In this study, we analyze a dataset of over two million tweets collected from January to September 2021 to investigate the public's attitude towards the COVID-19 vaccine. We use natural language processing to analyze the use of political framing in tweets about the vaccine. We link the use of different frames to real-world events related to the pandemic. We then combine our framing analysis with emotion analysis to get a more comprehensive understanding of the public's attitude. By combining framing analysis with emotion analysis we were able to capture changes in the ideas being discussed as the pandemic progressed, as well as the overall sentiment towards these ideas.

Mentor(s):

Dan Goldwasser, Computer Science, College of Science

Govanni Granados, Department of Mathematics

College of Science

Role of PP2A-B56a in KRAS-driven Transformation of Pancreatic Epithelial Cells and the Progression of Pancreatic Cancer

Author(s):

Rebecca Shelley, College of Science

Abstract:

Pancreatic cancer is the fourth leading cause of cancer-related deaths in the United States. Most pancreatic ductal adenocarcinoma (PDAC) patients have an oncogenic, gain-of-function mutation in KRAS (KRASG12D), which is considered "undruggable." It's important to understand how oncogenic KRAS contributes to PDAC to develop alternative therapeutic strategies. Protein phosphatase 2A (PP2A) is a regulator of many of the downstream effectors of KRAS, and the tumor suppressive activity of PP2A is downregulated in PDAC cell lines. There are many different B-subunits of the PP2A complex that control substrate recognition, but low expression of the B56α subunit correlates with poor prognosis in PDAC patients. Together, these studies suggest that PP2A-B56α suppression may significantly contribute to PDAC progression. The goal of our research is to (1) determine if the expression of cellular PP2A inhibitors increases in early PDAC lesion formation, (2) identify how oncogenic KRAS leads to suppression of PP2A-B56α activity, and (3) determine if the loss of PP2A-B56α accelerates lesion formation. To investigate this, we will use KRASG12D mutation and PP2A-B56α knockdown approaches in vitro to identify how oncogenic KRAS and loss of PP2A-B56α cooperate to transform normal pancreatic cells by looking at cell identity and signaling changes. Mouse models with pancreas-specific oncogenic KRAS and PP2A-B56α loss will be used for in vivo studies to measure tumor characteristics and PDAC progression. Discovering the mechanisms of PP2A-B56α in relation to the oncogenic KRAS pathway will support the use of therapeutic activators of PP2A for PDAC patients and possibly other cancers with oncogenic KRAS.

Mentor(s):

Brittany Allen-Petersen, Biological Sciences, College of Science

Samantha Tinsley, Purdue University, PULSe

College of Science

Cortical circuits unifying bilateral space

Author(s):

Chengyu Bi, College of Science

Abstract:

Many learned behaviors such as tying our shoelaces, riding a bike, or typing on a keyboard require the coordinated exchange of tactile information between the cerebral hemispheres. This continuous flow of information between the hemispheres is known as bilateral integration. Bilateral tactile information is first integrated in the primary somatosensory cortices, yet the neural mechanisms underlying this computation remain unknown, especially during behavior. The whisker system in mice provides a powerful and direct approach for understanding the spatial principles of bilateral circuits, as individual whiskers on the face correspond to spatially discrete structures in the brain. Utilizing a novel bilateral discrimination task, we train mice to discriminate between homotopic (matching) and heterotopic (non-matching) pairs of bilateral whisker stimuli. Electrophysiological recordings and targeted manipulations of neural circuits are then used to determine the contribution of different neurons and circuits to the formation of a goal-directed, bilateral percept. We found that bilateral integration flexibly controls the flow of information between the cerebral hemispheres in accordance with goal direction.

Mentor(s):

Scott Pluta, Biological Sciences, College of Science

Hyein Park, Purdue University

College of Health and Human Sciences

Compressed sensing and the use of 3D UTE acquisition for high-resolution accelerated 23Na imaging at 3T

Author(s):

Evan Pogue, College of Health & Human Sciences

Abstract:

Purpose

To determine averaging and acceleration parameters of sodium (23Na) magnetic resonance imaging (MRI) to minimize scan time while preserving signal quality.

Methods

We scanned a healthy volunteer in a Siemens MAGNETOM Prisma 3-Tesla MRI with a 23Na transmit/receive knee coil using a novel UTE sequence with compressed sensing. Image reconstruction and post processing steps were performed in MATLAB platform.

To examine the effects of acceleration via compressed sensing, we simulated acquisitions using only 1/3 and 1/7 of required data corresponding and acceleration factors of 3 and 7, respectively. We also compared the effect of reducing from three to two averages (NA=2) to further minimize the total acquisition time. We used a structural similarity coefficient between zero and one to evaluate the effect on image quality based on luminance, contrast, and structure. We chose a region of interest for comparisons that included the distal epiphysis of the femur and the proximal epiphysis of the tibia.

Results

The total scan times for each combination of averaging and acceleration were estimated to provide context for reductions in image quality with reduced averaging and acceleration by compressed sensing. Using experimental data with NA=3 and no acceleration as the reference, reduction to NA=2 yielded a structural similarity coefficient of 0.957. Using NA=3, three- and seven-times acceleration yielded structural similarity coefficients of 0.868 and 0.732, respectively. Using NA=2, the structural similarity coefficients were 0.859 and 0.725, respectively.

Conclusion

In this study we determined acceleration and averaging parameters which greatly reduce scan time without substantial losses to image quality based on comparisons to a reconstruction with NA=3 and no acceleration.

Mentor(s):

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

Deva Chan, Purdue University

Cameron Villarreal, Purdue University

Xin Shen, Purdue University

College of Health and Human Sciences

Using Magnetic Resonance Imaging and Magnetic Resonance Spectroscopy to Measure Neurochemicals Non-invasively in the Insula in Response to Pain.

Author(s):

William Mahoney, College of Health & Human Sciences

Abstract:

The Insula is located deep within the lateral sulcus of the brain and is one of the most quintessential structures of the cerebral cortex; being associated with a multitude of human functions including high-level cognition, visceral sensation, and specifically pain. In this study, we mapped neurochemicals in the Insula non-invasively with a novel neurotransmitter mapping technique.

In vivo studies were conducted on a 3 Tesla magnetic resonance system (Siemens, Erlangen, Germany) with a 32-channel receive array head-coil, five healthy volunteers participated in this study. The left insular ROIs were obtained using the Insular MNI FNIRT Maxprob thr25-2 mm of SUIT Atlas. Each subject's MRSI slice and metabolite maps were determined in the MPRAGE image space using statistical parametric mapping 31. The resulting MRSI resolution was 0.9 Å~ 0.9 Å~ 1 mm3. The mean metabolite distribution was calculated in the insular ROIs of the Harvard-Oxford Cortical Structural Atlas.

We mapped 10 metabolites in the Insula with high reproducibility, all scaled to the brain's creatine ratio. The mean metabolite values in the Insula for Ascorbate, GABA, Glutathione, myo-Inositol, Total Choline, Total NAA, and Glutamate + Glutamine are 1.2 +/- 0.4 mM, 2.0 +/- 0.2 mM, 1.6 +/- 0.2 mM, 6.0 +/- 0.4 mM, 1.7 +/- 0.4 mM, 10.1 +/- 0.5 mM and 12.8 +/- 0.7 mM, respectively.

This study demonstrates that the proposed technique can map 10 metabolites with high-quality values in the Insula.

Mentor(s):

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

Nicholas Farley, Purdue University

Xin Shen, Purdue University

Presentation Abstract Number: 611 :: Social Sciences/Humanities/Education

College of Veterinary Medicine

Momentary energy levels in healthcare professionals working with facility dogs

Author(s):

Shania Sinha, School of Management

Abstract:

Past research has shown that pediatric healthcare professionals working with full-time therapy dogs (facility dogs) reported less work-related burnout and better mental health overall. However, specific in-the-moment effects of facility dogs on healthcare professionals have yet to be examined. The purpose of this study was to use Ecological Momentary Assessment (EMA) to assess the effects of facility dog presence on momentary energy levels of pediatric healthcare professionals. EMA data for the present study were collected from 122 healthcare professionals working in pediatric hospitals. Within the sample, participants working with a facility dog (handlers; n=61) were compared to control participants working without one (n=61), matched on age, gender identity, job position category and pet ownership. Average daily energy levels were compared between handlers and control participants using independent t-test analysis. Among handlers, multilevel modeling analysis was used to test the association of facility dog presence with momentary energy levels. Results showed that facility dog handlers and control participants reported similar energy at work overall (p=.115). However, we found that handlers reported having significantly higher energy at specific timepoints in which their facility dogs were present at work (p<.01). Findings suggest that working with a facility dog does not affect overall energy at work, but may help pediatric healthcare professionals to feel more energetic in the moments when the dog is present. Future research should aim to collect more data on mental states of healthcare professionals to examine short- and long-term effects of working with facility dogs.

Mentor(s):

Clare Jensen, Purdue University College of Veterinary Medicine, Graduate Student

Marguerite O'Haire, Purdue University College of Veterinary Medicine

College of Science

Where did they come from, where will they go? The case of three invasive anurans

Author(s):

Jackson Kirkwood, College of Science

Addy Messerly, College of Science

Abstract:

Human activity often results in the transplantation of species to locations where they can become established. Such species typically become established in locations with climates similar to those in their native range, but some species can survive in areas with novel climates, different from the conditions under which they evolved. It is unclear, however, the role that abiotic factors play in modulating invasion success across species. In this study, we use occurrence data and published records to reconstruct the invasion history and progress of three non-native congeneric species that have recently expanded their ranges in the Americas: Eleutherodactylus coqui, E. planirostris, and E. johnstonei. We also use bioclimatic variables to characterize the climate in the native and non-native ranges of each species. Overall, the three species colonized non-native locations with relatively warm temperatures and high precipitation. However, these three species have been able to establish in locations where climatic conditions are different from those in their native range . Non-native E. coqui populations, for instance, have colonized Hawai'i, where precipitation levels are outside those found in their native Puerto Rico. This pattern suggests there is some degree of plasticity within these species' physiological tolerance to their environment that allows them to persist in novel abiotic conditions. Varying ability between species to confront physiological stressors may explain the observed differences in their invasion history and success as biological invaders. This study highlights the difficulty in predicting the relationship between abiotic factors in native and invasive ranges, even among closely related species.

Mentor(s):

Ximena Bernal, Biological Sciences, College of Science

Andrew Mularo, Purdue University

College of Liberal Arts

Gender, Perceived Promotion Opportunities, and the Life Course: Patterns and Consequences

Author(s):

Anna Szolwinski, College of Liberal Arts

Abstract:

Prior research has highlighted the organizational practices that contribute to gender disparities in promotions. However, few studies have explored men's and women's subjective assessment of their advancement opportunities, and none have examined these patterns over the life course. Understanding workers' assessments of their opportunities is critical in understanding their intentions to stay within a given role and is likely to have consequences for their job-related attitudes and mental wellbeing. In this article, we draw on theoretical perspectives linked to gender and ideal worker norms to examine three research questions. First, how do perceptions of promotion opportunities vary over the life course for men and women? Second, how are these patterns affected by marital status and parenthood? Third, what are the consequences of these subjective assessments for workers' mental wellbeing? To examine these questions, we analyze five waves of the U.S. General Social Survey (2002-2018). Our results show that while perceived advancement opportunities decline for all workers over the life course, (1) gender differences are absent in the early career, widen across workers' 20s to 40s with men reporting greater perceived promotion opportunities than women, and then converge becoming insignificant by the mid-to-late 50s; (2) marital and parenthood status do not explain much of the observed pattern; and (3) as a consequence of these perceptions, women and men who perceive limited promotion opportunities have greater job search intentions and report more days of poor mental health than those perceiving greater advancement opportunities. We conclude with implications for theory and future research.

Mentor(s):

Kevin Stainback, Sociology, College of Liberal Arts

Presentation Abstract Number: 614 :: Social Sciences/Humanities/Education

College of Liberal Arts

Identifying Potential Pork-Barrel Legislation with Machine Learning

Author(s):

Sunil Green, College of Science

Abstract:

Pork-barrel legislation has been criticized by some as an excessive and potentially corrupt use of Congressional appropriations. The task of finding the specific parts of legislation that have been "pork-barreled", however, requires many hours of labor by policy researchers. Using data from government watchdogs and machine learning algorithms, the research explores the idea of creating a model to flag specific line items of appropriations bills for policy researchers to further explore as potential pork-barrel legislation.

The model uses data from the Earmark Database by Taxpayers for Common Sense, and the Congressional Pig Book by Citizens Against Government Waste to attempt to identify line items in appropriations bills as either "potential pork" or "not potential pork". Criteria for the model are based upon Citizens Against Government Waste's seven criteria for pork-barrel legislation as well as their identification of egregious examples of pork-barrel projects. The research focuses on the fiscal years of 2008-2010 when Congressional rules required the disclosure of earmarks. The first prototype of a machine learning model was trained on fiscal year 2008 data and showed limited effectiveness at differentiating pork and non-pork in the 2008 Consolidated Appropriations Act. Work is ongoing and more in-depth results are expected by early April.

Mentor(s):

Eric Waltenburg, Political Science, College of Liberal Arts

College of Engineering

Characterizing Occupant-Induced Pollutant Emissions in a Zero Energy and Emissions Building

Author(s):

Reno Sarussi, College of Engineering

Juan Pablo Novoa Benavides, College of Engineering

Abstract:

Particle emissions generated from cooking activities within new buildings are often overlooked from domestic and commercial standpoints. As a result, the individual cooking is exposed to a wide range of aerosol particles released, which can be a source of a myriad of respiratory complications. While kitchen exhaust efficiency has been examined, the complexity of airflows and exposure to particulate matter due to occupant-induced pollutant emissions in a zero-energy building remains understudied. This study will mechanistically evaluate the interconnections between human exposure to particulate matter and the amount of energy consumed during the emission event in a state-of-the-art zero Energy Design Guidance for Engineers (zEDGE) laboratory.

In the zEDGE lab, we are investigating the variability of these interconnections through controlled experiments accounting for (i) ventilation conditions, (ii) modulation of electric cooktop power levels, and (iii) particulate matter produced under variable ventilation conditions. Our preliminary research suggests that cooking poultry, on average, results in particle diameter < 2.5 µm (PM2.5) emissions of 1.2E+05 µg/hr. We will look to minimize the emissions produced through improved ventilation conditions and reduced energy used via modulation of the electrical induction cooktop. This methodology will utilize the newly installed building energy management system (current transducers) and an aerosol particle sensor that will account for concentrations of particles in the range of 10 nm to 10 µm in aerodynamic diameter. zEDGE Tiny House will provide a controlled, completely mixed-flow reactor to inform our mass balance analysis further. Our preliminary results suggest that cooking poultry produces significantly more aerosol particles at the maximum power (1200 W) despite a greater cooking time during lower power input.

Mentor(s):

Nusrat Jung, Civil Engineering, College of Engineering

College of Science

Formation of Mars-like soils in southern Peru's hyper-arid Atacama Desert

Author(s):

Faith Van Winkle, College of Science

Abstract:

Redacted.

Mentor(s):

Greg Michalski, Purdue University, Faculty

Presentation Abstract Number: 617 :: Life Sciences

College of Science

Behavior and Fitness Consequences of Host Selection by Frog-Biting Mosquitoes

Author(s):

Ethan Guardado, College of Science

Abstract:

Over evolutionary time, sensory and behavioral adaptations have refined to allow blood-sucking insects to detect, identify and attack appropriate hosts. Over the past few centuries with globalization, humans have translocated numerous species, which have altered the composition of communities by making novel hosts available to blood-sucking insects. However, it is unclear how blood-sucking insects approach the novelty of non-native hosts, which could be potentially exploited as another means for egg production. Here we investigate host feeding behavior in response to native and non-native hosts and the fitness consequences of such feedings, focusing on the frog-biting mosquito Uranotaenia lowii. We hypothesize that the lack of evolutionary history between frog-biting mosquitoes and non-native anuran hosts results in inefficient feeding strategies. Thus, we predict U. lowii will be more likely to feed on native than non-native frogs. Similarly, we expect feeding on native hosts will be associated with higher fecundity and better performance of offspring. To examine the feeding behavior of mosquitoes, we presented them with native (Hyla cinerea, Anaxyrus terrestris) and non-native (Osteopilus septentrionalis, Rhinella marina) anuran hosts. Specifically, we exposed groups of around 40 U. lowii individuals to one species of host at a time and examined their strength of preference and feeding behavior. We assessed the fitness consequences of feeding on both host types by tracking offspring's survival and developmental rates, as well as number of offspring per feeding. This research will provide valuable insights on how biological invasions modulate ecological interactions as novel species are brought into communities.

Mentor(s):

Ximena Bernal, Biological Sciences, College of Science

Katherine González, Purdue University

College of Health and Human Sciences

Assessment Of Skeletal Muscle Oxygenation During Exercise In Patients With Peripheral Artery Disease Using Near Infrared Spectroscopy: Impact of Skin Color And Adipose Tissue Thickness

Author(s):

Byung Joon Pae, College of Health & Human Sciences

Abstract:

Redacted.

Mentor(s):

Bruno Roseguini, Health & Kinesiology, College of Health & Human Sciences

College of Health and Human Sciences

The influence of a developmental lead (Pb) exposure on genetic risk factors of Alzheimer's Disease: a focus on Sortilin-related Receptor 1 (SORL1)

Author(s):

Jenny Chen, College of Health & Human Sciences

Abstract:

Alzheimer's disease (AD) is the most common neurodegenerative disease in the elderly with several genetic risk factors identified. Recently, sortilin-related receptor 1 (SORL1) has been indicated as a genetic risk factor in AD. In addition, AD is influenced by environmental factors such as developmental exposure to the heavy metal lead (Pb), which has been associated with an increased risk of AD later in life. However, we have limited research on the mechanisms that underlie AD pathology, especially when coupled to environmental risks. This study will enhance the mechanistic understanding of the amyloid-beta protein hypothesis by evaluating the effects of SORL1 in the trafficking and processing of amyloid precursor protein and ultimately characterizing the risk for AD development. In this study, a recently developed CRISPR-Cas9 sorl1 knockout zebrafish model is used to investigate the influence of exposure to the heavy metal Pb on AD pathogenesis. We hypothesized that Pb exposure will have a greater impact on AD pathogenesis in the sorl1 knockout compared to the wild-type zebrafish. Wild-type and sorl1 genetic model zebrafish were exposed to 0, 10, or 100 ppb Pb (lead acetate) during development (1-120 hours post fertilization; hpf). Protein was isolated from each treatment group and assessed using a Western blot assay. Preliminary data shows decreased sorl1 protein expression in the knockout model. The findings of this study will inform on the influence of Pb exposure on AD, specifically evaluating the sorl1 genetic risk factor.

Mentor(s):

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

Keturah Kiper, Purdue University

College of Engineering

Kanga: A Unified Controller Board For Thermoregulating And Monitoring Vitals In Premature Newborns

Author(s):

Kevin Alessandro Bautista, College of Engineering

Akio Fujita, College of Engineering

Alyson Pickering, College of Engineering

Abstract:

While incubators are traditionally used to prevent neonatal hypothermia, high cost limits their distribution in low-resource settings. In such settings, Kangaroo Mother Care (KMC), where the neonate is held against the caregiver's bare chest, effectively assists in regulating neonatal temperature. However, KMC is unable to monitor infant vitals and imposes strain on caregivers after long-term use. This study aims to augment KMC by implementing automated vitals sign monitoring and thermoregulation using a unified controller board, Kanga. All algorithms were written in-house using C/C++ and implemented on the Arduino development platform. Temperature was regulated using a finite state machine with feedback from bead thermistors coupled to a fabric heating pad. Vital signs were monitored using an electrocardiogram (ECG) for heart rate (HR) in beats per minute (BPM). We verified Kanga by maintaining the temperature of one heating pad at 37 °C and recording an ECG signal using three-lead electrodes and calculating BPM. Kanga was able to maintain the temperature of a single heating pad at a normal, core-body temperature of 37 °C within the normal range of 36.5 °C to 37.5 °C after being pre-warmed to 35 °C to simulate a hypothermic neonate. It was also able to record an ECG signal and calculate a heart rate of 95 BPM in real-time, on-chip, compared to 96 BPM measured manually. While future directions include the implementation of our photoplethysmogram for HR and blood oxygen, we present a low-cost method of simultaneous thermoregulation and vital signs monitoring in low-resource settings to prevent neonatal hypothermia.

Mentor(s):

Jacqueline Linnes, Biomedical Engineering, College of Engineering

Orlando Hoilett, Purdue University

Sherri Bucher, Indiana University School of Medicine

College of Science

Methylation-based Regulation of the Small GTPase, Ras, via Isoprenylcysteine carboxyl methyltransferase (ICMT)

Author(s):

MaryClaire Cooke, College of Science

Abstract:

Isoprenylcysteine carboxyl methyltransferase (ICMT) and its methylating activity on the small GTPase Ras is understood to be an important regulator of the localization and functioning of Ras. Ras is highly involved in various cellular pathways, including the mitogen-activated protein kinase (MAPK) signaling cascade, stimulating cell growth and migration. It is hypothesized that the GTPase activity of Ras on its substrates is contingent upon the localization of Ras to the plasma membrane, facilitated by its methylation. When a Ras mutation occurs, cancerous Ras isoforms can be found in a continual state of activation leading to unregulated cell proliferation. Ras mutations contribute highly to the development of cancers, specifically 30% of pancreatic cancer. Our research aims at better understanding the mechanisms in which Ras is methylated by ICMT, and to demonstrate the role that this post-translational modification plays on the functioning of Ras and other downstream kinases. This understanding is integral in order to identify mechanisms of Ras that could be targeted therapeutically.

Mentor(s):

Shalini Low-Nam, Chemistry, College of Science

Ariana Cardillo, Purdue University

Purdue Polytechnic Institute

Comparing Work Environments in the Technology Industry Post-Pandemic

Author(s):

Natalie Amodeo, Polytechnic Institute

Abstract:

Over the last few years, much of the world's workforce experienced a shift in its work environment in response to the global pandemic. Many employees and even entire companies switched to a work-from-home (WFH) environment. As the world recovers from the pandemic, individuals, companies, and industries as a whole must consider how different work environments play a role in wellbeing and productivity.

The technology industry, with a theoretical advantage in WFH environments, should particularly explore how WFH and work-from-office (WFO) environments compare. Without understanding the role of work environments in wellbeing and productivity, the technology industry may sacrifice overall productivity, employee mental health, and costs associated with space and equipment. If individuals in the technology industry can understand how their surroundings affect their work, they can make better, data-driven decisions both on how they work and where they work.

Using data visualization, it is possible to discover what types of work environments are viable options in the future for employers and employees alike. This study analyzes raw survey data from subjects of different occupations and compares their WFH and WFO environments using Likert scale variables to assess sleep quality, work-life balance, stress level, and job opportunity. Produced in Tableau and with D3.js, the interactive data visualizations created from this data add to current research on general WFH productivity and highlight how the technology industry plays a unique role in this generation's shift in work norms.

Mentor(s):

Vetria Byrd, Computer Graphics Technology, Polytechnic Institute

Presentation Abstract Number: 623 :: Life Sciences

College of Health and Human Sciences

Presence of Copper Chaperone for Superoxide Dismutase (CCS) in Brain Choroid Plexus

Author(s):

Vivian Hurn, College of Health & Human Sciences

Abstract:

Brain homeostasis is a process maintained by the barrier between blood circulation and cerebrospinal fluid (CSF). The choroid plexus in the brain ventricles is a brain tissue that constitutes this blood-CSF barrier functioning to produce the CSF and maintain chemical balance in the brain extracellular fluid. Like the kidney, the choroid plexus aids in waste and metabolite removal in the brain. Copper chaperone for superoxide dismutase (CCS) is a chaperone protein that prevents oxidative damage and contributes to brain homeostasis of copper. Yet, the presence and function of CCS in blood-brain interfaces remain largely unknown. This project examined the expression of the CCS in the choroid plexus, its potential functionality, and the impact of exposure to metals such as lead and manganese on its expression. Immunohistochemical staining was used to visualize the CCS in mouse choroid plexus with rabbit anti-SOD4 polyclonal unconjugated antibody and fluorophore conjugated secondary antibody, followed by confocal microscopic imaging analysis. The results revealed CCS was expressed in the choroid plexus. Furthermore, it appeared the CCS had the highest expression in brain subventricular zone followed by the choroid plexus. Preliminary data confirms the expression of CCS in the choroid plexus and indicated it may contribute to the choroid plexus's ability to maintain copper homeostasis. Further studies into CCS will focus on its subcellular distribution, roles in regulating copper uptake and transport by the blood-CSF barrier, and the consequences of incubation with lead and manganese on its expression. The results will help explain toxic metal-induced neurotoxicity.

Mentor(s):

Wei Zheng, Health Sciences, College of Health & Human Sciences

Lara (Tianyuan) Sang, Purdue University

Luke (Luqing) Liu, Purdue University

College of Liberal Arts

Carboard as an Artistic Material: Its Uses and Complications

Author(s):

Nicolas Dowling, College of Liberal Arts

Abstract:

An often-overlooked element within art historical research is that of materials. While it may not be as enticing as subject matter or symbolism, the materials used in an artwork provide evidence for the personal history of an artist.

The staggering technological advancement that began during the industrial revolution provided artists with never-before-seen tools to incorporate into their work. In the late 19th century, cardboard was adopted by industries as a cutting-edge packaging material. Several artists, beginning with Edgar Degas, experimented with incorporating it into their work. The aim of this research was to suggest possible reasons for why turn of the century artists chose cardboard as a ground for their work using a combination of historical and biographical data.

By focusing on four artists— Mihri Müşfik, Henri de Toulouse-Lautrec, Edvard Munch, and Pablo Picasso— certain trends became apparent. The most common reasons for cardboard's adoption within the art world are its price, portability, and texture. Cardboard was far less expensive than canvas or wood panel, with some artists even finding used pieces in dumpsters. It was easy to carry when working outside the studio. And its tendency to absorb the oils out of paint left a matte finish.

While these explanations lend understanding to individual artists, it is important to note that art on cardboard poses many difficulties for museums. Early cardboard's acidity limits the longevity of important works. It is often nearly impossible to conserve pieces once lasting damage is done. Contemporary artists should consider the impacts materials can have on the life of their art, and museums should be proactive in their efforts to preserve works on cardboard before they are ruined beyond repair.

Mentor(s):

Catherine Dossin, Rueff School of Design, Art, and Performance, College of Liberal Arts

Presentation Abstract Number: 625 :: Life Sciences

College of Science

Genomic Diversity of SARS-CoV-2 on Purdue University Campus: Spring 2021

Author(s):

Jack Dorman, College of Science

Nicole Perry, College of Science

Abstract:

Since its emergence as the causative agent of the novel disease COVID-19 in late 2019, SARS-CoV-2 has demonstrated a high capacity for generating genomic diversity. Since this diversity is impactful on disease spread and progression, monitoring it is key to understanding the course of the pandemic. Nanopore sequencing using Oxford Nanopore Technologies's platform allows for scalable and real-time monitoring of viral diversity at a population level. We successfully applied ONT's MinION and GridION platforms to sequence 670 SARS-CoV-2 genomes from patients in the Purdue University community during the Spring 2021 semester. We identified at least one case of eight of the ten Variants Being Monitored by the CDC as well as instances of the Delta Variant of Concern. In addition, we observed changes in the dominant variants on campus with sometimes weekly transitions. Initial phylogenetic analysis of Gamma variants indicated there were at least ten independent introductions from domestic sources for that variant alone. This work improves our understanding of the underlying diversity and epidemiology of virus transmission in campus settings. Further, it demonstrates the public health potential of nanopore sequencing due to its ability to be rapidly adapted and deployed in local settings.

Mentor(s):

Giovanna Carpi, Biological Sciences, College of Science

Dennis Minchella, Purdue University

College of Engineering

Optimization of Lipid Analysis for Anaerobic Digestion Feedstocks and Samples

Author(s):

Kyra Keenan, College of Engineering

Abstract:

Anaerobic co-digestion (AcoD) is widely implemented for its ability to generate renewable energy from agro-industrial waste. Theoretical gas yield of AcoD processes can depend on the macromolecule proportions of substrates. In certain proportions, lipids optimize biomethane yield without exhibiting inhibitory behavior, which is why characterizing lipid quantity and degradation in AcoD is of particular interest. The Bligh and Dyer method can be used to estimate lipid content in a variety of biological substances, which includes digestion feedstocks, pre-digestate, and post-digestate. This method is favorable because it is both efficient and reproducible, however there is little existing information on parameters that influence its effectiveness for AcoD substrates and digestate. Lipid concentration of AcoD substrates was estimated by the Bligh and Dyer method to evaluate if refrigeration storage time affected extraction or degradation. Further experiments will expand upon this knowledge by examining seasonal lipid content variation of feedstocks and organic homogenate volume effect on lipid extraction. Understanding the factors influencing the Bligh and Dyer method may enable the development of accurate, more effective variations that are appropriate for anaerobic digestion lipid extraction.

Mentor(s):

Jennifer Rackliffe, Agricultural & Biological Engineering, College of Agriculture

Honors College

Spectrophotometric Analysis of Synechococcus sp. Questions the Concept of the Q-cycle in Oxygenic Photosynthesis.

Author(s):

Aaditya Prabhu, College of Science

Abstract:

A current concept in the theoretical presentation of oxygenic photosynthesis suggests that the rate of light-dependent electron transfer depends on the 'Q-cycle' in which the reduction of cytochrome heme-b6 contributes to the electrochemical proton gradient required for the various downstream reactions. The 'Q-cycle' has been studied extensively in mitochondria; however, there is no definite experimental evidence for its existence in chloroplasts. It was assumed to be conceptually relevant due to the shared structural features between the two organelles. The purpose of the project is to obtain spectrophotometric data on the existence of the Q-cycle in intact cyanobacterial cells. Late log-phase Synechococcus sp. cells were exposed to actinic light, and a flash spectrophotometer was used to measure the change in absorbance as a function of wavelength. We observed a clear absorbance change corresponding to the oxidation of cytochrome f; however, there was no evidence for the reduction of heme b6. The latter contradicts the expectation of the 'Q-cycle' mechanism and can only be explained if the internal environment of the cells is already reduced in their resting unexcited state. This development would imply that the Q-cycle does not operate in cyanobacterial cells, and that the rate-determining step requires an alternate mechanism to explain it.

Mentor(s):

William Cramer, Biological Sciences, College of Science

College of Engineering

System on Chip Extension Technologies AFTx04 Post-silicon Validation using Printed Circuit Board

Author(s):

Boon Kiat Julian Kang, College of Engineering

Fan Jing Hoon, College of Engineering

Pranav Srisankar, College of Engineering

Roan Numa, College of Engineering

Abstract:

The AFTx04 is the fourth system-on-chip silicon package designed by the System-on-Chip Extension Technologies (SoCET) research group. Although the AFTx04 chip has been functionally tested through simulations and has passed a structural test through scan chains, the silicon design of the AFTx04 has never been functionally verified to be working. The objective of this project is to verify the AFTx04 design by creating a hardware and software package to communicate with the AFTx04 in order to program the AFTx04 and send or retrieve data stored in its random access memory (RAM). The hardware component includes a 5V to 1.2V Logic-Level Shifter circuit to enable standardized USB ports to communicate with the 1.2V required by the AFTx04. The software component includes implementing a compiler toolchain in order to compile a program that can be loaded into the AFTx04 as well as a USB interface that allows users to probe for information in RAM addresses and to send micro-instructions to verify that the AFTx04 is working. Once the communication platform is established, the team will be able to perform functional and performance tests on other peripherals and eventually unlock the full potential of this chip.

Mentor(s):

Matthew Swabey, College of Engineering

Mark Johnson, Purdue University

College of Agriculture

Toxicity of a "Forever Chemical" in an estuarine fish: does salinity mediate the toxicity of perfluorooctanesulfonic acid (PFOS)?

Author(s):

Lucy Burcham, College of Science

Abstract:

Per- and polyfluorinated alkyl substances (PFAS) pose risks to human and environmental health. PFAS are widespread due to use in products like food packaging and makeup, among others. Toxicity of PFAS to estuarine species is understudied and little is known about how fluctuating salinities, typical of estuaries, might mediate toxicity. Our central objective was to evaluate the toxicity of PFOS, a ubiquitous contaminant of estuaries, and whether salinity mediates toxicity in sheepshead minnows (Cyprinodon Varietgatus). We hypothesized that 1) PFOS reduces survival, growth, and developmental rate in a dose-dependent manner and 2) salinity and PFOS interact non-additively on these same responses. Embryos were exposed through hatching to 0, 1, 10, 100, 1000, or 10,000 parts per billion (ppb) at 10 or 30 parts per thousand salinities in a factorial design with 15 replicates per treatment. We assessed 96-hour survival, time-to-hatch, and standard length at hatching. PFOS was not acutely toxic to sheepshead minnow embryos. Survival was unaffected, indicating that mortality is unlikely in the environment. Both 1000 and 10,000 ppb PFOS delayed hatching by 4.7%. Hatchlings were 1.7% longer at 10 ppt salinity relative to 30 ppt. There were no salinity by PFOS interactions observed. Overall, our study suggests that PFOS is not particularly toxic to sheepshead minnow embryos, as the lowest observable effect concentration (LOEC) in our study was 1000 ppb for time-to-hatch. Future studies should focus on toxicity of PFOS across salinity gradients in recently hatched larvae, which are generally more sensitive to contaminants than embryos.

Mentor(s):

Tyler Hoskins, ,

Elizabeth Allmon, Purdue University

Maria Sepulveda, Purdue University

College of Agriculture

Continual Monitoring of the Local Burying Beetle Prey Base on Nantucket and Block Islands

Author(s):

Evan Kinnevan, College of Agriculture

Abstract:

Once a wide-spread species, the American burying beetle (ABB, Nicrophorus americanus) now occupies only 5–10% of its historic range. The cause of this decline is not well understood, but one potential factor is the decreasing availability of small vertebrate carrion, the beetle's primary food source for breeding and larval development. Unlike ABB on nearby Nantucket Island that exhibit little evidence of recruitment and requires provisioning of resources for population success, the ABB population on Block Island, RI has been self-sustaining. We hypothesize that one reason for the successful population of ABB on Block Island is that they are using pheasants as a carrion resource, which are unavailable on Nantucket Island. We also predict that competition for carrion resources is lower on Block Island compared to Nantucket Island. We used stable isotope analysis (δ13C and δ15N) to evaluate carrion use by wild ABB and three other native burying beetle species on Block Island in 2020–2021. The unique isotopic signatures in the beetle elytra samples serve as record of the carrion ingested by larvae, where isotopes are incorporated into larval tissues and remain present after metamorphosis into adults. We compared beetle signatures with known isotopic signatures of small vertebrates in the region to identify carrion species that comprised the larvae's developmental resource. We also evaluated competition among species by measuring their isotopic niche overlap. By developing an understanding of the carrion base necessary to support burying beetle communities, we hope to improve management and conservation of a federally threatened species.

Mentor(s):

Elizabeth Flaherty, Forestry & Natural Resources, College of Agriculture

College of Engineering

Cost Model for Extra-terrestrial Habitat Evaluation

Author(s):

Kathleen Martinus, College of Education

Abstract:

The desire to explore space and celestial objects has existed long before humanity's first steps on the moon. Resilient, extra-terrestrial habitat systems must be developed before long-duration missions can take place. A deep-space habitat must be built to withstand the most extreme environments with subsystems that interact seamlessly with each other. In the Resilient Extra-Terrestrial Habitats Institute (RETHi), I developed a simulation environment to investigate different configurations of potential habitats. A design cost estimation was needed to compare these configurations and subsystems, as well as estimate cost needs. The developed cost model analyzes establishing the habitat and its operations over its life cycle. I used an Equivalent System Mass (ESM) and Design, Development, Testing, and Experimentation (DDT&E) method for this project to evaluate mass and production costs of different subsystems. ESM is used to create an equivalent mass for each subsystem. This is done to eliminate the need to analyze many quantities with varying units; one sum of mass can instead be evaluated. DDT&E represents the development and production costs of creating a new system. A Python interface was then developed to parse various parameters from subsystem designs within RETHi and calculate respective ESM and DDT&E values. The data gathered will be used to provide estimates on requirements for different habitat configurations as a part of the National Aeronautics and Space Administration. The results of the cost model will be a crucial tool for evaluating deep space habitats and will be an important mechanism for the future of space exploration.

Mentor(s):

Shirley Dyke, Mechanical Engineeriing, College of Engineering

Amir Behjat, Purdue University

Purdue Polytechnic Institute

Attitudes towards Mods

Author(s):

Robert Hastidt, Polytechnic Institute

Abstract:

Video game modification also known as modding has been historically part of the gaming industry. Modding is a form of software modification and can cause copyright infringement unless defined in the software's license agreement. The modified software then is called a mod. Minecraft, a popular computer game, supports their modding scene by explicitly allowing for the creation and distribution of mods. This study looks at the relationship between modders, the creators of mods, their perceived level of ownership of the mods they have created and their internet privacy. This was done by creating a survey and distributing it through forum websites like Reddit and IRC-like applications such as Discord. Questions varied from experience making mods, working in teams, and questions about understanding copyright. Questions pertaining to privacy were derived from Georgia Tech's Internet Privacy Survey. Participants were assumed to have created or worked on at least one mod for the video game Minecraft. The goal of 100 participants of the survey has not been reached as the survey is currently being distributed. The hypothesis is that modders with a strong sense of ownership will also have a strong desire to maintain internet privacy.

Mentor(s):

Kathryn Seigfried-Spellar, Computer Information, Polytechnic Institute

Presentation Abstract Number: 633 :: Social Sciences/Humanities/Education

College of Liberal Arts

Environmental Racism and Uranium Mining

Author(s):

Aidan Andronicos,

Abstract:

Are some portions of the U.S. population more likely to be exposed to environmental contaminants? Are these people more likely to experience negative health outcomes as a result? In this project, I will use exposure to environmental contaminants from uranium mining as a way to address this question. During the nuclear arms race, a new uranium mining boom began. Numerous uranium sources happened to be within Indian Reservations, particularly in the western U.S. The most notable case would be the Navajo Nation with territory in Arizona, New Mexico, and Utah. While there are clusters of uranium mining and milling sites within both native and non-native communities, this project will address the question of whether Native Americans are more likely to experience negative health outcomes as a result of living near abandoned uranium mines and mills. The focus of negative health outcomes will be on kidney and respiratory diseases, especially cancers. Previous literature and data have confirmed that lung cancer created a high mortality rate for former uranium miners in the Navajo Nation. This research will explore other Native communities that have been affected by past uranium mining activity. These communities include Laguna Pueblo in New Mexico and the Spokane Reservation in Washington. In order to use race as a variable, clusters of uranium mining activity in non-native communities will be explored as well. These areas will include central Florida, south Texas, and central Tennessee. The prevalence of uranium related health problems will be measured in these places in order to determine whether Native Americans may be disproportionately affected by these problems. Measurements will be done at the county level. In addition to health data, GIS methods will be used to visualize where the uranium mines are located relative to populated areas. It is also important to consider the uneven access to healthcare that exists on Indian Reservations, which compounds the negative health outcomes. In addition to health and geographic data, unemployment rates will be measured at the county level in order to help understand how poor labor markets enabled these communities to be exploited in the past. So far, I have used GIS methods to explore this problem in The Navajo Nation. I determined that 20-21% of populated areas within The Navajo Nation are within 1 mile of an abandoned uranium mine. Additionally, people living within The Navajo Nation are more likely to have kidney cancer when compared to Non-Hispanic whites in Arizona and New Mexico.

Mentor(s):

Joshua Doyle, Sociology, College of Liberal Arts

College of Health and Human Sciences

Investigating Manganese Transport through the Use of Small Molecules in an hIPSC-Derived Neuronal Model

Author(s):

Kaitlin Stone, College of Health & Human Sciences

Abstract:

Manganese, Mn, is an essential heavy metal that is crucial for numerous physiological pathways and processes. However, brain levels of Mn must be regulated within a narrow range, as both low and high levels of Mn increase the probability of adverse effects and neurodegeneration. Homeostatic regulatory mechanisms are critical in this process, but these mechanisms, more specifically Mn transport, are significantly under investigated. Understanding how the brain maintains Mn homeostasis through transportation is vital to understanding Mn-associated pathogenesis.

Past work to quantify Mn levels relied upon detergents, which resulted in cell death and did not specifically elucidate Mn transportation. Because of this, recent efforts in the Bowman Laboratory have shifted towards small molecules: drug-like compounds that are Mn-selective and increase or decrease intracellular Mn content. The current project investigates the impact that these molecules have on human-induced pluripotent stem cell (hIPSC) derived neurons and optimizes the protocol in these cells–as small molecules have been tested in a very limited manner in hIPSC derived neuronal systems. Ultimately, data collected will be applied towards a mechanistic explanation, which will ideally illuminate therapeutic options for Mn-associated pathogenesis. Throughout this presentation, small molecules will be introduced and their application in an hIPSC-derived neuronal model will be delineated. The presentation will also explore each molecule's ability to up-regulate or down-regulate Mn extraction and highlight the efficacy of this method in studying Mn transportation.

Mentor(s):

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

Anke Tukker, Purdue University

College of Engineering

Light Curve Inversion for Robust Shape Reconstruction of Man-Made Space Objects

Author(s):

Liam Robinson, College of Engineering

Abstract:

Characterizing unknown space objects is a growing field of study in Space Domain Awareness. One fundamental measurement used to characterize objects is its light curve; a set of brightness measurements gathered over time. While the measurement is simple, it depends on the positions of the sun and the observer, and orientation, material composition, and shape of the object. If the orientation and material properties of an object are known, its shape can be estimated from the light curve alone in a process called light curve inversion. This work seeks to strengthen and extend current inversion algorithms to more complex object geometry, including non-convex objects that can cast shadows on themselves. To enable this, a new shadow rendering pipeline is introduced, reducing light curve simulation time and improving data quality. Existing techniques based on the Extended Gaussian Image (EGI) are reinforced through resampling and merging steps, producing more accurate geometry and enabling fully sparse reconstruction. Tools from geometry processing are applied to accelerate object reconstruction from an optimized EGI. Finally, initial steps are made towards detecting and introducing simple concavities, an important capability long desired in the literature of direct light curve shape inversion. These results could enable observers to more efficiently gather and update actionable information on objects of interest in real time.

Mentor(s):

Carolin Frueh, Aeronautics & Astronautics, College of Engineering

Presentation Abstract Number: 636 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

SWARMS: Multi-Agent Control Simulation Platform

Author(s):

Younggil Chang, College of Engineering

Avi Dube, College of Engineering

Konrad Kawnatra, College of Engineering

Sully Cisco, College of Engineering

Arjith Jegannathan, College of Engineering

Jason Park, College of Engineering

Jack Roy, College of Engineering

Shashank Sridhar, College of Engineering

Harrison Wongsonegoro, College of Science

Abstract:

The SWARM Simulation platform provides a novel web-based application for researchers to design, implement, and evaluate multi-agent flight control algorithms while reducing computational requirements for the end users. By leveraging cloud services, SWARM is a scalable, realistic, and user-friendly simulator. The platform provides downloadable data log files and visualizations of the simulation results, such as drone positions over time. The platform ensures security of user data by automatically patching codebase vulnerabilities, and prevents unauthorized access and communications between drones. SWARM provides various realistic benchmarks to reduce development times and costs for real-world scenarios. The platform includes built-in libraries of common swarm functions, including task allocation and obstacle avoidance (utilizing LiDar sensor data from the platform). Our future plans include improving the security capabilities, the data portal, and adding disaster management scenarios on the infrastructure side. We also plan to improve our existing algorithm implementations and implement built-in machine learning capabilities.

Mentor(s):

Shreyas Sundaram, Electrical & Computer Engineering, College of Engineering

Tong Yao, Purdue University

Presentation Abstract Number: 637 :: Innovative Technology/Entrepreneurship/Design

Purdue Polytechnic Institute

A GUI for Measuring Cognitive Workload Stimulus in Human Robot Interaction

Author(s):

Revanth Krishna Senthilkumaran, College of Engineering

Abstract:

A method to measure cognitive stimulus in the area of Human Robot Interaction to identify the state and workload of users with a GUI is being researched. Existing applications that aid in measuring cognitive stimulus are out-dated and not suited for applications in more recent times. Hence, a new developed GUI based stimulus to evoke cognitive loads with the help of a defined user experiment is proposed. The user experiment was conducted with the help of SMARTmBOTs (robots that were developed for this experiment), along with some biosensors and a Vicon camera system, all setup on ROS2, on a population of 30 people. Users performed tasks while wearing the wearable biosensors and the data collected from them and a survey that followed on the GUI was collected to be passed into a multi-modal perception model that was used to draw conclusions based on the cognitive workload stimulus measured. The GUI was built with the help of PyQt as ROS2 support is offered by PyQt. A ROS Topic list for the experiment conducted was also made available via the software developed. Though this GUI is currently made for this specific experiment, it is being made open source and with added capabilities for it to be more applicable as a standard for the area of research of Human Robot Interaction.

Mentor(s):

Byung-Cheol Min, Computer Information, Polytechnic Institute

Wonse Jo, Purdue University

Ruiqi Wang, Purdue University

College of Agriculture

Optimization of Protein Analysis for Anaerobic Digestion Feedstocks and Samples

Author(s):

Amanda Pisarczyk, College of Agriculture

Abstract:

Redacted.

Mentor(s):

Jennifer Rackliffe, Agricultural & Biological Engineering, College of Agriculture

Presentation Abstract Number: 639 :: Innovative Technology/Entrepreneurship/Design

College of Engineering

Towards the development of implantable biosensors with biocompatible adhesives

Author(s):

Carl Russell III, College of Engineering

Pei-Lun Chen, College of Engineering

Abstract:

Observing changes in the human body is critical for the management of many chronic illnesses. Implantable biosensors have the capability to help track various biomarkers to enable more personalized medicine. Biosensors typically feature a biorecognition element and a signal transducer. However, many implantable biochemical sensors have limited in vivo functionality in terms of long-term reliability. There are several reasons for biosensor performance drift including foreign body response, biorecognition molecule degradation, and physical abiotic device failures (i.e., breakage, corrosion, migration, etc.). Device migration is a big issue for chronically implanted electronics including neurostimulators and biosensors. In this work, we seek to utilize the latest in bioadhesive technology to better localize and immobilize biosensors during implantation to prevent migration. We will use a surface coating procedure to construct and package a model enzymatic biosensor for glutamate and evaluate the electrochemical performance of the biosensor in vitro including cyclic voltammetry, electrochemical impedance spectroscopy, and chronoamperometry. This preliminary work will demonstrate whether the biosensor can maintain its functional properties while eliminating the concerns of sensor migration. In addition, the bioadhesive will facilitate future surgical implantation procedures by eliminating the need for device anchoring.

Mentor(s):

Hyowon Lee, Biomedical Engineering, College of Engineering

JongCheon Lim, Laboratory of Implantable Microsystems Research, Purdue University

Angel Enriquez, Laboratory of Implantable Microsystems Research, Purdue University

College of Liberal Arts

The Frog Giggers of Corydon: Exploration and Storytelling of Multispecies Relatedness between Humans and Frogs

Author(s):

Saish Solankar, College of Liberal Arts

Abstract:

Hunting frogs with gigs to cook and consume legs of the frogs is a widespread tradition practiced by some communities in the United States. While hunting is perceived to be an act of violence, anthropologists have argued that hunting often reflects some sort of relatedness - the myriad ways in which the potential and outcome of life always unfolds in relation to that of another - and reciprocity between human persons and the non-human persons that they hunt. Interspecies entanglements that once seemed the stuff of fables are now material for serious discussion among biologists and ecologists. The hunting and eating of frogs is such a perceived act of violence that could form a similar relatedness. There is a global amphibian crisis with a huge threat of mass extinction looming around frogs and understanding how frogs and humans form such socialities can help address the crisis. Frog gigging is a multi-generational tradition and meaningful to many who do it. This ethnographic study with a community of frog hunters in Corydon, Indiana, gives us further insight into the world of multispecies relatedness and entanglements, outside of a companion animal and mammalian context, and contributes to multispecies anthropological theory.

Mentor(s):

Andrew Flachs, Anthropology, College of Liberal Arts

College of Liberal Arts

Metallographic and Portable X-Ray Fluorescence Analysis of Copper-based Metals from Fort Ouiatenon

Author(s):

Samuel Bakeis, College of Liberal Arts

Abstract:

Fort Ouiatenon was a fur trading post built to protect French fur-trading interests in the Wabash River valley in the 18th century. Excavations performed in the 1960s and 70s recovered a rich material collection including copper-based artifacts that have eluded focused research until now. This project has emphasized the analysis of copper-based artifacts, especially kettle fragments and other pieces of scrap copper to better understand the metallurgical practices of Fort Ouiatenon and contextualize them within a larger regional framework. Selected copper fragments displayed a variety of colors, sizes, and signs of manipulation. Analysis was performed with a Bruker portable X-Ray Fluorescence (pXRF) device. Data were interpreted using established standrards to provide rough estimates of the weight percent of elements that made up the examined artifacts. A secondary objective involved the identification of diverse metal artifacts correlated with the site and surrounding areas. The analysis of these materials expand the narrative of Fort Ouiatenon and how identity, values, practices, and cultures were negotiated between European and Indigenous actors.

Mentor(s):

Kory Cooper, Anthropology, College of Liberal Arts

Ian Lindsay, Purdue University

Presentation Abstract Number: 642 :: Mathematical/Computation Sciences

College of Engineering

How Brain-like is your Artificial Neural Network?

Author(s):

Aditi Anand, College of Engineering

Abstract:

Biological brains have inspired many ideas in the field of artificial intelligence (AI), including artificial neural networks (ANNs). While ANNs have exceeded human capabilities in an ever-increasing range of tasks, their computational requirements have increased exponentially, motivating efforts towards more efficient, brain-like AI systems. Quantifying the similarity between ANNs and their biological counterparts is an important step towards this end. Recent efforts in this direction use neural predictivity, or the ability to predict the responses of a biological brain given the information in an ANN (such as its internal activations), when both are presented with the same stimulus. We propose a new approach to quantifying neural predictivity by explicitly mapping the activations of an ANN to brain responses with a non-linear function, and then computing the error between the predicted and actual brain responses. Further, we propose to train a neural network as a decoder to approximate this mapping function. The proposed method was implemented within the TensorFlow framework and evaluated on a suite of 8 state-of-the-art image recognition ANNs and neural recordings from the visual cortex of rhesus macaques. Our experiments suggest that the proposed method leads to a more accurate estimate of an ANN's neural predictivity. Our findings also indicate that the latest advances in classification performance of image recognition ANNs are not matched by improvements in their neural predictivity. Finally, we examine the impact of pruning, a widely used ANN optimization, on neural predictivity, and demonstrate that network sparsity leads to higher neural predictivity.

Mentor(s):

Kaushik Roy, Purdue University, Faculty

Sanchari Sen, IBM Research Center

College of Science

Quantification of Folate Receptor Density as a Tool to Improve CAR T Cell Therapies

Author(s):

Kenneth Rodriguez-Lopez, College of Science

Abstract:

Engineered T cells expressing surface chimeric antigen receptors (CARs) are tunable anti-tumor therapeutics that have demonstrated promise in treating blood cancers by repurposing the potent targeting and killing activities of these adaptive immune cells. Unfortunately, the translation of this technology to eradicating solid tumors has largely failed and some clinical trials have been halted due to severe toxicities from CAR T cell treatments. We are working to define the thresholds for CAR T activation to promote improved receptor design and more tolerable therapeutic regimens. Tumor evolution includes changing levels of CAR target expression which could alter efficacy. One such cell surface marker, the folate receptor, is overexpressed on ovarian, breast, lung, pancreatic, and kidney cancer cells. We are developing a well-defined breast tumor cell model by generating clonal populations with different expression levels of folate receptor (FRs) and spanning the 2 to 3 orders of magnitude that are characteristic of the normal-to-disease surface densities. The distribution of FR expression is quantified using flow cytometry. These populations will be used in cell-cell killing assays to measure cytokine-induced cell death as a function of folate receptor density. The results are paired with in vitro reconstitution-based assays to map the numbers and characteristics of CAR-FR binding events to T cell activation. We are building a more complete mechanistic understanding of engineered cell-tumor cell interactions, giving insight on how to better modify CAR T cells for more effective cancer immunotherapies.

Mentor(s):

Kevin Scrudders, Chemistry, College of Science

Shalini Low-Nam, Purdue University

College of Science

Macroscopic Resistance of Vanadium Dioxide during Metal Insulator Phase Transition

Author(s):

Amit Rohan Rajapurohita, College of Science

Abstract:

Vanadium Dioxide (VO2) exhibits unique pattern formation while it undergoes a temperature-driven Metal-Insulator (MI) phase transition. We use optical microscopy techniques to image the surface of a VO2 thin film, simultaneously measuring the macropscopic resistance. Patches of metal and insulator form while undergoing the MI phase transition and display hysteresis. We model the observed resistance by converting each pixel of the recorded images into an insulating node or a metallic node with four terminals. The resulting two-dimensional resistor grid was generated by connecting each node with its four neighbors, with equal temperature-dependent insulating resistors or saturated metallic resistors. The resistance values connecting the nodes with their four terminals were based on the temperature and macropscopic resistance measurements taken during the saturation of each phase. I used a time and memory-efficient Bond Propagation Algorithm mediated by Y-Delta/Delta-Y transformations in JAVA, which reduces the 2D resistor grid into a single equivalent resistance. Comparison between computationally simulated and experimental resistance measurements sheds light on a shortcoming of the model. The modeled resistance curve was sharper, opened later, and closed earlier than the measured resistance curve, implying intricate pattern formation beyond the microscope's resolution. Equipped with the idea of a more delicate sub-pixel structure, the grayscale intensities of each pixel are now modeled using patterns from the Random-Field Ising model. This model has the potential of capturing the entire macroscopic resistance measurements. This study would further our understanding of temperature-driven phase transition in VO2 and open new avenues in nanoelectronics and neuromorphic computing.

Mentor(s):

Erica Carlson, Physics & Astronomy, College of Science

Forrest Simmons, Purdue University

Presentation Abstract Number: 645 :: Social Sciences/Humanities/Education

<div align="center">

College of Health and Human Sciences

Methodological Changes in Global Food Security Studies during the Pandemic: Limitations and Recommendations

</div>

Author(s):

Madeline Powers, College of Health & Human Sciences

Abstract:

Introduction: The COVID-19 pandemic has substantially impacted food security, diets, and nutrition inequities. Given limitations imposed by the pandemic, studies to assess its impacts globally have used new methods. We conducted a comprehensive review of studies on food security during the COVID-19 pandemic to examine their methodological strengths and limitations.

Methods: We identified peer-reviewed and grey literature appearing on Google Scholar between March 2020 and July 2021 using the search string [food security "COVID-19"]. For each study, data were extracted on geographical locations and populations covered, data collection timing and methods, reported outcomes, and disaggregation of results.

Results: We identified 216 studies across 92 countries, with just 8% of studies including a low-income country. Only 17% of studies included more than one time point, 26% included qualitative data, and 45% were peer-reviewed. Remote data collection was used for most studies, only 24% of studies used random sampling methods, and 20% of studies were unclear in their sampling method. Few studies (15%) reported response rate. Studies reported on food security (70%), livelihood effects (31%), food availability (17%), and diets (14%). Overall, 69% of studies reported disaggregated outcomes; however, only 23% of studies reported outcomes by gender, 17% by income, and 16% by race/ethnicity.

Implications: Although remote data collection offers several benefits, it has significant limitations, particularly in excluding the most vulnerable, creating biased estimates, and limiting the generalizability of results. When disseminating results, researchers should develop ways to ensure representative samples, reduce bias, clearly state methods, and report disaggregated results.

Mentor(s):

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

Ramya Ambikapathi, Purdue University

Morgan Boncyk, Purdue University

College of Science

Antibiotic activity of Streptomyces Isolates

Author(s):

Diane Santos, College of Science

Abstract:

Streptomyces are soil-dwelling bacteria belonging to the actinobacteria phylum. They are prolific producers of natural products, many of which have antibiotic activity and could have great utility against the rising threat of antibiotic resistant bacteria. To prevent the global spread of these antibiotic resistant pathogens, novel natural products are in need. This project focuses on the discovery of novel antibiotics from newly isolated Streptomyces strains. First, bacteria were isolated from a variety of soils using a procedure that selects for actinobacteria. After isolation, genomic DNA was isolated and 16s rRNA gene sequencing was conducted to confirm that the bacteria were Streptomyces. Cross streaks were then performed on SAM media to observe antibiotic activity against ESKAPE pathogens through a zone of inhibition. To stimulate a variety of biosynthetic gene clusters, SAM media was supplemented with different antibiotics. Future directions for the project will include growing these strains on multiple media to verify the antibiotic activity noticed on the cross streaks. GUBC, MS, AGS, and ISP4 media will be used, due to their difference in carbon, phosphorus, and nitrogen sources. Supernatant collected from these plates will undergo solid phase extraction, extracts from this process will be tested for antibiotic activity. Metabolomics will then be conducted to determine whether possible natural products are known or novel and structure determination using mass spectrometry and NMR.

Mentor(s):

Elizabeth Parkinson, Chemistry, College of Science

Amir Alwali, Purdue University

Honors College

Investigating the effects of an after-school program on the social well-being of urban youth

Author(s):

Alexander Patton, College of Health & Human Sciences

Abstract:

It is impossible to deny that there is a major issue with the living situations children are exposed to within impoverished urban communities. We are taking steps to aid in developing them into leaders so that they are able to help improve their own community. Over the course of several years, Purdue students have been going to the local community center in order to interact with the children both through tutoring and through play. While at the community center, students have taken ethnographic notes in the hopes of gaining some level of insight into the children's daily lives. Some of the findings are quite alarming, as stories surrounding the quality of homes, lack of food, and exposure to violence have been recorded by the researchers. The hope, however, is that by acting as mentors to these children, we are able to build a relationship with them and thereby help them develop the ability to transform their own lives for the better. The research being focused on therefore inquires to what extent does a after-school program aid in challenges urban youth face in a local impoverished community in Lafayette Indiana. Following the embedding of Purdue students into the community, there have been a number of positive benefits that have been observed. Better academic performance from some of the students, as well as an improved relationship between the children's parents and the community center's leadership are just a few of the outcomes that can directly improve a child's well-being.

Mentor(s):

Jason Ware, Honors College

College of Engineering

Deviatoric Stress Driven Transient Melting Below the Glass Transition Temperature in Shocked Polymers

Author(s):

Jalen Macatangay, College of Engineering

Abstract:

Shock compression introduces a near-instantaneous increase in temperature and deviatoric stress as the shockwave propagates within a condensed matter system. When polymers are subjected to strong shocks, relaxation mechanisms, such as cooperative intramolecular motion and chain rearrangements, operate to reduce deviatoric stresses towards a hydrostatic equilibrium state. However, these mechanisms and their associated rates are poorly understood, especially challenging is the initial response following shock loading. Therefore, we simulate shock loading on glassy polystyrene using molecular dynamics simulations with the multiscale shock technique (MSST) to characterize the stress relaxation processes. For strong shocks, the relaxation of deviatoric (von Mises) stress exhibits two regimes: i) an initial fast relaxation lasting 2-5 ps, ii) followed by a more gradual process. Analysis of the torsional transition events in the polymer backbone bonds (dihedral angles switching between low-energy states) indicates that the fast relaxation is associated with shock-induced virtual melting. The second regime corresponds to glassy dynamics.

Mentor(s):

Brenden Hamilton, Materials Engineering, College of Engineering

Alejandro Strachan, Purdue University

Presentation Abstract Number: 649 :: Life Sciences

College of Pharmacy

Modeling and Restoring Neurotypical Function in Scn2a Deficient Mice

Author(s):

Jacob Paulaskas, College of Pharmacy

Abstract:

Encoded by the gene SCN2A, Nav 1.2 sodium channels propagate action potentials as the main form of communication in the brain, especially during development. When the SCN2A gene becomes disrupted by mutation, the phenotypic results range from epilepsy to autism in humans. To model the effects of SCN2A-related neurodevelopmental disorders and examine the efficacy of potential therapies, a gene trap strategy was used to create a mouse model, which displayed similar symptoms to humans with the disorder. The gene trap was inserted between Exons 1 and 2 and contained a "leaky" promoter region, which allowed for a functional transcript of the Scn2a gene to be produced at levels of 29±4% in homozygous (HOM) mice, compared to 100% expression in wild-type (WT). The HOM and WT mice were then put through a series of behavioral and sociability assays to test the effects of various pharmaceutical therapies on restoring normal cognitive function. Furthermore, the HOM did not mate so heterozygous (HET) had to be used for breeding, this required each mouse to be genotyped with PCR due to Mendelian genetics. The primary issues which arose with the genotyping procedure were maintaining consistent DNA/elution buffer concentrations during extraction and streaking on the electrophoresis gel. In the future, we will continue to monitor and adjust the protocol as necessary for successful genotyping. Overall, the HOM gene trap mice will continue to serve as a model for testing new therapies for Scn2a disorders to help those affected.

Mentor(s):

Muriel Eaton, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Yang Yang, Purdue University

College of Pharmacy

The reversibility of social deficits in adult SCN2A gene-trap mice

Author(s):

Chau Phan, College of Pharmacy

Abstract:

Significant progress in genetic research has identified SCN2A gene mutations as the leading cause for neurodevelopmental disorders, especially autism spectrum disorder. SCN2A are encodes for protein sodium voltage-gated channel NaV1.2 expression throughout the development of brain. This neuronal sodium channel is important for action potential initiation, propagation, and backpropagation in both excitatory and inhibitory neurons. These action potentials could then influence many functions, including activity-dependent gene transcription, synaptic integration, and synaptic plasticity.

From a therapeutic perspective, insights into SCN2A pathology and NaV1.2 function provide potential treatment. A knockout mouse model was previously used for pre-clinical study of disorders associated with SCN2A. However, homozygous knockout (null) of SCN2A-/- results in perinatal lethality. To illustrate the more severe pathogenic phenotypes of SCN2A, we are the first to utilize the gene-trap knockout (gtKO) model. This novel approach allows 75% reduction of SCN2A mRNA, leaving enough SCN2A residual expressions for viability. Our gene-trap design is very versatile since the modification is reversible via cleavage by flippase recombinase. These homozygous SCN2AgtKO/ gtKO mice demonstrates social deficit in multiple social behavior tests, including stranger interaction.

The aim of this study is to restore SCN2A expression, especially in neurons projecting to the striatum, to increase sociability. Unfortunately, overexpression of SCN2A could increase risk of seizures. Since the ratio excitatory to inhibitory firing in the medial prefrontal cortex increases in SCN2A-deficient mice, we hypothesize that decreasing the excitatory firing (DREADD) or increasing the inhibitory firing (GABA receptor agonists) would balance the ratio and rescue social in SCN2A-deficient mice.

Mentor(s):

Muriel Eaton, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

College of Science

Discovery of a Novel Tunable SHP2 Covalent Inhibitor Scaffold by Fragment Screening

Author(s):

Quyen Nguyen, College of Science

Abstract:

SHP2, Src homology region 2-containing protein tyrosine phosphatase 2, is a protein tyrosine phosphatase (PTP) that affects cell growth, survival, and proliferation. Its overexpression is associated with human diseases such as leukemia, breast cancer, lung cancer, and liver cancer. Several studies have demonstrated that SHP2 inhibition induces apoptosis of cancer cells, delay tumorigenesis, or reduce tumor size. Hence, SHP2 is a potential therapeutic target for cancer treatment. However, works to date primarily focus on reversible small molecule inhibitors that suffer from protein mutation and poor bioavailability. Covalent small molecule inhibitors, on the other hand, can easily overcome these shortcomings and achieve similar potency with lower dosages. In this work, a high-throughput screening (HTS) methodology was developed and performed to identify covalent fragments targeting SHP2. Around 4,600 small fragments were screened, and hits of interest were purchased and resynthesized. From the library, a novel acetoacetanilide scaffold was acquired. Unlike other previously reported covalent probes, acetoacetanilide has an "interior" warhead rather than a terminal warhead, representing a unique and novel chemotype. Substitution or installment of various functional groups at 3 different positions of the acetoacetanilide generated a structure-activity relationship (SAR) that supports the utility of this series as a novel and bonafide covalent SHP2 inhibitor with the ability to tune the electrophilicity of the scaffold. The methodology of this work has provided a platform for future discovery of other covalent PTP inhibitors. Additionally, the obtained acetoacetanilide scaffold provided insights into the development of covalent inhibitors as an alternative strategy to target SHP2.

Mentor(s):

Zihan Qu, Chemistry, College of Science

Zhong-Yin Zhang, Purdue University, Department of Medicinal Chemistry and Molecular Pharmacology, Purdue Institute for Drug Discovery

Presentation Abstract Number: 652 :: Life Sciences

College of Engineering

Practical Implications for Great Saphenous Vein Closure Using a New Radiofrequency Ablation Catheter: A First Experience, Comparative Study

Author(s):

Megha Gupta, College of Engineering

Abstract:

Introduction:

While numerous tools are available for the treatment of chronic venous disease resulting from superficial venous insufficiency, only 1 radiofrequency ablation (RF) catheter (ClosureFastTM) has been widely available for clinical use. We sought to compare the short-term success of great saphenous vein (GSV) ablation with VENCLOSE as compared to ClosureFast, using 2 consecutive post-procedure duplex ultrasounds (DUS). We also compared the occurrence of negative outcomes, treatment times, and number of RFA cycles performed.

Methods:

We performed a retrospective matched cohort study of patients that had RF for symptomatic GSV insufficiency at a vascular surgery practice 2019-2020. We included 100 consecutive patients treated with VENCLOSE and matched them with patients treated with ClosureFast by age and sex (1:1). We tested for significant differences in outcomes with Fisher's exact test, multivariable logistic regression, and Poisson regression.

Results and Conclusion:

GSV were closed at first ultrasound and none were recanalized at second (~1-6 months). Approximately 17% of ClosureFast and 22% of VENCLOSE reported superficial venous thrombosis (SVT). However, the odds of SVT were no different between groups when controlling for surgeon (aOR = 1.5, 95% CI = 0.7, 3.6, p = 0.30). Treatment time was significantly shorter ($p < 0.01$) among patients treated with VENCLOSE, controlling for confounders. The number of RF cycles was also significantly lower ($p < 0.01$) among patients treated with VENCLOSE after controlling for the same. Both devices achieved equal numbers of successful saphenous vein ablation. Procedure times and number of treatment cycles were significantly less with VENCLOSE.

Mentor(s):

Oleg Sostin

College of Liberal Arts

The Great Chinese Famine and its Long-Term Health Consequences (1959-Present)

Author(s):

Suhas Yernool, College of Liberal Arts

Abstract:

The Great Chinese Famine (1959 to 1961) is the deadliest famine in recorded history, killing between 15-50 million. The Chinese government has minimized its impact, and the society at large has simply pushed aside memories of the famine and discussions of its consequences. The causes of the famine, the scale, and the immediate toll it took on the society are well understood. However, the long-term health effects remain unclear. Studies on long-term effects will provide insights into the current health of the famine-exposed Chinese population as well as any long-term effects to be anticipated in people exposed to subsequent famines elsewhere. Analysis of medical, historical, and scientific literature reveals only few segments of the population suffered lasting health consequences, namely those born during the famine (the birth cohort) and right after the famine (the infant cohort) The infant and birth cohorts exhibit greater rates of adverse effects on fertility, growth, development, and susceptibility to disease in comparison to other famine exposed groups. In general, females were more affected than males, and so were rural people compared to urban populations. The rural birth cohort are more likely to suffer from early menopause, stillbirths, and premature ovarian failure. In terms of growth, members of both cohorts lost height up to several centimeters. Lastly, both cohorts have increased risk of developing chronic diseases including obesity, diabetes, hypertension, and metabolic syndrome. The prenatal cohort is also at greater risk for certain chronic infectious diseases like pulmonary tuberculosis (PTB).

Mentor(s):

Ray Douglas Hurt, History, College of Liberal Arts

College of Engineering

Environmental Testing and Computational Modeling for NASA Solar Cruiser Sail Context Camera

Author(s):

Becca Reinecke, College of Engineering

Tasveen Chopra, College of Engineering

Samantha Unger, College of Engineering

Aleksey Urmanov, College of Engineering

Abstract:

Solar Sails meet the demand in long-distance propulsion technology. They use solar radiation pressure to propel a vehicle through space. Purdue University students are developing a camera system for analyzing by image processing the efficiency of a solar sail that will be used on the NASA Solar Cruiser mission that will be launched in 2025. In an effort to understand and address new technicalities, research centers on certain environmental stressors: thermal, radiation and shock effect. Investigations of these factors on the test camera are led in Solid Works, with computational simulations, while physical testing will be conducted with the final camera. By analyzing the specs of the chosen camera, the simulations will determine if the camera remains in the working parameters. Solid Works simulation testing is a viable alternative to physical testing. A steady-state thermal simulation testing manual has already been developed. With this tool, analysis of the thermal response of a component can be conducted by assigning heat sources in the CAD model and specifying any heat transfer that happens between parts. Additionally, physical testing procedures for unsteady thermal, steady-state and unsteady transient thermal, steady radiation, and steady vibration simulation testing will be drafted concurrently with computational simulation. An engineering testing unit will be selected for use prior to the acquisition of actual mission hardware from NASA. This unit will be used for modeling and physical testing to expedite future mission hardware testing.

Mentor(s):

Katherine Fowee Gasaway, Aeronautics & Astronautics, College of Engineering

Alina Alexeenko, Purdue University

Anthony Cofer, Purdue University

College of Health and Human Sciences

Needs, Challenges, and Coping Strategies of FEH in Tippecanoe County: A Providers Prospective

Author(s):

Madeline Moser, College of Health & Human Sciences

Sophie Shank, College of Health & Human Sciences

Elinor Carmona, College of Health & Human Sciences

Shaulay Ward, College of Health & Human Sciences

Abstract:

Background:

Families experiencing homelessness/housing instability (FEH) face multiple disadvantages. The COVID-19 pandemic magnified challenges leaving FEH struggling to find safe housing, work, and services. Coping can buffer the burden faced by FEH. A need persists to understand how the pandemic has impacted the lives of FEH and how they cope. This study sought to understand from providers who serve this vulnerable population, the challenges, needs, and coping strategies of FEH living through the COVID-19 pandemic.

Methods:

Interviews were conducted and thematically analyzed with organizational staff (N = 15).

Results:

Provider's identified barriers to finding quality housing, locating needed services, and securing employment. They identified mental health issues and family violence as pressing concerns. COVID-19 disrupted family dynamics as well as parental roles. Providers shared being concerned about how the lives of FEH would be affected once COVID relief measures end. Providers discussed sense of optimism, and social and organizational support as FEH coping strategies. COVID policies (e.g., eviction moratorium) provided safety nets. Providers offered ways the pandemic could allow clients to gain control of their lives.

Conclusion:

Study findings reveal that providers view COVID-19 and the safety protocols that were implemented in response to the pandemic as amplifying the challenges faced by FEH and exacerbating their needs. Providers also described coping strategies that helped FEH reduce their persistent stress and offered them a sense of control over their circumstances. This study can inform future program and policy development that focus on decreasing challenges faced by FEH and enhancing coping mechanisms.

Mentor(s):

Yumary Ruiz, Public Health, College of Health & Human Sciences

Carlyn Kimiecik, Purdue University

Natalia Rodriguez, Purdue University

Jason Ware, Purdue University

College of Science

Structural determination of bacterial effector CteC

Author(s):

Hannah Rondon, College of Science

Abstract:

ADP-ribosylation is a post-translational modification strategy that various pathogens employ to interfere with host cellular processes. One of the targets for ADP-ribosylation is ubiquitin, a small globular protein vital in host immune response and protein degradation. Recently, a bacterial effector, CteC, from Chromobacterium violaceum has been found to ADP-ribosylate ubiquitin on Threonine-66. This modification on ubiquitin hinders normal host ubiquitination by disabling ubiquitin transfer from E1 activating enzyme to E2 conjugating enzyme. However, the molecular basis of this ADP-ribosylation is not well understood, which limits our current understanding of this bacterial ADP-ribosyl transferase. To address this, protein crystallography technique is applied to gain structural details of this bacterial effector and its interactions with the substrates. So far, I have successfully crystallized CteC in its apo form and collected a 2.8 Å dataset. Meanwhile, I also conducted a gel-based assay to clearly show the enzymatic activity of CteC. Currently, I am working on optimizing the crystals and trying to obtain co-crystals of CteC in complex with its substrates. Eventually, I hope to elucidate the catalytic mechanism of this bacterial enzyme and provide insights into how C. violaceum hijacks the host ubiquitination pathway.

Mentor(s):

Zhengrui Zhang, Chemistry, College of Science

Chittaranjan Das, Purdue University

College of Health and Human Sciences

Chlorpyrifos and chlorpyrifos-oxon exposure leads to the dysregulation of basal glutamate release in human induced pluripotent stem cell derived glutamatergic neurons

Author(s):

Adam Barmash Rubinchik, College of Health & Human Sciences

Abstract:

Chlorpyrifos is an organophosphate pesticide and insecticide that was developed with intended use in agricultural and household settings. It is known that chlorpyrifos (CP), or its more toxic metabolite CP-oxon (CP-O), causes a wide range of health complications such as neurological dysfunction, immunotoxicity, and developmental issues. Due to its dangerous nature, the use of chlorpyrifos has been severely restricted to completely banned in many countries. However, it is only partially outlawed in the US. The main source of CP-O neurotoxicity has long been thought to be from acetylcholinesterase inhibition, though much emergent data suggest that other neurotransmitter systems are targeted. Currently, little is known about its effects on the glutamatergic (GLUergic) system. The aim of this study is to determine the neurotoxic effects of CP and CP-O on neurotransmitter release in human iPSC derived GLUergic cortical neurons.

GLUergic cortical cultures were differentiated via dual-SMAD inhibition from hiPSCs. Upon maturation (>D90), a baseline collection for extracellular glutamate was performed followed by a 24-hour exposure to CP (3 µM – 300 µM) or CP-O (0.1 µM – 10 µM). Following exposure, cells recovered for 48 hr with additional glutamate collections performed at 24 and 48 hr. After the recovery period, whole-cell protein lysates were collected to correct measured glutamate release for cell density by BCA. Our findings demonstrated that cells exposed to CP showed a concentration-dependent increase in net glutamate release compared to baseline. The upregulating effect was maintained over a 24-hour period. On the other hand, cells exposed to CP-O showed no significant upregulating or downregulating effect on net glutamate release. In addition, our 60-minute collection timeframe was identified to be at net glutamate uptake-release equilibrium.

Mentor(s):

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

Anke Tukker, Purdue University

College of Agriculture

Effects of Novel Tumbling Application and Postmortem Aging on Cull Cow Beef Loin Tenderness

Author(s):

Madison Romanyk, College of Agriculture

Abstract:

Cull cows comprise about 20% of all cattle slaughtered in the U.S., however their meat is under-utilized due to its inferior meat quality attributes and toughness. While several methods have been used to improve quality, there is a need for a natural and easy post-harvest improvement strategy. The objective of this study was to investigate the effect of fresh beef tumbling coupled with postmortem aging on tenderness and proteolysis of cull cow beef loins. Loin muscles (Longissimus lumborum) from twelve Holstein cows over 30 months of age were obtained and divided into three tumbling treatments: no tumbling control (NT), tumbling normal (T), and tumbling with spiked liner (TS). These sections were separated into two aging treatments: no further aging and 2 weeks of further aging after tumbling. Several meat quality and biochemical attributes of beef samples were determined. The Warner-Bratzler shear force values (WBSF; instrumental tenderness) showed no significant differences between tumbling treatments ($P>0.05$). However, TS samples showed a downward trend of slightly decreasing values. Western blot analysis showed no significant differences in amount of proteolysis that occurred between tumbling treatments ($P>0.05$). Tumbling treatments had no adverse impacts on water-holding capacity, color, or pH ($P>0.05$). A consumer panel (n=72) concluded that tumbled cull cow beef loins were more tender and favorable to early postmortem NT samples, indicating the positive impacts of tumbling on sensory evaluation. Further trials with different tumbling conditions (e.g. tumbling speed, time etc.) could maximize the impact of fresh beef tumbling on tenderization of under-utilized beef products.

Mentor(s):

Brad Kim, Animal Sciences, College of Agriculture

Mariah Nondorf, Purdue University

College of Science

Agent-based modeling and game engines compatibility for human behavior analysis

Author(s):

Siwen Hu, College of Science

Bo Wu, College of Engineering

Huihao Yin, College of Engineering

Pelin Yu, College of Engineering

Xinyou Chen, College of Engineering

Abstract:

This paper seeks to contribute to studies in human behavior modeling by using a video game engine to develop artificial intelligence (AI) based actors (NPCs) to simulate how people would react to elements in the built environment. This agent-based investigation will model individual people with randomly generated traits as opposed to more common fluid-based simulations. Unreal Engine, CryEngine, and Unity engine are the three most common game engines available for design. The team will analyze each toolset's advantages and disadvantages for the purpose of finding the one that is the most compatible for our research purpose. Finally, a demonstration AI simulation is generated and its decision tree system is explained.

Mentor(s):

David Barbarash, Horticulture & Landscape Architecture, College of Agriculture

College of Science

The Effects of Point Mutations on the Dimerization Domain of Ebola Virus Protein VP40

Author(s):

Jacob Conarty, College of Science

Abstract:

The Ebola Virus (EBOV) is a deadly virus first identified in 1976 from the Ebola River region of Zaire (presently the Democratic Republic of Congo). EBOV is known for causing viral hemorrhagic fever and it can cause a high mortality rate in infected patients. VP40 is the matrix protein of EBOV (eVP40), which has an N-terminal domain responsible for dimerization and oligomerization of the protein to form filaments of dimers at the plasma membrane inner leaflet of the host cell. The eVP40 dimerization and filament formation is necessary for viral budding from the host cell membrane. This project aims to investigate which amino acid residues in this N-terminal dimerization domain are necessary for the protein to be able to oligomerize at the plasma membrane inner leaflet. First, computational screens were performed to determine which residues may play a role in dimerization, and then mutant plasmids with changes at these residues harboring a green fluorescent protein tag were created. Based on the computational screen, we hypothesized amino acid residues Arg52, Ile54, Ala55, Asp56, and His61 would be essential for dimerization of eVP40. Mutants of these residues were then transfected into Cos-7 cells and imaged using confocal microscopy compared to that of WT eVP40. Cellular images were analyzed using ImageJ to determine the amount of fluorescently-tagged protein present at the plasma membrane. Confocal imaging confirmed our central hypothesis and the computational data as these mutations had a significant loss of eVP40 plasma membrane localization. The next steps in this project will be to perform virus-like particle (VLP) collection to further analyze the effects of point mutations on the dimerization domain as it relates to VLP formation budding out of the host cell.

Mentor(s):

Robert Stahelin, Medicinal Chemistry & Molecular Pharmacology, College of Pharmacy

Souad Amiar, Purdue University

Olaf Wiest, University of Notre Dame

Presentation Abstract Number: 661 :: Innovative Technology/Entrepreneurship/Design

College of Liberal Arts

The correlation between age and perspectives towards technology

Author(s):

Evan Humphrey, Polytechnic Institute

Miyu Sumimoto, School of Management

De'keva Tindal, College of Liberal Arts

Abstract:

Emerging literature on virtual assistants such as Alexa and Siri suggests that older individuals use these technologies and, in some cases, view them more positively than younger individuals (Stigall et al., 2019). However, this literature could be improved through research on how age impacts interactions with these virtual assistants. This project seeks to assess whether there are differences in the causes individuals attribute to a virtual assistant's displays of emotion, based on age. For the project, 194 participants were recruited through Amazon's Mechanical Turk Program. The participants took a qualtrics survey where they watched a video of a confederate asking Alexa to change the temperature and where Alexa responded with a confirmation of temperature and a statement about either current news or a new HBO show. Alexa then displayed emotion towards either the request or its statement about the news/HBO. Attributions were measured through a forced-choice question about what participants believed caused an Alexa's display of emotion, asking participants which of four choices (a user's request, the user in general, the virtual assistant's disposition, or information provided by the virtual assistant unrelated to the user request) the Alexa's emotional display was most likely caused by. It is predicted that older participants will attribute Alexa's response to its disposition towards displaying those emotions more than younger participants. In order to test this hypothesis, a nominal logistic regression will be used to assess whether the age of an individual is correlated with the resulting nominal attributions.

Mentor(s):

Hayden Barber, Purdue University, Graduate Student

Torsten Reimer, Purdue University

College of Science

Structural and Functional Characterization of Phospholipase C β3 in Solution

Author(s):

Kennedy Outlaw, College of Science

Abstract:

Phospholipase C β (PLCβ) plays an important role in cardiovascular diseases and opioid analgesia. PLCβ catalyzes the hydrolysis of the inner membrane lipid phosphatidylinositol-4,5-bisphosphate (PIP2) to inositol-1,4,5-triphosphate (IP3) and diacylglycerol (DAG). IP3 and DAG are crucial secondary messengers that activate multiple signaling pathways and modulate gene expression to control responses to extracellular signals. PLCβ is a downstream effector of G-protein coupled receptors (GPCRs) and is activated by both the Gαq and Gβγ subunits. Our lab and others have reported that PLCβ is more flexible in solution, as compared to crystal structures of the protein. In small angle X-ray scattering (SAXS) experiments, the solution structure of PLCβ had additional density that cannot be accounted by the crystal structure. We propose that this additional density corresponds to an open conformation, wherein the PH and EF hand domains are extended from the core of the lipase, and that this conformation of PLCβ represents an autoinhibited state. To test this hypothesis, we mutated residues in PLCβ3 at the interface between the PH and EF hand domains to disrupt their interaction, and then measured changes in PLCβ basal activity and Gβγ-stimulated activity. We are currently working to solve the structure of PLCβ3 in solution using single particle cryo-electron microscopy (cryo-EM), which will allow us to determine a solution structure of PLCβ to a higher resolution than SAXS studies. We hypothesize that PLCβ3 will exist in the open, autoinhibited conformation, and will also shed light on possible allosteric interactions between the distal CTD and the core.

Mentor(s):

Angeline Lyon, Chemistry, College of Science

Isaac Fisher, Purdue University

Kaushik Muralidharan, Purdue University

Honors College

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

Author(s):

Jace Newell, College of Engineering

Eli Coltin, School of Management

Eric Flaningam, College of Engineering

Abstract:

The City of Lafayette is actively seeking to improve livability in six specific neighborhoods in the north-end region utilizing community indicators. Therefore, without the current budget or human capital, the city requested that the Ware Community Indicators Research Group develop a sustainable, digestible data system to help the city analyze desired indicators and exhibit areas with the greatest growth potential. The research group developed an automated data analytics dashboard to help the city make adaptable, optimal, and informed decisions on existing and future community development initiatives to address the city's needs.

This project centers on three specific indicators: homelessness, affordable housing, and neighborhood revitalization. Homelessness and affordable housing have become increasingly important to measure throughout the COVID-19 pandemic. To clarify: neighborhood revitalization refers to various property condition measures across Lafayette, such as street light, garage, and window conditions.

The data dashboard highlights an interactive visualization measuring the three indicators above. First, the team gathers data from manual property conditions surveys, economic databases, and housing price sources. Then, the data is converted to a CSV file and pulled into a visualization software called Plotly using Python algorithms. Finally, the information is organized into an interactive heat map which provides insights into the various community indicators. With a complete map regarding neighborhood revitalization, the team will develop visualizations for homelessness and affordable housing. These results will continuously and positively impact the outcomes of the decisions our partners, the City of Lafayette, commit to concerning the well-being of its members.

Mentor(s):

Jason Ware, Honors College

Presentation Abstract Number: 664 :: Social Sciences/Humanities/Education

College of Health and Human Sciences

Ethnic and Socioeconomic Disparities in Residential Proximity to Brownfields or Superfund Sites per Census Tract in Indiana

Author(s):

Sharon Kulali, College of Agriculture

Abstract:

Brownfields and superfund sites contain harmful chemicals that can lead to high exposures for nearby residents. The goal of this analysis is to determine the correlation between demographic characteristics with the number of sites at the census tract level. Publicly-available data from 2010 were used to identify locations of hazardous sites and demographics in Indiana. Demographic data included age, gender, income, unemployment rate, race, and ethnicity; and was available for 3,001 census tracts with 2,380 brownfields and 2,488 superfund sites. The mean number of brownfields per census tract was 1.0 (minimum: 0, maximum: 20); for superfund sites the mean was 1.0 (minimum: 0, maximum: 17). In adjusted linear regression models, higher percent Hispanic was significantly associated with more brownfields (β = 0.11; 95% confidence interval (CI) = 0.03, 0.20), superfund sites (β = 0.30; 95% CI = 0.24, 0.36), and total sites (β = 0.41; 95% CI = 0.29, 0.53). Higher income was significantly associated with fewer brownfields (β = -0.01; 95% CI = -0.01, -0.006), superfund sites (β =-0.004; 95% CI = -0.007, -0.001), and total sites (β = -0.01; 95% CI = -0.02, -0.009). Higher percent white was significantly associated with fewer brownfields (β = -0.07; 95% CI = -0.10, -0.03), but with a higher number of superfund sites (β =0.05; 95% CI = 0.02, 0.07). These results contribute to our understanding of social injustice and environmental contamination. Moving forward, an analysis will be conducted examining whether the number of hazardous sites correlates with health outcomes.

Mentor(s):

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

College of Health and Human Sciences

Developmental exposure to active herbicide ingredients in Roundup Ready Xtend products, glyphosate and dicamba, results in hypoactivity in the zebrafish

Author(s):

Ryker Bond, College of Health & Human Sciences

Abstract:

Glyphosate (GLY) is the most heavily used agricultural herbicide in the United States and is the active ingredient in Roundup Ready products. GLY residues are detected in food products and the herbicide can move in the environment after field application contaminating drinking water sources. As a result there are multiple exposure routes in the general population in addition to occupational exposure risks in agricultural workers. Recently due to over application of GLY leading to weed resistance, a second generation of Roundup Ready products were developed that also include the herbicide dicamba (Roundup Ready Xtend) in mixture with GLY. With past limited use of dicamba, there is currently not a lot known on toxicity risks or if increased application will result in drinking water source contamination. This study evaluated developmental neurotoxicity of GLY, dicamba, and binary mixtures with a visual motor response behavioral assay using the zebrafish model. Zebrafish were exposed from 1-120 hour post fertilization (hpf) encompassing embryogenesis and early larval development. GLY concentrations centered around the US regulatory limit in drinking water (700 ppb), with single treatment concentrations ranging from 0.7-7000 ppb. Since there is no current US regulatory level for dicamba, treatment concentrations ranged from 0.01-1000 ppb. Binary treatment concentrations were chosen based on results of the single chemical exposures. Hypoactivity was observed for both herbicides in total distance moved, velocity, and time spent moving in groups exposed to 7000 ppb GLY, at concentrations as low as 1 ppb dicamba, and in the mixtures of 700 ppb GLY / 100 ppb dicamba and 7000 ppb GLY / 100 ppb dicamba ($p < 0.05$). Overall, this is the first study to evaluate behavioral alterations for dicamba and glyphosate/dicamba mixtures indicating a need for further assessments into developmental neurotoxicity risks.

Mentor(s):

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

Ola Wasel, Purdue University

Vasisht Sridhar, Purdue University

Krannert School of Management

Airport Catchment Analysis Using Mobile Location Data

Author(s):

Sitong Chen,

Abstract:

The purpose of this research project is to estimate airport catchment areas model through geospatial information and spatial analysis. The approach includes two steps. First of all, we will use spatial analysis method (i.e. Huff model) to identify theoretical airport catchment areas. Then, we will compare the model output with mobility datasets to evaluate the model effectiveness. In order to ensure the comprehensiveness and reliability of the research, we chose to analyze the catchment areas for 4 airports of different sizes and different geographical locations in the United States. Huff Model was chosen for this study, which is an established theory in spatial analysis usually applied in business analytics. In this study, we will apply this method in airport catchment analysis for the selected airports, with consideration of travel distance and airport attractiveness. After comparing models with real mobility patterns data (collected from smartphone apps with users' consent to share their location information), we will choose one that can best predict the airport catchment area. For results, we will detect the distance factor that performs the best model for airports of different regions and sizes. We also hope to understand the parameters included in Huff model such as travel distance and airport attractiveness and their relationships to the model prediction results. At the end of this project, we hope the result will provide reliable information for the selected four airports for their management and the model will be able to provide a good reference for other airport catchment analysis studies about the effectiveness of Huff model in prediction.

Mentor(s):

Nicole Kong, Libraries Admin, Libraries

College of Liberal Arts

The Role of Women in the Early UN

Author(s):

Madilin Goodwin,

Abstract:

This research project aims to determine the role played by women in the United Nations in its earliest years (1945-1950). These women are largely absent from the scholarship on this subject, which to date has focused on the role of prominent male politicians and diplomats in the UN. To date, my research has focused on secondary sources related to the United Nations, which I have used to gage the atmosphere surrounding its creation and its early years and thus the environment in which these women worked and lived. Using this research, I have developed short biographies for women connected to the United Nations, focusing on their roles in the organization. During the research conference, I will introduce my findings, including the fact that many women were hired as ambassadors to other countries representing the United Nations. For example, Perle Mesta was appointed Minister to Luxembourg by President Harry S. Truman in 1949.

Mentor(s):

Jennifer Foray, , College of Liberal Arts

College of Science

Avoiding Pitfalls in Mininet Software-Defined Networking

Author(s):

Benjamin Hardin, College of Science

Abstract:

Mininet is a software tool widely used in industry and research to develop and test Software-Defined Networks (SDNs). Mininet simulates a computer ethernet network using a computer CPU rather than the physical hardware of switches, routers, links, and network cards. Unlike the hardware devices mentioned, computer CPUs are prone to bottlenecks and slowdowns associated with concurrent software tasks on the system. However, little research has investigated how Mininet network results such as latency and throughput can be affected by a myriad of configuration and operating system factors. To tackle this problem, we developed a framework for testing Mininet in both simple and complex scenarios on standard computer hardware available to most researchers and industry professionals. Our emulated datacenter uses a folded Clos topology with up to 48 servers. We explore if Mininet's ping and throughput results align with theoretical values or degrade as the system becomes more process-laden. Preliminary results indicate that Mininet fulfills its promise of emulating networks to near theoretical performance. However, we discovered several common scenarios which can produce misleading results. This paper documents these scenarios and presents a set of recommendations for configuring Mininet to ensure results remain competitive with physical hardware results.

Mentor(s):

Douglas Comer, Computer Science, College of Science

Presentation Abstract Number: 669 :: Innovative Technology/Entrepreneurship/Design

College of Science

Chiller Water Monitor

Author(s):

Santiago Lopez, College of Science

Abstract:

Quantum computers need to be maintained at ultra-low temperatures, and one method of achieving this is through "mixes" of water and helium cooling. In doing so, temperature and pressure difference of the water need to be taken going into and out of the computer. This was already achieved through a temporary chiller water monitor set up by Professor Alex Ruichao Ma. However, there were issues with the helium pressure being less than what was calculated, and this was due to the temperature of the room which houses the tanks. Thus, the goal of this project was to create an improved version of the monitor that was previously set up and add temperature and humidity readings of 2 different rooms to it. In creating this device, the NodeMCU ESP8266 along with Arduino IDE to code the Wi-Fi module were used. (Jayakumar & Instructables, 2017) (Teja) Additionally, Influx DB, an open-source time series data base, was used to receive and display the data. Once connected, it was found that the lab's temperature varied overnight, and this caused inconsistencies in Helium tank pressure which affected the measurement of how much "mix" was accounted for. With these the overnight lab temperatures were corrected and now accurate and consistent measurements of various readings regarding the water and helium are made.

References

InfluxDB: Open source time series database. InfluxData. (2022, February 24). Retrieved February 27, 2022, from https://www.influxdata.com/

Jayakumar, M., & Instructables. (2017, September 30). Quick start to NODEMCU (ESP8266) on Arduino Ide. Instructables. Retrieved February 27, 2022, from https://www.instructables.com/Quick-Start-to-Nodemcu-ESP8266-on-Arduino-IDE/

Teja, R. (n.d.). Getting started with esp8266 and Arduino ... - electronics hub. Retrieved February 27, 2022, from https://www.electronicshub.org/esp8266-arduino-interface

Mentor(s):

Ruichao Ma, Physics & Astronomy, College of Science

Presentation Abstract Number: 670 :: Innovative Technology/Entrepreneurship/Design

<div align="center">

Purdue Polytechnic Institute

Fully Automated Microbrewery

</div>

Author(s):

Jami Pryde, Polytechnic Institute

Carson Rohdes, Polytechnic Institute

Abstract:

The purpose of this research is to test and design the feasibility for a small-scale automated brewery with a recipe management system. This research is done under the supervision of Flexware Innovation using a Blichmann home brewing system as the brewing equipment, Ignition software for the recipe management, and Rockwell Automation components for automation. During my time on the project, the brewery set up and the creation of the recipe management system was completed, while the automation aspect was being tested. Based on the results, for a small-scale brewery, a fully automated brewery with a recipe management system is plausible.

Mentor(s):

George Pate, Flexware Innovation

Presentation Abstract Number: 671 :: Life Sciences

College of Agriculture

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

Author(s):

Abigail Sipes, College of Agriculture

Abstract:

To deepen our understanding of plant gene function, it is important that we advance our knowledge of plant genomes and metabolic activity. With metabolite synthesis information in hand, we will have the capability to unlock higher plant productivity, develop new strategies to protect plants from stressors, and develop new plant-based products. This project applies isotopic labeling to characterize amino acid-derived metabolites in Arabidopsis and then applies Genome-Wide Association (GWA) to identify the genes responsible for their synthesis. A computational pipeline was utilized to generate metabolic features that are derived from the labeled amino acids and then we applied criterions to determine mass features of interest. This project aims to classify metabolites based on the precursor-of-origin and to provide the function of annotated genes that are associated with plant metabolism. Using this method, the methionine-derived metabolites glucoerucin, propylcysteine sulfoxide, glucoiberin, L-methionine sulfoxide, and dihomomethionine were identified. It is likely that mass features in our computational pipeline were identified but they have yet to be identified as metabolites in the literature. This information can be referenced for future research in metabolite identification. In combination with GWA, this method can also help to identify metabolites and candidate genes associated with their synthesis. This method allows for users to mass identify and classify metabolites based on the precursor-of-origin.

Mentor(s):

Clint Chapple, Biochemistry, College of Agriculture

College of Science

On the Use of Live Drosophila Larvae for DNA Extraction Through Sonication

Author(s):

Isabella Sirit, College of Science

Abstract:

Abstract

The viability of entomological evidence is an important aspect for many criminal and civil cases. However, typical DNA extraction methodologies that rely on tissue homogenization presents difficulty in the preservation of specimens. Preserving entomological evidence can provide more information as the specimen's life cycle progresses, such as a more accurate time of death. This paper responds to this by using sonication as a method for DNA extraction on live Drosophila larvae. By using and recording survivorship measurements throughout the trial the viability of the methodology as a means for preserving entomological evidence was measured. In addition, amplification of the extracted DNA collected was used to measure the amount of nucleotide base pairs extracted. Overall, it was found that as sonication times increase the survivorship proportion decreases. Although this technique requires far more standardization and approval before moving forward, this is a more effective manner to pursue criminal and civil convictions and should be implemented as a manner to provide the best possible evidence for the mitigation of wrongful convictions.

Keywords: Drosophila, survivorship, larvae, life cycle, sonication, DNA extraction

Mentor(s):

Stephen Cameron, Entomology, College of Agriculture

Christopher Wirth, Purdue University

Krannert School of Management

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

Author(s):

Hang Wang, College of Science

Abstract:

Since the first outbreak of COVID-19, the United States has tragically turned into one of the most impacted countries. Due to the pandemic, there have been great shortages of medical recourses and many hospitals have been tremendously overwhelmed. Our research team has been collaborating with IU Health with the goal of helping hospitals in Indiana make quick adjustments and design strategies to meet anticipated demands for space, staff, and other resources during the disruptive pandemic. With hospital records provided by IU Health, we have made sophisticated analyses of patient census, arrival, and discharge in different hospitals across multiple regions in Indiana. Meanwhile, we designed and fine-tuned a brute-force algorithm that learns from aforementioned descriptive statistics and makes daily census prediction. Later, we focused on more advanced machine learning algorithms including linear and logistic regressions, random forest, and neural network to generate more accurate discharge predictions from both the individual and hospital levels. Furthermore, we incorporated new layers and loss functions into our neural network to predict a full distribution of desired statistics under various probability distribution assumptions. So far, we have found that while our neural network model can make highly accurate hospital-wise discharge prediction, errors accumulated when the predicted discharge were used to produce census prediction. However, when we directly trained the network to predict the distribution of daily patient census using models like Gaussian and Poisson, we were able to obtain extremely accurate predictions for several major hospitals in Indiana.

Mentor(s):

Pengyi Shi, Operations Management, School of Management

Krannert School of Management

Statistical Machine Learning and Decision Analytics for Global Supply Chain and Health

Author(s):

Hui Zeng, School of Management

Congyu Pu, School of Management

Abstract:

Since the beginning of the COVID-19 pandemic, the confirmed cases have exceeded 79 million, and the deaths are more than 950 thousand in the U.S., which brings a massive threat to public health. Fortunately, the COVID-19 vaccine was developed and started to be administered to the public at the beginning of 2021. However, the effectiveness of vaccination and vaccine distribution remains an open question. Our research aims to address the following research questions: What are vaccine distribution and administration dynamics for the general population and high-risk communities (e.g., elderly people)? How did the vaccination and vaccine allocation impact the hospital admission rate related to COVID-19 along with other related factors (e.g., mobility, government policies)? What are the characteristics of the hospitalized covid-19 patients and the implications for vaccine allocation? How to improve the vaccine distribution and allocation policy to minimize mortality and hospitalization rate?

We collect the real-world data and perform exploratory data analysis to analyze vaccination patterns and the relationship between vaccination and mortality or hospitalization for COVID-19 patients. Moreover, we employ the Bass diffusion model to characterize the dynamics of vaccine allocation. We also developed an interactive dashboard containing two simulation models using the R Shiny App which allows users to manipulate the factors related to COVID-19, especially vaccine allocation and vaccination rate, and investigate the effect of such simulation. Lastly, we provided recommendations to policymakers to improve vaccine strategy and thus minimize the hospitalization rate.

Mentor(s):

Zhan Pang, Operations Management, School of Management

OFFICE OF UNDERGRADUATE RESEARCH
Online Courses

PURPOSE:

The OUR's original, four-course curriculum is for prospective and current undergraduate researchers, and those considering graduate or professional school. We deliver a comprehensive and cross-disciplinary view of research to encourage a student's productivity and effectiveness throughout their undergraduate years. Additionally, we support their search and application process for graduate or professional school programs. These courses are built on a framework emphasizing self-reflection and communication, both written and oral.

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GS 19501 — PREPARING FOR YOUR UNDERGRADUATE RESEARCH EXPERIENCE

This introductory course is for Purdue undergraduates who are interested in conducting undergraduate research or creative endeavors. Purdue students who have not already started an independent research project with a research mentor will learn valuable skills to market themselves to individuals and research programs.

Eligibility: No prior research experience
Cross-listed with ILS 180

GS 39501 — UNDERSTANDING YOUR UNDERGRADUATE RESEARCH EXPERIENCE II

This second course for Purdue undergraduate researchers focuses on data through collection, analysis, and communication. Each student develops an academic poster to present their research project data and implications and provides/receives peer feedback.

Eligibility: Completed 29501
Cross-listed with ILS 380

GS 29501 — UNDERSTANDING YOUR UNDERGRADUATE RESEARCH EXPERIENCE I

This first course for active Purdue undergraduate researchers employs self-reflection to better contextualize what they gain during their research. Students also use their research experience to further develop skills in time management, research communication, using Purdue Libraries' resources, and providing constructive feedback to peer researchers. Students deliver and critique research pitches and abstracts about their projects.

Eligibility: Current undergraduate researcher
Cross-listed with ILS 280

GS 49501 — BEYOND UNDERGRADUATE RESEARCH

This course is for Purdue students considering graduate or professional school. Students examine the various phases of program identification, selection, application, and funding. They recognize qualities and skills that make research mentors effective while developing their own skills as mentees and future mentors. Students conduct research to identify potential programs and develop a statement of purpose.

Eligibility: Junior or senior status interested in graduate/professional school
Cross-listed with ILS 480

PURDUE UNIVERSITY® | Office of Undergraduate Research

THEMATIC CATEGORIES' TOP ABSTRACTS

Physical Sciences

Experimental Investigation of the Rheological Characteristics of Printable Fiber-Reinforced Thermoplastics by Pattiya Pibulchinda (Poster #380)

Social Sciences/Humanities/Education

Using Satellite Imagery to Monitor Heritage Sites in Conflict Areas
by Grace Bowling (Poster #516)

Innovative Technology/Entrepreneurship/Design

Towards the development of implantable biosensors with biocompatible adhesives
by Carl Russell II and Pei-Lun Chen (Talk #639)

Life Sciences

Assessing the Effect of Bd Reservoir Species on the Geographic Range and Climatic Niche of Robber Frogs in Costa Rica by Jasmina Davis (Poster #133)

Mathematical and Computational Sciences

Predicting Short-term Cryptocurrency Volatility Using Twitter Data
by Jacob Roach (Poster #397)

Algorithm to Detect Inducible Laryngeal Obstruction from Vocal Fold Vibrations
by Noah Mehringer (Poster #184)

Automated Data Processing: Making Community Indicators Possible for Lafayette, IN
by Jace Newell, Eli Coltin, and Eric Flaningam (Talk #663)

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SPECIAL APPRECIATION TO THE CONFERENCE PLANNING COMMITTEE'S UNIT DELEGATES

2022 *Purdue Undergraduate Research Conference: <u>All</u> Presentations by Student*

Last Name	First Name	Presentation
	Shivansh	Poster #166 presented 4/12 @ 9:30am-noon
Abboud	Landon	Poster #300 presented 4/12 @ 1pm-3:30pm
Abebe	SeArre	Poster #100 presented 4/12 @ 9:30am-noon
Adnson	Isabelle	Poster #564 presented 4/11-18 virtually
Agarwal	Shivangi	Poster #101 presented 4/12 @ 9:30am-noon
Agrawal	Aditya	Poster #361 presented 4/12 @ 1pm-3:30pm
Agrillo	Michael	Poster #123 presented 4/12 @ 9:30am-noon
Ahmed	Hadi	Poster #301 presented 4/12 @ 1pm-3:30pm
Ahmed	Khunsha	Poster #102 presented 4/12 @ 9:30am-noon
Ahonsi	Olohitare Dorinda	Poster #103 presented 4/12 @ 9:30am-noon
Ahuja	Pranav	Poster #166 presented 4/12 @ 9:30am-noon
Akbar	Adhil	Poster #500 presented 4/11-18 virtually
Akinleye	Olukunle	Poster #104 presented 4/12 @ 9:30am-noon
Akoro	Isabelle	Poster #105 presented 4/12 @ 9:30am-noon
Albert	MarySara	Poster #302 presented 4/12 @ 1pm-3:30pm
Alchaer	Haddy	Talk #601 presented 4/14 @ 10:00am
Alford	William	Poster #106 presented 4/12 @ 9:30am-noon
Alhabshi	Mezna	Poster #527 presented 4/11-18 virtually
Allen	Brandon	Poster #303 presented 4/12 @ 1pm-3:30pm
Alminauskas	Gabriel	Poster #360 presented 4/12 @ 1pm-3:30pm
Aloufi	Fahad	Poster #501 presented 4/11-18 virtually
Alvarez	Daniela	Poster #436 presented 4/12 @ 1pm-3:30pm
Amodeo	Natalie	Talk #622 presented 4/14 @ 11:20am
Anand	Aditi	Talk #642 presented 4/14 @ 2:40pm
Anastario	Aidan	Poster #437 presented 4/12 @ 1pm-3:30pm
Anderson	Lauren	Poster #502 presented 4/11-18 virtually
Anderson	Milo	Poster #586 presented 4/11-18 virtually
Andronicos	Aidan	Talk #633 presented 4/14 @ 1:20pm
Anthony	Faith	Poster #368 presented 4/12 @ 1pm-3:30pm
Arakawa	Keita	Poster #107 presented 4/12 @ 9:30am-noon
Arinze	Brianna	Poster #304 presented 4/12 @ 1pm-3:30pm
Arinze	Brianna	Poster #503 presented 4/11-18 virtually
Arndt	Mitch	Poster #334 presented 4/12 @ 1pm-3:30pm
Arnold	Kamryn	Poster #308 presented 4/12 @ 1pm-3:30pm
Arnold	Nathan	Poster #135 presented 4/12 @ 9:30am-noon
Artang	Mae	Poster #504 presented 4/11-18 virtually
Ashok	Rahul	Poster #406 presented 4/12 @ 1pm-3:30pm
Asthana	Maansi	Poster #505 presented 4/11-18 virtually
Athreya	Tanay	Poster #321 presented 4/12 @ 1pm-3:30pm
Atlas	Ari	Poster #593 presented 4/11-18 virtually
Attardo	Joseph	Poster #594 presented 4/11-18 virtually
Avula	Guna	Poster #178 presented 4/12 @ 9:30am-noon
Avula	Guna	Poster #373 presented 4/12 @ 1pm-3:30pm
Awasthi	Nishka	Poster #571 presented 4/11-18 virtually
Ay	Deha	Poster #305 presented 4/12 @ 1pm-3:30pm
Azeem	Bazim	Poster #509 presented 4/11-18 virtually
Bajszar	Anna	Poster #306 presented 4/12 @ 1pm-3:30pm
Bakeis	Samuel	Talk #641 presented 4/14 @ 2:20pm
Balasamy	Rajesh	Poster #503 presented 4/11-18 virtually
Ballabh	Sagnik	Poster #106 presented 4/12 @ 9:30am-noon

2022 *Purdue Undergraduate Research Conference:* <u>*All*</u> *Presentations by Student*

Last Name	First Name	Presentation
Barahona Rosales	Jason	Poster #506 presented 4/11-18 virtually
Barker	Samantha	Poster #108 presented 4/12 @ 9:30am-noon
Barlas	Efe	Poster #402 presented 4/12 @ 1pm-3:30pm
Barmash Rubinchik	Adam	Talk #657 presented 4/14 @ 3:40pm
Bartol	Kyler	Poster #307 presented 4/12 @ 1pm-3:30pm
Bass	Kalei	Poster #109 presented 4/12 @ 9:30am-noon
Bautista	Kevin Alessandro	Talk #620 presented 4/14 @ 11:40am
Beatty	Molly	Poster #110 presented 4/12 @ 9:30am-noon
Beckman	Jennifer	Poster #507 presented 4/11-18 virtually
Behl	Ranjan	Poster #508 presented 4/11-18 virtually
Bellad	Gouri	Poster #104 presented 4/12 @ 9:30am-noon
Bergendorf	Alexander	Poster #111 presented 4/12 @ 9:30am-noon
Berlier	Nicolas	Poster #509 presented 4/11-18 virtually
Beveridge	Jaden	Poster #510 presented 4/11-18 virtually
Bhamidipati	Suryatej	Poster #546 presented 4/11-18 virtually
Bhatia	Arsh	Poster #112 presented 4/12 @ 9:30am-noon
Bhattacharya	Arka	Poster #511 presented 4/11-18 virtually
Bhoopathy	Saron	Poster #135 presented 4/12 @ 9:30am-noon
Bhowmik	Anish	Poster #178 presented 4/12 @ 9:30am-noon
Bhowmik	Anish	Poster #373 presented 4/12 @ 1pm-3:30pm
Bi	Chengyu	Talk #608 presented 4/14 @ 10:00am
Biggs	Katelyn	Poster #113 presented 4/12 @ 9:30am-noon
Bignotti	Joseph	Poster #308 presented 4/12 @ 1pm-3:30pm
Binau	Amelia	Poster #114 presented 4/12 @ 9:30am-noon
Birthright	Caitlin	Poster #512 presented 4/11-18 virtually
Birthright	Caitlin	Poster #513 presented 4/11-18 virtually
Bjerke	Maya	Poster #514 presented 4/11-18 virtually
Blum	Hannah	Poster #115 presented 4/12 @ 9:30am-noon
Boes	Aaron	Poster #546 presented 4/11-18 virtually
Bond	Ryker	Talk #665 presented 4/11-18 virtually
Booth	Alec	Poster #515 presented 4/11-18 virtually
Bottini	Lucas	Poster #110 presented 4/12 @ 9:30am-noon
Bovenschen	Anthony	Poster #309 presented 4/12 @ 1pm-3:30pm
Bovenshen	Anthony	Poster #378 presented 4/12 @ 1pm-3:30pm
Bowling	Grace	Poster #516 presented 4/11-18 virtually
Boyd	Ryan	Poster #594 presented 4/11-18 virtually
Brady	Jackson	Poster #116 presented 4/12 @ 9:30am-noon
Brandenburg	Dakota	Poster #336 presented 4/12 @ 1pm-3:30pm
Branstetter	Ryan	Poster #117 presented 4/12 @ 9:30am-noon
Brewster	Garrett	Poster #310 presented 4/12 @ 1pm-3:30pm
Brideweser	Tristan	Poster #595 presented 4/11-18 virtually
Bryant	Josie	Poster #396 presented 4/12 @ 1pm-3:30pm
Bryant	Josie	Poster #517 presented 4/11-18 virtually
Budde	Jessica	Poster #423 presented 4/12 @ 1pm-3:30pm
Bullock	John	Poster #518 presented 4/11-18 virtually
Buls	Jared	Poster #311 presented 4/12 @ 1pm-3:30pm
Burcham	Lucy	Talk #629 presented 4/14 @ 1:20pm
Burgess	Mason	Poster #509 presented 4/11-18 virtually
Burgess	Mason	Poster #519 presented 4/11-18 virtually
Burgess	Mason	Poster #570 presented 4/11-18 virtually

Last Name	First Name	Presentation
Buro	Bethany	Poster #520 presented 4/11-18 virtually
Buscemi	Luke	Poster #118 presented 4/12 @ 9:30am-noon
Bushok	Reagan	Poster #119 presented 4/12 @ 9:30am-noon
Cahya	Leonard	Poster #120 presented 4/12 @ 9:30am-noon
Cahya	Leonard	Poster #312 presented 4/12 @ 1pm-3:30pm
Cai	Shangzhe	Poster #121 presented 4/12 @ 9:30am-noon
Caldemeyer	Andrew	Poster #196 presented 4/12 @ 9:30am-noon
Calhoun	Vincent	Poster #122 presented 4/12 @ 9:30am-noon
Carmona	Elinor	Talk #655 presented 4/14 @ 3:00pm
Carpenter	Robin	Poster #123 presented 4/12 @ 9:30am-noon
Castro	Raul	Poster #124 presented 4/12 @ 9:30am-noon
Ceglio	Daniel	Poster #176 presented 4/12 @ 9:30am-noon
Ceglio	Daniel	Poster #313 presented 4/12 @ 1pm-3:30pm
Chai	Miranda	Poster #437 presented 4/12 @ 1pm-3:30pm
Chakravarthula	Aneesh	Poster #521 presented 4/11-18 virtually
Chan	Pou Hei	Poster #125 presented 4/12 @ 9:30am-noon
Chan	Pou Ut	Poster #125 presented 4/12 @ 9:30am-noon
Chang	Younggil	Talk #636 presented 4/14 @ 2:20pm
Chari	Shriansh	Poster #595 presented 4/11-18 virtually
Chen	Jenny	Talk #619 presented 4/14 @ 11:20am
Chen	Pei-Lun	Talk #639 presented 4/14 @ 2:20pm
Chen	Sitong	Poster #550 presented 4/11-18 virtually
Chen	Sitong	Talk #666 presented 4/11-18 virtually
Chen	Xinyou	Talk #659 presented 4/14 @ 4:20pm
Chevrier	Cameron	Poster #393 presented 4/12 @ 1pm-3:30pm
Chitturi	Lahiri	Poster #126 presented 4/12 @ 9:30am-noon
Chokkhanchitchai	Tanon	Poster #519 presented 4/11-18 virtually
Chopra	Tasveen	Talk #654 presented 4/14 @ 3:40pm
Chotiprasidhi	Perapa	Poster #314 presented 4/12 @ 1pm-3:30pm
Christie	Niamh	Poster #315 presented 4/12 @ 1pm-3:30pm
Chung Ma	Alan	Poster #166 presented 4/12 @ 9:30am-noon
Cisco	Sully	Talk #636 presented 4/14 @ 2:20pm
Clapper	Payton	Poster #316 presented 4/12 @ 1pm-3:30pm
Clark	Stephanie	Poster #317 presented 4/12 @ 1pm-3:30pm
Clayton	Melanie	Poster #318 presented 4/12 @ 1pm-3:30pm
Clevenger	Sarah	Poster #166 presented 4/12 @ 9:30am-noon
Cody	Zachary	Poster #372 presented 4/12 @ 1pm-3:30pm
Colananni	Brian	Poster #328 presented 4/12 @ 1pm-3:30pm
Cole	Tyler	Poster #526 presented 4/11-18 virtually
Collins	Harris	Talk #600 presented 4/14 @ 9:40am
Collins	Tyler	Poster #319 presented 4/12 @ 1pm-3:30pm
Coltin	Eli	Talk #663 presented 4/14 @ 4:20pm
Conarty	Jacob	Talk #660 presented 4/14 @ 4:00pm
Cook	Logan	Poster #119 presented 4/12 @ 9:30am-noon
Cook	Nicholas	Poster #127 presented 4/12 @ 9:30am-noon
Cooke	MaryClaire	Talk #621 presented 4/14 @ 11:00am
Coon	Sarah	Poster #522 presented 4/11-18 virtually
Copenhaver	Justin	Poster #128 presented 4/12 @ 9:30am-noon
Costello	Conor	Poster #123 presented 4/12 @ 9:30am-noon
Cox	Brooklynn	Poster #521 presented 4/11-18 virtually

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2022 Purdue Undergraduate Research Conference: <u>All</u> Presentations by Student

Last Name	First Name	Presentation
Coy	Amanda	Poster #129 presented 4/12 @ 9:30am-noon
Crace	Nadia	Poster #353 presented 4/12 @ 1pm-3:30pm
Craig	Maggie	Poster #320 presented 4/12 @ 1pm-3:30pm
Craven	Mitchel	Poster #340 presented 4/12 @ 1pm-3:30pm
Crocker	Owen	Poster #130 presented 4/12 @ 9:30am-noon
Crytzer	William	Poster #321 presented 4/12 @ 1pm-3:30pm
Cullins	Eva	Poster #131 presented 4/12 @ 9:30am-noon
Curtis	Perry	Poster #132 presented 4/12 @ 9:30am-noon
Curtis	Reese	Poster #322 presented 4/12 @ 1pm-3:30pm
Czerkiewicz	Bailey	Poster #591 presented 4/11-18 virtually
Dai	Xilai	Poster #423 presented 4/12 @ 1pm-3:30pm
Das	Soumalya	Poster #323 presented 4/12 @ 1pm-3:30pm
Daudi	Hasnain	Poster #533 presented 4/11-18 virtually
Davis	Jasmina	Poster #133 presented 4/12 @ 9:30am-noon
Davis	Kevin	Poster #550 presented 4/11-18 virtually
de Bruyn	Herbert Alexander	Poster #523 presented 4/11-18 virtually
Denker	Erika	Poster #324 presented 4/12 @ 1pm-3:30pm
Denny	Asher	Poster #524 presented 4/11-18 virtually
Denton	Alicia	Poster #325 presented 4/12 @ 1pm-3:30pm
Derloshon	James	Poster #525 presented 4/11-18 virtually
Desai	Shreya	Poster #134 presented 4/12 @ 9:30am-noon
Dhillon	Mehul	Poster #526 presented 4/11-18 virtually
Dierolf	Benjamin	Poster #513 presented 4/11-18 virtually
Dimitri	Brandon	Poster #135 presented 4/12 @ 9:30am-noon
Dimmick	Abigail	Talk #600 presented 4/14 @ 9:40am
Ding	Andy	Poster #341 presented 4/12 @ 1pm-3:30pm
Dinh	Alice	Poster #526 presented 4/11-18 virtually
Dodd	Brian	Poster #535 presented 4/11-18 virtually
Dolidze	Lukas	Poster #339 presented 4/12 @ 1pm-3:30pm
Donakonda	Sudhanva	Poster #361 presented 4/12 @ 1pm-3:30pm
Donnelly	Anna	Poster #136 presented 4/12 @ 9:30am-noon
Dorman	Jack	Poster #379 presented 4/12 @ 1pm-3:30pm
Dorman	Jack	Talk #625 presented 4/14 @ 11:20am
Dorsch	Avery	Poster #549 presented 4/11-18 virtually
Dowling	Nicolas	Talk #624 presented 4/14 @ 11:00am
Dragnea	Alice	Poster #501 presented 4/11-18 virtually
Dreussi	Samantha	Poster #538 presented 4/11-18 virtually
Drevalas	Brittany	Poster #527 presented 4/11-18 virtually
Dube	Avi	Talk #636 presented 4/14 @ 2:20pm
Dubec	Luke	Poster #137 presented 4/12 @ 9:30am-noon
Dubish	Nicole	Poster #528 presented 4/11-18 virtually
Dubois	Adrien	Poster #178 presented 4/12 @ 9:30am-noon
Dubois	Adrien	Poster #373 presented 4/12 @ 1pm-3:30pm
Dunn	Sarah	Poster #138 presented 4/12 @ 9:30am-noon
Earnhardt	Allison	Poster #139 presented 4/12 @ 9:30am-noon
Easton	Alyssa	Poster #326 presented 4/12 @ 1pm-3:30pm
Easton	Alyssa	Poster #529 presented 4/11-18 virtually
Edelbrock	Peyton	Poster #327 presented 4/12 @ 1pm-3:30pm
Eisenhut	Allison	Poster #368 presented 4/12 @ 1pm-3:30pm
Elgaali	Husam	Poster #140 presented 4/12 @ 9:30am-noon

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Last Name	First Name	Presentation
Elkin	Samuel	Poster #530 presented 4/11-18 virtually
Ellis	Audrey	Poster #141 presented 4/12 @ 9:30am-noon
Ellis	Zachary	Poster #328 presented 4/12 @ 1pm-3:30pm
Emerson	Jamie	Poster #142 presented 4/12 @ 9:30am-noon
Ertel	Hanna	Poster #437 presented 4/12 @ 1pm-3:30pm
Ettestad	Sarah	Poster #143 presented 4/12 @ 9:30am-noon
Eyrick	Rebecca	Poster #144 presented 4/12 @ 9:30am-noon
Eyster	Jacob	Poster #329 presented 4/12 @ 1pm-3:30pm
Fazioli	James	Poster #145 presented 4/12 @ 9:30am-noon
Fechtman	Joshua	Poster #330 presented 4/12 @ 1pm-3:30pm
Feickert	Seth	Poster #531 presented 4/11-18 virtually
Ferrante	Daniella	Poster #331 presented 4/12 @ 1pm-3:30pm
Fink	Alexander	Poster #360 presented 4/12 @ 1pm-3:30pm
Fisher	Abigail	Poster #332 presented 4/12 @ 1pm-3:30pm
Fisher	Aidan	Poster #532 presented 4/11-18 virtually
Flanary	Sean	Poster #340 presented 4/12 @ 1pm-3:30pm
Flaningam	Eric	Talk #663 presented 4/14 @ 4:20pm
Flores	Sophia	Poster #333 presented 4/12 @ 1pm-3:30pm
Flores	Sophia	Poster #385 presented 4/12 @ 1pm-3:30pm
Forbes	Dylan	Poster #146 presented 4/12 @ 9:30am-noon
Francis	Grace	Poster #231 presented 4/12 @ 9:30am-noon
Frazier	Aedan	Poster #334 presented 4/12 @ 1pm-3:30pm
Frazier	Aedan	Poster #335 presented 4/12 @ 1pm-3:30pm
Freck	Joseph	Poster #540 presented 4/11-18 virtually
Frederick	Jeremy	Poster #135 presented 4/12 @ 9:30am-noon
Friberg	Lunden	Poster #442 presented 4/12 @ 1pm-3:30pm
Fritz	Aaron	Poster #541 presented 4/11-18 virtually
Fujita	Akio	Talk #620 presented 4/14 @ 11:40am
Fung	Alison	Poster #537 presented 4/11-18 virtually
Funkhouser	Summer	Poster #336 presented 4/12 @ 1pm-3:30pm
Gadre	Rishikesh	Poster #533 presented 4/11-18 virtually
Gall	Kylee	Poster #337 presented 4/12 @ 1pm-3:30pm
Garal	Neyven	Poster #534 presented 4/11-18 virtually
Garcia Duran	Andrea	Poster #338 presented 4/12 @ 1pm-3:30pm
Garg	Akanksha	Poster #535 presented 4/11-18 virtually
George	Alyssa	Poster #339 presented 4/12 @ 1pm-3:30pm
Ghoneima	Mariam	Poster #147 presented 4/12 @ 9:30am-noon
Giacchetti	Mason	Poster #340 presented 4/12 @ 1pm-3:30pm
Gianchandani	Nicky	Poster #561 presented 4/11-18 virtually
Giese	Brenna	Poster #148 presented 4/12 @ 9:30am-noon
Gil	Manny	Poster #123 presented 4/12 @ 9:30am-noon
Gillig	Molly	Poster #149 presented 4/12 @ 9:30am-noon
Glenn	Caden	Poster #114 presented 4/12 @ 9:30am-noon
Godhani	Akshay	Poster #367 presented 4/12 @ 1pm-3:30pm
Gold	Evan	Poster #536 presented 4/11-18 virtually
Goldberg	Michael	Poster #341 presented 4/12 @ 1pm-3:30pm
Goldenberg	Grant	Poster #580 presented 4/11-18 virtually
Goli	Preethi	Poster #406 presented 4/12 @ 1pm-3:30pm
Goncher	Ben	Poster #302 presented 4/12 @ 1pm-3:30pm
Gonzalez	Emily	Poster #331 presented 4/12 @ 1pm-3:30pm

2022 *Purdue Undergraduate Research Conference:* <u>All</u> *Presentations by Student*

Last Name	First Name	Presentation
Goode	Fi	Poster #119 presented 4/12 @ 9:30am-noon
Goodwin	Madilin	Talk #667 presented 4/11-18 virtually
Grace	Bethany	Poster #150 presented 4/12 @ 9:30am-noon
Grams	Joshua	Poster #511 presented 4/11-18 virtually
Green	Sunil	Talk #614 presented 4/14 @ 10:40am
Griffin	Colton	Poster #151 presented 4/12 @ 9:30am-noon
Guada	Santiago	Poster #406 presented 4/12 @ 1pm-3:30pm
Guardado	Ethan	Talk #617 presented 4/14 @ 11:40am
Gupta	Dhruv	Poster #334 presented 4/12 @ 1pm-3:30pm
Gupta	Dhruv	Poster #335 presented 4/12 @ 1pm-3:30pm
Gupta	Megha	Talk #652 presented 4/14 @ 3:00pm
Gyger	Morgan	Poster #553 presented 4/11-18 virtually
Hackleman	Abigail	Poster #152 presented 4/12 @ 9:30am-noon
Haddow	Kelly	Poster #336 presented 4/12 @ 1pm-3:30pm
Hagerman	Drake	Poster #561 presented 4/11-18 virtually
Hall	Connor	Poster #537 presented 4/11-18 virtually
Hamilton	Abigail	Poster #342 presented 4/12 @ 1pm-3:30pm
Hamilton	Logan	Poster #302 presented 4/12 @ 1pm-3:30pm
Hardin	Benjamin	Talk #668 presented 4/11-18 virtually
Hardin	Cassidy	Poster #343 presented 4/12 @ 1pm-3:30pm
Harper	Madeline	Poster #153 presented 4/12 @ 9:30am-noon
Harrison	Kyler	Poster #393 presented 4/12 @ 1pm-3:30pm
Hartanto	Christabel J.	Poster #154 presented 4/12 @ 9:30am-noon
Hartings	Ben	Poster #114 presented 4/12 @ 9:30am-noon
Hastidt	Robert	Talk #632 presented 4/14 @ 1:40pm
Hauser	Sarah	Poster #344 presented 4/12 @ 1pm-3:30pm
Hedrick	Hailey	Poster #345 presented 4/12 @ 1pm-3:30pm
Heimlich	Jake	Poster #408 presented 4/12 @ 1pm-3:30pm
Heinowitz	Caitlin	Poster #509 presented 4/11-18 virtually
Henson	Caroline	Poster #155 presented 4/12 @ 9:30am-noon
Herbert	Adrik	Poster #156 presented 4/12 @ 9:30am-noon
Herbert	Amanda	Poster #346 presented 4/12 @ 1pm-3:30pm
Hermo	Douglas Andrew	Poster #305 presented 4/12 @ 1pm-3:30pm
Herr	Brandon	Poster #347 presented 4/12 @ 1pm-3:30pm
Hilgarth	Karsten	Poster #518 presented 4/11-18 virtually
Hinshaw	Belle	Poster #348 presented 4/12 @ 1pm-3:30pm
Hinton	Kayla	Poster #549 presented 4/11-18 virtually
Hobbib	Kristina	Poster #228 presented 4/12 @ 9:30am-noon
Hochbaum	Jasper	Poster #367 presented 4/12 @ 1pm-3:30pm
Holder	Kal	Talk #603 presented 4/14 @ 10:40am
Holliday	Rhenn	Poster #157 presented 4/12 @ 9:30am-noon
Holstine	Alton	Poster #325 presented 4/12 @ 1pm-3:30pm
Hooda	Pavit	Poster #566 presented 4/11-18 virtually
Hoon	Fan Jing	Talk #628 presented 4/14 @ 1:40pm
Hristov	Danny	Poster #349 presented 4/12 @ 1pm-3:30pm
Hu	Siwen	Talk #659 presented 4/14 @ 4:20pm
Huang	Ching Chia	Poster #570 presented 4/11-18 virtually
Huang	David	Poster #135 presented 4/12 @ 9:30am-noon
Huang	Joseph	Poster #519 presented 4/11-18 virtually
Huang	Laula	Poster #361 presented 4/12 @ 1pm-3:30pm

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Last Name	First Name	Presentation
Huang	Xinzhu	Poster #350 presented 4/12 @ 1pm-3:30pm
Hummel	Sydney	Poster #158 presented 4/12 @ 9:30am-noon
Humphrey	Evan	Talk #661 presented 4/14 @ 4:20pm
Huntoon	Dylan	Poster #390 presented 4/12 @ 1pm-3:30pm
Hurn	Vivian	Talk #623 presented 4/14 @ 11:40am
Hurst	Avery	Poster #351 presented 4/12 @ 1pm-3:30pm
Hwang	Jongkyu	Poster #538 presented 4/11-18 virtually
Ibrahim	Muhja	Poster #152 presented 4/12 @ 9:30am-noon
Imanov	Rufat	Poster #334 presented 4/12 @ 1pm-3:30pm
Imanov	Rufat	Poster #335 presented 4/12 @ 1pm-3:30pm
Iqbal	Ishmam	Poster #539 presented 4/11-18 virtually
Jaensson	Elissa	Poster #159 presented 4/12 @ 9:30am-noon
Jain	Aryan	Poster #518 presented 4/11-18 virtually
Jajoo	Aaradhya	Poster #423 presented 4/12 @ 1pm-3:30pm
Jegannathan	Arjith	Talk #636 presented 4/14 @ 2:20pm
Jennewein	Aidan	Poster #352 presented 4/12 @ 1pm-3:30pm
Jensen	Ryan	Poster #319 presented 4/12 @ 1pm-3:30pm
Jeon	Brad	Poster #540 presented 4/11-18 virtually
Jeong	Byeongchan	Poster #541 presented 4/11-18 virtually
Jewett	Austin	Poster #526 presented 4/11-18 virtually
Jiang	Cecilia	Poster #521 presented 4/11-18 virtually
Jiang	Crystal	Poster #525 presented 4/11-18 virtually
Jiang	Rina	Poster #160 presented 4/12 @ 9:30am-noon
Johnson	Emily	Poster #161 presented 4/12 @ 9:30am-noon
Johnson	Zoe	Poster #353 presented 4/12 @ 1pm-3:30pm
Joshi	Rohan	Poster #500 presented 4/11-18 virtually
Jung	Leonard	Poster #508 presented 4/11-18 virtually
Kabat	Lily	Poster #506 presented 4/11-18 virtually
Kadadi	Simran	Poster #162 presented 4/12 @ 9:30am-noon
Kalra	Adhiksit	Poster #542 presented 4/11-18 virtually
Kang	Boon Kiat Julian	Talk #628 presented 4/14 @ 1:40pm
Kang	Kevin	Poster #383 presented 4/12 @ 1pm-3:30pm
Kang	Shannon	Poster #354 presented 4/12 @ 1pm-3:30pm
Kanter	Nathan	Poster #222 presented 4/12 @ 9:30am-noon
Kanwischer	Kenneth	Poster #163 presented 4/12 @ 9:30am-noon
Kaplan	Ben	Poster #537 presented 4/11-18 virtually
Kapur	Neha	Poster #164 presented 4/12 @ 9:30am-noon
Karthik	Kaushik	Poster #437 presented 4/12 @ 1pm-3:30pm
Kaur	Navjot	Poster #165 presented 4/12 @ 9:30am-noon
Kawiecki	Joseph	Poster #428 presented 4/12 @ 1pm-3:30pm
Kawnatra	Konrad	Talk #636 presented 4/14 @ 2:20pm
Kaya	Bora	Poster #510 presented 4/11-18 virtually
Kee	Jay	Poster #437 presented 4/12 @ 1pm-3:30pm
Keefer	Natalie	Poster #542 presented 4/11-18 virtually
Keenan	Kyra	Talk #626 presented 4/14 @ 11:40am
Kenning	Scott	Poster #543 presented 4/11-18 virtually
Kermani	Mansoorah	Poster #544 presented 4/11-18 virtually
Khanolkar	Vivek	Poster #166 presented 4/12 @ 9:30am-noon
Khilnani	Aneesh	Poster #151 presented 4/12 @ 9:30am-noon
Khoo	Emily	Poster #137 presented 4/12 @ 9:30am-noon

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Last Name	First Name	Presentation
Khurana	Isheeta	Poster #355 presented 4/12 @ 1pm-3:30pm
Kim	Hansoo	Poster #538 presented 4/11-18 virtually
Kim	Jinrae	Poster #319 presented 4/12 @ 1pm-3:30pm
Kim	Juhyung	Poster #541 presented 4/11-18 virtually
King	Jaden	Poster #356 presented 4/12 @ 1pm-3:30pm
King	Sam	Poster #357 presented 4/12 @ 1pm-3:30pm
King	Trevor	Poster #338 presented 4/12 @ 1pm-3:30pm
Kini	Aditya	Poster #135 presented 4/12 @ 9:30am-noon
Kinnevan	Evan	Talk #630 presented 4/14 @ 1:40pm
Kirkwood	Jackson	Talk #612 presented 4/14 @ 10:00am
Klaas	Brendan	Poster #391 presented 4/12 @ 1pm-3:30pm
Kleiman	Jocelyn	Poster #196 presented 4/12 @ 9:30am-noon
Klipsch	Alyssa	Poster #512 presented 4/11-18 virtually
Klueppelberg	Eric	Poster #393 presented 4/12 @ 1pm-3:30pm
Kneeland	Katie	Poster #390 presented 4/12 @ 1pm-3:30pm
Knosp	Carley	Poster #358 presented 4/12 @ 1pm-3:30pm
Knox	Jack	Poster #437 presented 4/12 @ 1pm-3:30pm
Koeiman	Rachel	Poster #546 presented 4/11-18 virtually
Kohlmeier	Renee	Poster #167 presented 4/12 @ 9:30am-noon
Kohn	Sydney	Poster #359 presented 4/12 @ 1pm-3:30pm
Kolar	Tomas	Poster #424 presented 4/12 @ 1pm-3:30pm
Koliba	Jasper	Poster #178 presented 4/12 @ 9:30am-noon
Koliba	Jasper	Poster #373 presented 4/12 @ 1pm-3:30pm
Komay	Thomas	Poster #168 presented 4/12 @ 9:30am-noon
Kon	Eddie	Poster #533 presented 4/11-18 virtually
Koshy	Joshua	Poster #509 presented 4/11-18 virtually
Kosmerl	Mark	Poster #391 presented 4/12 @ 1pm-3:30pm
Kraft	Sonya	Poster #566 presented 4/11-18 virtually
Kraynik	Matthew	Poster #424 presented 4/12 @ 1pm-3:30pm
Krefta	Oliver	Poster #532 presented 4/11-18 virtually
Krishnasamy	Jagan	Poster #545 presented 4/11-18 virtually
Kuczajda	Michael	Poster #169 presented 4/12 @ 9:30am-noon
Kulali	Sharon	Talk #664 presented 4/14 @ 4:00pm
Kulkarni	Anshul	Poster #423 presented 4/12 @ 1pm-3:30pm
Kurz	Ian	Poster #170 presented 4/12 @ 9:30am-noon
Labianca-Campbell	Ethan	Poster #546 presented 4/11-18 virtually
Lacoursiere	Chase	Poster #424 presented 4/12 @ 1pm-3:30pm
Lam	Jamie	Poster #360 presented 4/12 @ 1pm-3:30pm
Langdu	Vishnu	Poster #319 presented 4/12 @ 1pm-3:30pm
Lantz	Max	Poster #171 presented 4/12 @ 9:30am-noon
Lanzer	Jessie	Poster #106 presented 4/12 @ 9:30am-noon
Layadi	Iris	Poster #547 presented 4/11-18 virtually
Le	Victor	Poster #545 presented 4/11-18 virtually
Leblanc	Marjorie	Poster #548 presented 4/11-18 virtually
Lee	Chun	Poster #361 presented 4/12 @ 1pm-3:30pm
Lee	Eugene	Poster #550 presented 4/11-18 virtually
Lee	Harry	Poster #172 presented 4/12 @ 9:30am-noon
Lee	Hyunseo	Poster #173 presented 4/12 @ 9:30am-noon
Lee	Kenny	Poster #549 presented 4/11-18 virtually
Lee	Kyu Been	Poster #174 presented 4/12 @ 9:30am-noon

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Last Name	First Name	Presentation
Lee	Max	Poster #367 presented 4/12 @ 1pm-3:30pm
Lee	Sangin	Poster #551 presented 4/11-18 virtually
Lee	Seoyoung	Poster #361 presented 4/12 @ 1pm-3:30pm
Lee	Shang-Hsuan	Poster #205 presented 4/12 @ 9:30am-noon
Lehman	Anna	Poster #552 presented 4/11-18 virtually
Lei	Chon Weng	Poster #125 presented 4/12 @ 9:30am-noon
Lenart	Elizabeth	Poster #362 presented 4/12 @ 1pm-3:30pm
Li	David	Poster #175 presented 4/12 @ 9:30am-noon
Li	Jiaxiang	Poster #363 presented 4/12 @ 1pm-3:30pm
Lin	Ya-Fei	Poster #573 presented 4/11-18 virtually
Lin	Yu-Hsuan	Poster #205 presented 4/12 @ 9:30am-noon
Liu	Allen	Poster #175 presented 4/12 @ 9:30am-noon
Liu	Jingyuan	Poster #500 presented 4/11-18 virtually
Liu	Louis	Poster #361 presented 4/12 @ 1pm-3:30pm
Lohanakakul	Leng	Poster #408 presented 4/12 @ 1pm-3:30pm
Lohar	Aditi	Poster #558 presented 4/11-18 virtually
Long	Erica	Poster #364 presented 4/12 @ 1pm-3:30pm
Long	Erica	Poster #546 presented 4/11-18 virtually
Lopez	Santiago	Talk #669 presented 4/11-18 virtually
Lopez	Xavier	Poster #365 presented 4/12 @ 1pm-3:30pm
Loshe	Benjamin	Poster #594 presented 4/11-18 virtually
Lovell	Heath	Poster #361 presented 4/12 @ 1pm-3:30pm
Lowe	Alexis	Poster #176 presented 4/12 @ 9:30am-noon
Lowe	Alexis	Poster #313 presented 4/12 @ 1pm-3:30pm
Lowe	Alexis	Poster #366 presented 4/12 @ 1pm-3:30pm
Lowe	Alexis	Poster #553 presented 4/11-18 virtually
Lu	Austin	Poster #557 presented 4/11-18 virtually
Lundin	Drew	Poster #135 presented 4/12 @ 9:30am-noon
Luthra	Shaan	Poster #178 presented 4/12 @ 9:30am-noon
Luthra	Shaan	Poster #373 presented 4/12 @ 1pm-3:30pm
Macatangay	Jalen	Talk #648 presented 4/14 @ 3:40pm
Maduwuba	Celine	Poster #537 presented 4/11-18 virtually
Mahajan	Riya	Poster #177 presented 4/12 @ 9:30am-noon
Mahoney	William	Talk #610 presented 4/14 @ 10:40am
Malerbi	Kathryn	Poster #320 presented 4/12 @ 1pm-3:30pm
Mansur	Caio	Poster #554 presented 4/11-18 virtually
Marks	Alex	Poster #178 presented 4/12 @ 9:30am-noon
Marks	Alex	Poster #373 presented 4/12 @ 1pm-3:30pm
Marlin	Makayla	Poster #179 presented 4/12 @ 9:30am-noon
Martin	Emily	Poster #555 presented 4/11-18 virtually
Martinez	Isaac	Poster #367 presented 4/12 @ 1pm-3:30pm
Martinus	Kathleen	Talk #631 presented 4/14 @ 1:20pm
Mathis	Kelly	Poster #368 presented 4/12 @ 1pm-3:30pm
Mayo	Christine	Poster #352 presented 4/12 @ 1pm-3:30pm
McDonald	Abigail	Poster #180 presented 4/12 @ 9:30am-noon
McKean	Carly	Poster #171 presented 4/12 @ 9:30am-noon
McNamara	A. Meenakshi	Poster #181 presented 4/12 @ 9:30am-noon
McQuade	Alexander	Poster #182 presented 4/12 @ 9:30am-noon
Medel	Nicolas	Poster #183 presented 4/12 @ 9:30am-noon
Mehringer	Noah	Poster #184 presented 4/12 @ 9:30am-noon

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Last Name	First Name	Presentation
Meng	Isaac	Poster #186 presented 4/12 @ 9:30am-noon
Meng	Kenneth	Poster #185 presented 4/12 @ 9:30am-noon
Mercer	Luke	Poster #527 presented 4/11-18 virtually
Messerly	Addy	Talk #612 presented 4/14 @ 10:00am
Mevaa	Iman	Poster #591 presented 4/11-18 virtually
Meves	Katherine	Poster #187 presented 4/12 @ 9:30am-noon
Mian	Umar	Poster #557 presented 4/11-18 virtually
Michalec	Maxwell	Poster #369 presented 4/12 @ 1pm-3:30pm
Micolta	Erika	Poster #140 presented 4/12 @ 9:30am-noon
Milicia	Allison	Poster #188 presented 4/12 @ 9:30am-noon
Miller	Elise	Poster #101 presented 4/12 @ 9:30am-noon
Miller	Elise	Poster #370 presented 4/12 @ 1pm-3:30pm
Miller	Nathan	Poster #354 presented 4/12 @ 1pm-3:30pm
Milliron	Heather	Poster #189 presented 4/12 @ 9:30am-noon
Mills	Madeline	Poster #556 presented 4/11-18 virtually
Millspaugh	Lillian	Poster #190 presented 4/12 @ 9:30am-noon
Moeller	Sydney	Poster #191 presented 4/12 @ 9:30am-noon
Moga	Stephanie	Poster #371 presented 4/12 @ 1pm-3:30pm
Mold	Rebecca	Poster #506 presented 4/11-18 virtually
Mondal	Ankit	Poster #171 presented 4/12 @ 9:30am-noon
Moon	Youngjoo	Poster #541 presented 4/11-18 virtually
Moonesinghe	Dilhara	Poster #192 presented 4/12 @ 9:30am-noon
Moore	Kaylin	Poster #193 presented 4/12 @ 9:30am-noon
Moran	Kathryn	Poster #557 presented 4/11-18 virtually
Morgan	Tyler	Poster #194 presented 4/12 @ 9:30am-noon
Morris	Dale	Poster #504 presented 4/11-18 virtually
Morrison	Chris	Poster #424 presented 4/12 @ 1pm-3:30pm
Morse	Margaret	Poster #372 presented 4/12 @ 1pm-3:30pm
Moser	Madeline	Talk #655 presented 4/14 @ 3:00pm
Moser	Sherman	Poster #535 presented 4/11-18 virtually
Mosier	Kara	Poster #195 presented 4/12 @ 9:30am-noon
Moss	Charlotte	Poster #557 presented 4/11-18 virtually
Motz	Mallory	Poster #525 presented 4/11-18 virtually
Mou	Allison	Poster #592 presented 4/11-18 virtually
Mulligan	Margaret	Poster #145 presented 4/12 @ 9:30am-noon
Mulligan	Margaret	Poster #196 presented 4/12 @ 9:30am-noon
Murday	Matthew	Poster #135 presented 4/12 @ 9:30am-noon
Murphy	Samantha	Poster #242 presented 4/12 @ 9:30am-noon
Mylvaganan	Mitesh	Poster #197 presented 4/12 @ 9:30am-noon
Narayan	Vishaak	Poster #178 presented 4/12 @ 9:30am-noon
Narayan	Vishaak	Poster #373 presented 4/12 @ 1pm-3:30pm
Narayanan	Anjana	Poster #577 presented 4/11-18 virtually
Narra	Niharika	Poster #542 presented 4/11-18 virtually
Nathella	Siddharth	Poster #198 presented 4/12 @ 9:30am-noon
Naughton	Noelle	Poster #374 presented 4/12 @ 1pm-3:30pm
Nemeth	Sam	Poster #199 presented 4/12 @ 9:30am-noon
Newell	Jace	Talk #663 presented 4/14 @ 4:20pm
Newhard	Corbin	Poster #411 presented 4/12 @ 1pm-3:30pm
Ngo	Raymond	Poster #424 presented 4/12 @ 1pm-3:30pm
Nguyen	Bach	Poster #200 presented 4/12 @ 9:30am-noon

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Last Name	First Name	Presentation
Nguyen	Quyen	Talk #651 presented 4/14 @ 3:40pm
NGUYEN	TRANG	Poster #201 presented 4/12 @ 9:30am-noon
Nonamaker	Evelyn	Poster #558 presented 4/11-18 virtually
Novoa Benavides	Juan Pablo	Talk #615 presented 4/14 @ 11:00am
Numa	Roan	Talk #628 presented 4/14 @ 1:40pm
Nylen	Jacob	Poster #202 presented 4/12 @ 9:30am-noon
O'Banion	Ethan	Poster #409 presented 4/12 @ 1pm-3:30pm
O'Brien	Benjamin	Poster #595 presented 4/11-18 virtually
O'Leary	Frances	Poster #341 presented 4/12 @ 1pm-3:30pm
Ophaug-Johansen	Ian	Poster #586 presented 4/11-18 virtually
O'Sullivan	Sean	Poster #203 presented 4/12 @ 9:30am-noon
OTTERBACHER	C. MAXIMILLIA	Poster #201 presented 4/12 @ 9:30am-noon
Otterbacher	Conrad	Poster #375 presented 4/12 @ 1pm-3:30pm
Outlaw	Kennedy	Talk #662 presented 4/14 @ 4:00pm
Owens	Hal	Poster #204 presented 4/12 @ 9:30am-noon
Owens	Trevor	Poster #535 presented 4/11-18 virtually
Pachin	Tikhon	Poster #205 presented 4/12 @ 9:30am-noon
Pae	Byung Joon	Talk #618 presented 4/14 @ 11:00am
Panicker	Isabel	Poster #206 presented 4/12 @ 9:30am-noon
Panzade	Aarini	Poster #500 presented 4/11-18 virtually
Panzade	Aarohi	Poster #178 presented 4/12 @ 9:30am-noon
Panzade	Aarohi	Poster #373 presented 4/12 @ 1pm-3:30pm
Paone	Karina	Poster #392 presented 4/12 @ 1pm-3:30pm
Paranjape	Manas	Poster #117 presented 4/12 @ 9:30am-noon
Park	Hajin	Poster #207 presented 4/12 @ 9:30am-noon
Park	Jason	Talk #636 presented 4/14 @ 2:20pm
Park	Myung Sun	Poster #559 presented 4/11-18 virtually
Park	Sunwoo	Poster #361 presented 4/12 @ 1pm-3:30pm
Patel	Feny	Poster #208 presented 4/12 @ 9:30am-noon
Patel	Mili	Poster #209 presented 4/12 @ 9:30am-noon
Patel	Mili	Poster #376 presented 4/12 @ 1pm-3:30pm
Patel	Sophia	Poster #560 presented 4/11-18 virtually
Patil	Rhutuja	Poster #511 presented 4/11-18 virtually
Patton	Alexander	Talk #647 presented 4/14 @ 3:20pm
Paulaskas	Jacob	Talk #649 presented 4/14 @ 3:00pm
Pawlecki	Amanda	Poster #513 presented 4/11-18 virtually
Paz Hernandez	Alessandro	Poster #514 presented 4/11-18 virtually
Pechin	Jackson	Poster #377 presented 4/12 @ 1pm-3:30pm
Pecoraro	Nicholas	Poster #309 presented 4/12 @ 1pm-3:30pm
Pecoraro	Nicholas	Poster #378 presented 4/12 @ 1pm-3:30pm
Pei	Anthony	Poster #518 presented 4/11-18 virtually
Pelnekar	Sanika	Poster #210 presented 4/12 @ 9:30am-noon
Perry	Nicole	Talk #625 presented 4/14 @ 11:20am
Perry	Nicole	Poster #379 presented 4/12 @ 1pm-3:30pm
Petratos	Kaitlyn	Poster #354 presented 4/12 @ 1pm-3:30pm
Petri	Justin	Poster #211 presented 4/12 @ 9:30am-noon
Phan	Chau	Talk #650 presented 4/14 @ 3:20pm
Piaseczny	Adam	Poster #500 presented 4/11-18 virtually
Pibulchinda	Pattiya	Poster #380 presented 4/12 @ 1pm-3:30pm
Pickering	Alyson	Talk #620 presented 4/14 @ 11:40am

Last Name	First Name	Presentation
Pickett	Holly	Poster #381 presented 4/12 @ 1pm-3:30pm
Pike	Hannah	Poster #382 presented 4/12 @ 1pm-3:30pm
Pirrello	Julia	Poster #212 presented 4/12 @ 9:30am-noon
Pisarczyk	Amanda	Talk #638 presented 4/14 @ 2:00pm
Pliego Torres	Tania	Poster #582 presented 4/11-18 virtually
Pogue	Evan	Talk #609 presented 4/14 @ 10:20am
Pontious	Chris	Poster #510 presented 4/11-18 virtually
Powers	Madeline	Talk #645 presented 4/14 @ 2:40pm
Prabhu	Aaditya	Talk #627 presented 4/14 @ 1:20pm
Prabhu	Kotekar Annapoorna	Poster #205 presented 4/12 @ 9:30am-noon
Pramanik	Sohan	Poster #423 presented 4/12 @ 1pm-3:30pm
Prasannakumar	Akshaj	Poster #213 presented 4/12 @ 9:30am-noon
Prem Sankar	Dhanyasree	Poster #383 presented 4/12 @ 1pm-3:30pm
Prendergast	Aidan	Poster #213 presented 4/12 @ 9:30am-noon
Pricher	Isaac	Poster #561 presented 4/11-18 virtually
Priebe	Christopher	Poster #424 presented 4/12 @ 1pm-3:30pm
Prince	Owen	Talk #602 presented 4/14 @ 10:20am
Priyadarshini	Neha	Poster #521 presented 4/11-18 virtually
Prospero	Madeline	Poster #384 presented 4/12 @ 1pm-3:30pm
Proudman	Alexis	Poster #333 presented 4/12 @ 1pm-3:30pm
Proudman	Alexis	Poster #385 presented 4/12 @ 1pm-3:30pm
Pryde	Jami	Talk #670 presented 4/11-18 virtually
Psimos	Mike	Poster #214 presented 4/12 @ 9:30am-noon
Pu	Congyu	Talk #674 presented 4/11-18 virtually
Puch	Caroline	Poster #562 presented 4/11-18 virtually
Pyle	Bailey	Poster #563 presented 4/11-18 virtually
Qi	Qingzhuo	Poster #386 presented 4/12 @ 1pm-3:30pm
Qiao	Frank	Poster #566 presented 4/11-18 virtually
Quan	Ian	Poster #367 presented 4/12 @ 1pm-3:30pm
Quintero Bisono	Diana	Poster #564 presented 4/11-18 virtually
Rachabattuni	Abhirama	Poster #171 presented 4/12 @ 9:30am-noon
Raghavan	Alekya	Poster #387 presented 4/12 @ 1pm-3:30pm
Ragheb	Rhiana	Poster #215 presented 4/12 @ 9:30am-noon
Rajapurohita	Amit Rohan	Talk #644 presented 4/14 @ 2:20pm
Ramadesikan	Rasesh	Poster #321 presented 4/12 @ 1pm-3:30pm
Ranawat	Harsh	Poster #519 presented 4/11-18 virtually
Rao	Ishaan	Poster #391 presented 4/12 @ 1pm-3:30pm
Rasmussen	Bram	Poster #577 presented 4/11-18 virtually
Ravi	Nikita	Poster #542 presented 4/11-18 virtually
Ravichandran	Shyam	Poster #388 presented 4/12 @ 1pm-3:30pm
Ravindra	Vijayeendra	Poster #561 presented 4/11-18 virtually
Rayan	Sahana	Poster #216 presented 4/12 @ 9:30am-noon
Rebeiro	Aloysius	Poster #427 presented 4/12 @ 1pm-3:30pm
Reich	Katie	Poster #389 presented 4/12 @ 1pm-3:30pm
Reinbrecht	Hannah	Poster #558 presented 4/11-18 virtually
Reinecke	Becca	Poster #390 presented 4/12 @ 1pm-3:30pm
Reinecke	Becca	Poster #391 presented 4/12 @ 1pm-3:30pm
Reinecke	Becca	Talk #654 presented 4/14 @ 3:40pm
Reinhardt	Eric	Poster #156 presented 4/12 @ 9:30am-noon
Reining	Jordan	Poster #217 presented 4/12 @ 9:30am-noon

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Last Name	First Name	Presentation
Rekeweg	Emma	Poster #392 presented 4/12 @ 1pm-3:30pm
Remocaldo	Caleb	Poster #393 presented 4/12 @ 1pm-3:30pm
Retter	Jaden	Poster #394 presented 4/12 @ 1pm-3:30pm
Reyna	Kathleen	Poster #169 presented 4/12 @ 9:30am-noon
Reyna	Kathleen	Poster #395 presented 4/12 @ 1pm-3:30pm
Reynolds	Grace	Poster #517 presented 4/11-18 virtually
Reynolds	Grace	Poster #396 presented 4/12 @ 1pm-3:30pm
Reynolds	Jack	Poster #123 presented 4/12 @ 9:30am-noon
Reynolds	Jack	Poster #565 presented 4/11-18 virtually
Richman	Samuel	Poster #566 presented 4/11-18 virtually
Ridenour	Fiona	Poster #218 presented 4/12 @ 9:30am-noon
Riffell	Justina	Poster #114 presented 4/12 @ 9:30am-noon
Riley	Rachel	Poster #169 presented 4/12 @ 9:30am-noon
Rines	Matthew	Poster #542 presented 4/11-18 virtually
Rittner	Evan	Poster #428 presented 4/12 @ 1pm-3:30pm
Rivero	Marco	Poster #331 presented 4/12 @ 1pm-3:30pm
Roach	Jacob	Poster #397 presented 4/12 @ 1pm-3:30pm
Roach	Mallory	Poster #219 presented 4/12 @ 9:30am-noon
Robinson	Joseph	Poster #398 presented 4/12 @ 1pm-3:30pm
Robinson	Liam	Talk #635 presented 4/14 @ 2:00pm
Robinson	Shye	Poster #567 presented 4/11-18 virtually
Rodriguez-Lopez	Kenneth	Talk #643 presented 4/14 @ 2:00pm
Rohdes	Carson	Talk #670 presented 4/11-18 virtually
Rojas Salazar	Andres	Poster #561 presented 4/11-18 virtually
Romanyk	Madison	Talk #658 presented 4/14 @ 4:00pm
Rondon	Hannah	Talk #656 presented 4/14 @ 3:20pm
Rooney	James	Poster #399 presented 4/12 @ 1pm-3:30pm
Roy	Abigail	Poster #501 presented 4/11-18 virtually
Roy	Jack	Talk #636 presented 4/14 @ 2:20pm
Rubin de Celis	Carlos	Poster #400 presented 4/12 @ 1pm-3:30pm
Rubio	Laura	Poster #220 presented 4/12 @ 9:30am-noon
Ruiz-Avila	Diego	Poster #401 presented 4/12 @ 1pm-3:30pm
Rump	Gabrielle	Poster #568 presented 4/11-18 virtually
Rupani	Saaniya	Poster #569 presented 4/11-18 virtually
Rushing	Ryan	Poster #388 presented 4/12 @ 1pm-3:30pm
Russell III	Carl	Talk #639 presented 4/14 @ 2:20pm
Ryu	Kevin	Poster #339 presented 4/12 @ 1pm-3:30pm
Saagar	Vishrant	Poster #570 presented 4/11-18 virtually
Sale	Charlie	Poster #402 presented 4/12 @ 1pm-3:30pm
Sammons	Kelly	Poster #403 presented 4/12 @ 1pm-3:30pm
Sanders	Gracie	Poster #221 presented 4/12 @ 9:30am-noon
Sangeetha	Sundhar	Poster #508 presented 4/11-18 virtually
Santos	Diane	Talk #646 presented 4/14 @ 3:00pm
Saridena	Abhiram	Poster #423 presented 4/12 @ 1pm-3:30pm
Sarkar	Dhirodaatto	Poster #535 presented 4/11-18 virtually
Sarussi	Reno	Talk #615 presented 4/14 @ 11:00am
Sashti	Rajeev	Poster #408 presented 4/12 @ 1pm-3:30pm
Sawla	Chintan	Poster #222 presented 4/12 @ 9:30am-noon
Schifferdecker	Kian	Poster #571 presented 4/11-18 virtually
Schmucker	Katie	Poster #404 presented 4/12 @ 1pm-3:30pm

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Last Name	First Name	Presentation
Schwartz	Jack	Poster #405 presented 4/12 @ 1pm-3:30pm
See	Jing Yin	Talk #602 presented 4/14 @ 10:20am
Sego	Robert	Poster #406 presented 4/12 @ 1pm-3:30pm
Sen-Gupta	Nisha	Poster #407 presented 4/12 @ 1pm-3:30pm
Senthilkumar	Ashwin	Poster #166 presented 4/12 @ 9:30am-noon
Senthilkumaran	Revanth Krishna	Talk #637 presented 4/14 @ 2:40pm
Seo	Leo	Poster #408 presented 4/12 @ 1pm-3:30pm
Seshadri	Akul	Poster #409 presented 4/12 @ 1pm-3:30pm
Sethi	Yashoheet	Poster #171 presented 4/12 @ 9:30am-noon
Shafer	Peyton	Poster #410 presented 4/12 @ 1pm-3:30pm
Shah	Rishi	Poster #572 presented 4/11-18 virtually
Shaikh	Zainab	Poster #223 presented 4/12 @ 9:30am-noon
Shank	Sophie	Talk #655 presented 4/14 @ 3:00pm
Sharp	Perion	Poster #224 presented 4/12 @ 9:30am-noon
Shelley	Rebecca	Talk #607 presented 4/14 @ 9:40am
Shembekar	Arya	Poster #503 presented 4/11-18 virtually
Shen	Elena	Poster #573 presented 4/11-18 virtually
Shen	Kaiwen	Poster #594 presented 4/11-18 virtually
Shen	Xiaxin	Poster #411 presented 4/12 @ 1pm-3:30pm
Shetty	Siddhi	Poster #210 presented 4/12 @ 9:30am-noon
Shie	Amanda	Poster #225 presented 4/12 @ 9:30am-noon
Shie	Amanda	Poster #244 presented 4/12 @ 9:30am-noon
Shripal	Aakanksha	Poster #178 presented 4/12 @ 9:30am-noon
Shripal	Aakanksha	Poster #373 presented 4/12 @ 1pm-3:30pm
Shrivastava	Mehul	Poster #224 presented 4/12 @ 9:30am-noon
Sidani	Wesam	Poster #510 presented 4/11-18 virtually
Sidorowicz	Haley	Poster #560 presented 4/11-18 virtually
Simpson	Abby	Poster #119 presented 4/12 @ 9:30am-noon
Sin	Wai Teng	Poster #125 presented 4/12 @ 9:30am-noon
Singh	Jagroop	Poster #574 presented 4/11-18 virtually
Singh	Jasmine	Poster #226 presented 4/12 @ 9:30am-noon
Singh	Pranav	Poster #319 presented 4/12 @ 1pm-3:30pm
Singh	Siddharth	Poster #519 presented 4/11-18 virtually
Sinha	Shania	Talk #611 presented 4/14 @ 9:40am
Sinha	Shantanu	Poster #575 presented 4/11-18 virtually
Sipes	Abigail	Talk #671 presented 4/11-18 virtually
Sirit	Isabella	Talk #672 presented 4/11-18 virtually
Sixon	David	Poster #546 presented 4/11-18 virtually
Skadberg	Lauren	Poster #412 presented 4/12 @ 1pm-3:30pm
Skiba	Lisette	Poster #576 presented 4/11-18 virtually
Skipper	Kennedy	Poster #413 presented 4/12 @ 1pm-3:30pm
Skowronek	Gabriel	Poster #439 presented 4/12 @ 1pm-3:30pm
Slabach	Hannah	Poster #553 presented 4/11-18 virtually
Smith	Erin	Poster #123 presented 4/12 @ 9:30am-noon
Smith	Hunter	Poster #593 presented 4/11-18 virtually
Smith	Kiara	Poster #228 presented 4/12 @ 9:30am-noon
Smith	Samuel	Poster #391 presented 4/12 @ 1pm-3:30pm
Smith	Sidney	Poster #227 presented 4/12 @ 9:30am-noon
Smitley	Britney	Poster #577 presented 4/11-18 virtually
Solankar	Saish	Talk #640 presented 4/14 @ 2:00pm

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Last Name	First Name	Presentation
Song	Minjun	Poster #559 presented 4/11-18 virtually
Soni	Kshaunish	Poster #166 presented 4/12 @ 9:30am-noon
Spellman	Evan	Poster #561 presented 4/11-18 virtually
Spence	Samuel	Poster #436 presented 4/12 @ 1pm-3:30pm
Sperrazza	Melanie	Poster #331 presented 4/12 @ 1pm-3:30pm
Spillane	Dan	Poster #367 presented 4/12 @ 1pm-3:30pm
Spina	Peter	Poster #213 presented 4/12 @ 9:30am-noon
Spinazze	Matthew	Poster #338 presented 4/12 @ 1pm-3:30pm
Sridhar	Shashank	Talk #636 presented 4/14 @ 2:20pm
Srinivasan	Nanditha	Poster #578 presented 4/11-18 virtually
Srisankar	Pranav	Talk #628 presented 4/14 @ 1:40pm
St. Pere	Thomas	Poster #229 presented 4/12 @ 9:30am-noon
St. Pere	Thomas	Poster #414 presented 4/12 @ 1pm-3:30pm
Steinbrook	Ronald	Poster #230 presented 4/12 @ 9:30am-noon
steinhart	maya	Poster #579 presented 4/11-18 virtually
Stepp	Nicole	Poster #110 presented 4/12 @ 9:30am-noon
Stevens	William	Poster #205 presented 4/12 @ 9:30am-noon
Stone	Kaitlin	Talk #634 presented 4/14 @ 1:40pm
Strachan	Jake	Poster #415 presented 4/12 @ 1pm-3:30pm
Strom	Madeleine	Poster #416 presented 4/12 @ 1pm-3:30pm
Strong	Anna	Poster #417 presented 4/12 @ 1pm-3:30pm
Stucky	Lauren	Poster #231 presented 4/12 @ 9:30am-noon
Su	Roy	Poster #418 presented 4/12 @ 1pm-3:30pm
Sumimoto	Miyu	Talk #661 presented 4/14 @ 4:20pm
Sun	Albert	Poster #580 presented 4/11-18 virtually
Sun	Sikang	Poster #390 presented 4/12 @ 1pm-3:30pm
Sussman	Allison	Poster #232 presented 4/12 @ 9:30am-noon
Suter	Julia	Poster #417 presented 4/12 @ 1pm-3:30pm
Szolwinski	Anna	Talk #613 presented 4/14 @ 10:20am
Tackett	Drake	Poster #418 presented 4/12 @ 1pm-3:30pm
Talbot	Jacqueline	Poster #233 presented 4/12 @ 9:30am-noon
Tallman	Chevelle	Poster #234 presented 4/12 @ 9:30am-noon
Tate	Haley	Poster #235 presented 4/12 @ 9:30am-noon
Taylor	Abigail	Poster #581 presented 4/11-18 virtually
Teran	Oscar	Poster #236 presented 4/12 @ 9:30am-noon
Thai	Meghan	Poster #419 presented 4/12 @ 1pm-3:30pm
Thapar	Hersh	Poster #104 presented 4/12 @ 9:30am-noon
Thomas	Elizabeth	Poster #185 presented 4/12 @ 9:30am-noon
Thompson	Eric	Poster #420 presented 4/12 @ 1pm-3:30pm
Thompson	Sage	Poster #389 presented 4/12 @ 1pm-3:30pm
Thornton	Gianna	Poster #320 presented 4/12 @ 1pm-3:30pm
Thrasher	Sydney	Poster #169 presented 4/12 @ 9:30am-noon
Tierney	Jon	Poster #390 presented 4/12 @ 1pm-3:30pm
Tilley	David	Poster #421 presented 4/12 @ 1pm-3:30pm
Tilley	David	Poster #422 presented 4/12 @ 1pm-3:30pm
Tindal	De'keva	Talk #661 presented 4/14 @ 4:20pm
Toraman	Ata	Poster #171 presented 4/12 @ 9:30am-noon
Tran	Hoang	Poster #423 presented 4/12 @ 1pm-3:30pm
Tran	Minh	Poster #424 presented 4/12 @ 1pm-3:30pm
Trebley	Austin	Poster #425 presented 4/12 @ 1pm-3:30pm

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Last Name	First Name	Presentation
Trujillo	Alicia	Poster #426 presented 4/12 @ 1pm-3:30pm
Tsai	Darin	Poster #427 presented 4/12 @ 1pm-3:30pm
Tsai	Theodore	Poster #406 presented 4/12 @ 1pm-3:30pm
Tsai	YaLing	Poster #530 presented 4/11-18 virtually
Tso	Brandon	Poster #237 presented 4/12 @ 9:30am-noon
Tsortanidis	Matthew	Poster #185 presented 4/12 @ 9:30am-noon
Tuchinda	Pume	Poster #518 presented 4/11-18 virtually
Udo-Imeh	David	Talk #606 presented 4/14 @ 10:40am
Unger	Samantha	Talk #654 presented 4/14 @ 3:40pm
Upreti	Aniruddha	Poster #106 presented 4/12 @ 9:30am-noon
Uribe-Melchor	Arianna	Poster #583 presented 4/11-18 virtually
Urmanov	Aleksey	Talk #654 presented 4/14 @ 3:40pm
Urs	Vishal	Poster #408 presented 4/12 @ 1pm-3:30pm
Utayde	Mia	Poster #584 presented 4/11-18 virtually
Valdez	Jacob	Poster #428 presented 4/12 @ 1pm-3:30pm
Van Winkle	Faith	Talk #616 presented 4/14 @ 11:20am
VandeWalle	Kyle	Poster #429 presented 4/12 @ 1pm-3:30pm
vanVeldhuisen	Aletea	Poster #585 presented 4/11-18 virtually
Velasquez	Hunter	Poster #324 presented 4/12 @ 1pm-3:30pm
Verhoff	Stephen	Poster #586 presented 4/11-18 virtually
Vetter	Brittney	Poster #430 presented 4/12 @ 1pm-3:30pm
Von Ah	Halle	Poster #512 presented 4/11-18 virtually
Voronin	Philip	Poster #546 presented 4/11-18 virtually
Vorozhbit	Evgeniia	Poster #533 presented 4/11-18 virtually
Voss	Lauren	Poster #431 presented 4/12 @ 1pm-3:30pm
Wakal	Ethan	Poster #432 presented 4/12 @ 1pm-3:30pm
Waldren	Matthew	Poster #530 presented 4/11-18 virtually
Walke	Andrew	Poster #238 presented 4/12 @ 9:30am-noon
Walker	Erin	Poster #587 presented 4/11-18 virtually
Walls	Hannah	Poster #239 presented 4/12 @ 9:30am-noon
Walter	Ryan	Talk #600 presented 4/14 @ 9:40am
Wang	Hang	Talk #673 presented 4/11-18 virtually
Wang	Hyeonwoo	Poster #588 presented 4/11-18 virtually
Wang	Jerry	Poster #542 presented 4/11-18 virtually
WANG	MUHAN	Poster #201 presented 4/12 @ 9:30am-noon
Wang	Shiqi	Poster #594 presented 4/11-18 virtually
Wang	Zhaoqi	Poster #571 presented 4/11-18 virtually
Wanstall	Andrew	Poster #433 presented 4/12 @ 1pm-3:30pm
Ward	Shaulay	Talk #655 presented 4/14 @ 3:00pm
Ware	Alexandra	Poster #434 presented 4/12 @ 1pm-3:30pm
Watson	Brandon	Poster #589 presented 4/11-18 virtually
Watson	Monique	Poster #313 presented 4/12 @ 1pm-3:30pm
Webber	Dalton	Poster #510 presented 4/11-18 virtually
Welp	Hannah	Poster #435 presented 4/12 @ 1pm-3:30pm
Werner	Melanie	Poster #240 presented 4/12 @ 9:30am-noon
Wheeler	Erika	Poster #241 presented 4/12 @ 9:30am-noon
Whitsitt	William	Poster #390 presented 4/12 @ 1pm-3:30pm
Williams	Hannah	Poster #389 presented 4/12 @ 1pm-3:30pm
Williams	Logan	Poster #436 presented 4/12 @ 1pm-3:30pm
Winn	Elise	Poster #590 presented 4/11-18 virtually

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Last Name	First Name	Presentation
Witt	Mitchell	Poster #437 presented 4/12 @ 1pm-3:30pm
Wojcik	Sebastian	Poster #574 presented 4/11-18 virtually
Wolt	Taylor	Poster #591 presented 4/11-18 virtually
Wong	Elliot	Poster #390 presented 4/12 @ 1pm-3:30pm
Wong	Elliot	Poster #438 presented 4/12 @ 1pm-3:30pm
Wong	Ming Yuan Adrian	Poster #439 presented 4/12 @ 1pm-3:30pm
Wongsonegoro	Harrison	Talk #636 presented 4/14 @ 2:20pm
Woodall	Arden	Poster #242 presented 4/12 @ 9:30am-noon
Woodruff	Courtney	Poster #440 presented 4/12 @ 1pm-3:30pm
Wu	Bo	Talk #659 presented 4/14 @ 4:20pm
Wu	Songhao	Poster #592 presented 4/11-18 virtually
Xia	Zhujin	Poster #302 presented 4/12 @ 1pm-3:30pm
Xianyu	Zilan	Poster #514 presented 4/11-18 virtually
Xianyu	Zilin	Talk #604 presented 4/14 @ 10:00am
Xie	Jiarui	Poster #500 presented 4/11-18 virtually
Xie	Ricardo	Poster #439 presented 4/12 @ 1pm-3:30pm
Xie	Zhengxiang	Poster #441 presented 4/12 @ 1pm-3:30pm
Xiong	Katherine	Poster #150 presented 4/12 @ 9:30am-noon
Yang	Ivan	Poster #439 presented 4/12 @ 1pm-3:30pm
Yang	Madeline	Poster #354 presented 4/12 @ 1pm-3:30pm
Yang	Wenhui	Poster #519 presented 4/11-18 virtually
Yao	Stella	Poster #331 presented 4/12 @ 1pm-3:30pm
Yernool	Suhas	Talk #653 presented 4/14 @ 3:20pm
Yi	David	Poster #442 presented 4/12 @ 1pm-3:30pm
Yin	Huihao	Talk #659 presented 4/14 @ 4:20pm
Yoo	Chaeyoung	Poster #243 presented 4/12 @ 9:30am-noon
York	Sara	Poster #593 presented 4/11-18 virtually
Young	Rachel	Poster #225 presented 4/12 @ 9:30am-noon
Young	Rachel	Poster #244 presented 4/12 @ 9:30am-noon
Yu	Pelin	Talk #659 presented 4/14 @ 4:20pm
Yuan	Wendi	Poster #245 presented 4/12 @ 9:30am-noon
Zabalegui Lopez	Erik	Poster #533 presented 4/11-18 virtually
Zaumu	Lorraine	Poster #535 presented 4/11-18 virtually
Zaveri	Sohan	Poster #361 presented 4/12 @ 1pm-3:30pm
Zeh	Alicia	Poster #574 presented 4/11-18 virtually
Zeng	Hui	Talk #674 presented 4/11-18 virtually
Zhang	Alan	Poster #427 presented 4/12 @ 1pm-3:30pm
Zhang	Katherine	Poster #246 presented 4/12 @ 9:30am-noon
Zhang	Zhonghao	Poster #162 presented 4/12 @ 9:30am-noon
Zhou	Christine	Poster #573 presented 4/11-18 virtually
Zhou	Timothy	Poster #594 presented 4/11-18 virtually
Ziavras	George	Poster #595 presented 4/11-18 virtually
Zirkle	Benjamin	Talk #605 presented 4/14 @ 10:20am
Zurek	Adam	Poster #532 presented 4/11-18 virtually
Zylstra	John	Poster #175 presented 4/12 @ 9:30am-noon

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