# FALL UNDERGRADUATE RESEARCH EXPO

**NOVEMBER 14-21, 2022**

**Purdue University**

West Lafayette, Indiana

# FALL UNDERGRADUATE RESEARCH EXPO

## SCHEDULE OF EVENTS

### NOVEMBER 14, 2022 | PMU BALLROOMS

**10:00AM-11:30AM** **Morning Poster Session**

**1:00PM-2:30PM** **Afternoon Poster Session**

### NOVEMBER 16, 2022 | STEW 214

**9:30AM-12:00PM** **Morning Research Talks**

**1:15PM-3:45PM** **Afternoon Research Talks**

### NOVEMBER 14-21, 2022 | ONLINE

**Virtual posters and research talks**

*Virtual presentations are available on the Fall Expo website at* ***purdue.edu/undergrad-research/conferences/fall***

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

# POSTER SYMPOSIUM

*Posters sorted by last name of first author within each session. Spelling of names and titles as submitted.*

## MORNING POSTER SESSION | 10:00AM-11:30AM

100 *Olukunle Akinleye, Wyatt Alexander, Philip Voronin*
Mentors: Katherine Fowee Gasaway, Alina Alexeenko, Steven Pugia, Jesus Meza Galvan

101 *Sierra Allen*
Mentors: Sang Woo

102 *Gabriel Alminauskas, Collin Campbell, Runlin Wang*
Mentors: Luke Cohen, Andrew Weiner

103 *Aidan Anastario, Manav Bhasin, Chi-Jui Lin, Dheepa Hari, Jun Lim, Xinyi Zhang*
Mentors: Nan Kong, Nicole Adams

104 *FNU Archie, Harry Lee, Jacob Montrose*
Mentors: Garam Kim, Eduardo Barocio

105 *Lynley Arnholt, Alec Pannunzio, Gloria Cheng, Colleen Cole, Katharine Czech, Summer Fateley, Jackie Freeman, Emily Rastovski, Lucas Pedersen, Julie Wasyliw*
Mentors: Laura Moffat

106 *Rohan Aryan, Rahul Saproo*
Mentors: Seema Mattoo, Sherlene Brown

107 *Elliot Basem, Alexander Suppiah, Daniel Qi, Nachiketh Yellapragada*
Mentors: Eric Williamson

108 *Grace Beehler*
Mentors: Kameron Moding, Elizabeth Kielb

109 *Ancy Biju*
Mentors: Yujie Shan

110 *Elliot Bissman*
Mentors: Rebecca Ciez, Kelsey Biscoho

111 *Oliver Boettger, Niels Van Ritbergen, Lorenzo Cacciapuoti, Wilson Wong, Alexander Beal*
Mentors: Mark Johnson, Cole Nelson

112 *Vladimir Bovkis*
Mentors: Qian Wang

113 *Sean Brown*
Mentors: Rabern Simmons

114 *Gina Canino-Quiñones*
Mentors: Kristine Marceau, Amy Loviska

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

116 *Isabel Cava, Megan Morley, Dinah Waheed*
Mentors: Andrea DeMaria, Fatimah Lawal, Risa Cromer

117 *Pou Hei Chan, Wei Teng Sin, Lei Chon Weng*
Mentors: Byung-Cheol Min, Pou Ut Chan

118 *Meredith Chasse, Grace Gochnauer*
Mentors: Jill Newton, Signe Kastberg

119 *Ian Chen*
Mentors: Yang Yang

120 *Madison Chin*
Mentors: Amanda Seidl, Erica Hill

121 *Ronnie Cutler*
Mentors: Hugo Samayoa Oviedo, Julia Laskin

122 *Marissa Davide, Azza Sumait*
Mentors: John Peterson, Sutton Hathorn

123 *Maggie Dong*
Mentors: Katie Jarriel

124 *Samantha Dreussi, Jinrae Kim*
Mentors: Cole Nelson, Mark Johnson

125 *Adrien Dubois, Aarohi Panzade, Jasper Koliba, Rosemary Ajish*
Mentors: David Purpura, Avery Closser

126 *Molly Dye, Emilie Chadwell*
Mentors: Zada Anderson, Mitchell Sanchez, Thomas Everett, Bradley Duerstock

127 *Garret Eatinger, Pedro Pinto*
Mentors: Matthew Swabey, Jaeeun Kim

128 *Sarah Eckrote*
Mentors: Lavanya Reddivari, Vignesh Nathan

129 *Joseph Eisenberg*
Mentors: Gang Shao

130 *Aya Elhag*
Mentors: Sandeep Ravala, John Tesmer

131 *Anya Emerson*
Mentors: Jake Hosen, Ken Chong, Zaven Arra

132 *Rebecca Eyrick*
Mentors: Ellen Wells

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

134 *Mia Fleisher-de Kozan*
Mentors: Aaron Bowman, Anke Tukker, Jennifer Schmitz

135 *Kallie Fox*
Mentors: David McElhattan

136 *Yang Fu*
Mentors: Nicholas Gallina, Arun Bhunia

137 *Brooklynn Fugate, Jessica Kofman, Luke Lenz, Thomas Greer*
Mentors: Alejandro Benítez De la Riva

138 *David Gonzalez, Peter Kim*
Mentors: Matthew Swabey

139 *Shruti Goyal*
Mentors: Funing Li

140 *Adyson Gregory*
Mentors: Barbara Young, Hannah Bulow

141 *Mackenzie Greulach, Sofia Hrubiak, Elizabeth Salwitz*
Mentors: Andrea DeMaria

142 *Leah Griffin*
Mentors: Rebekah Shupe, Songlin Fei

143 *James Grimm*
Mentors: Katie Jarriel

144 *Meghan Gron, Conor McCarthy, Saichandana Pothireddy, Blake Iftiger, Mihika Saxena, Hongyi Shen, Adit Shah*
Mentors: Nachiket Vatkar

145 *Mahesh Gupta*
Mentors: Patrick Duffy, Irfan Zaidi, Jill Neal

146 *Emma Hall*
Mentors: Kathryn Brownell

147 *Moses Hamm*
Mentors: Vitaliy Rayz, Neal Patel

148 *Nina Hawkins*
Mentors: Jo Davisson, Tianqi Zhao, Vallabh Suresh

149 *Max Hess, Audrey Ward*
Mentors: Guofan Shao, Keith Woeste, Aishwarya Chandrasekaran

150 *Ben Holland*
Mentors: Humaira Gowher, Ming He

151 *Sophia Horn*
Mentors: Meredith Scherer, Tyler Hoskins

152 *Zhirui Hou*
Mentors: Santiago Torres Arias

153 *Yi-Fang Hsiung, Troy Wu*
Mentors: Sarang Pramod, Mark Johnson

154 *Guillaume Hu, Chun Yi Liu*
Mentors: Sarang Pramod, Mark Johnson

155 *Rongbo Hu*
Mentors: Abolfazl Hashemi, Zijian He

156 *Joseph Huang, Neil Brown, Julia Eifert, Andrew Hufford, Bruna Jasinowodolinski, Raveena Manivannan, Kaleb Lee, Tanishaa Shah, Aditya Sinha*
Mentors: Edward Delp, Carla Zoltowski

157 *Alexandra Hughes, Meagan DeMark, Ashley Bolen, Kayra Ucpinar*
Mentors: Andrea DeMaria, Laura Schwab-Reese, Kathryn Seigfried-Spellar

158 *Peyton James*
Mentors: Risa Cromer

159 *Lucas Johnson*
Mentors: Marxa Figueiredo, Ying Cheng Chen

160 *Megan Johnson*
Mentors: Safia Janjua

161 *Saniya Kamuni*
Mentors: Fiona Wang

162 *Grace Katz , Srihitha Kurapati*
Mentors: Rafael Lang, Juehang Qin

163 *Ethan Kessel*
Mentors: Eduardo Barocio

164 *Paing Khant, Junpei Ota, Jaya Hari, Akshata Manjunatha, Akash Kumar, William Jiang, Stephen Iwu, Yunfeng Jia, Qingwei LI*
Mentors: Yung-Hsiang Lu

165 *Soomin Kim*
Mentors: Byung-Cheol Min, Go-Eum Cha

166 *Erik Kocinare, Abhishek Kini, Austin Adkins, Caden Kuang*
Mentors: Shreya Ghosh

167 *Michael Kuczajda*
Mentors: Pamela Sari

168 *Anshul Kulkarni, Suyash Mishra, Aayush Patel*
Mentors: Shreya Ghosh, Samuel Labi

169 *Anne Kutemeier*
Mentors: Rod Allrich

170 *Jueqing Li*
Mentors: Jill Newton

171 *Yichi Liu, Colin Mcgeary, Samuel Yang, Connie Kang*
Mentors: Minghao Sun, Abolfazl Hashemi

172 *Santiago Lopez*
Mentors: Alex Ma, Botao Du

173 *Libby Loprete*
Mentors: Jonathon Day

174 *Madyson M Walker*
Mentors: Daniel Kim

175 *Taylor Main*
Mentors: Senay Simsek, Kristin Whitney

176 *Rachel Mendez*
Mentors: Katie Jarriel

177 *Addy Messerly*
Mentors: Ximena Bernal, Andrew Mularo

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

179 *Emily Morales Liddiard*
Mentors: Ignacio Camarillo

180 *Olivia Moreno*
Mentors: Dennis Savaiano, Tzu Wen Cross, Tracy Eaton

181 *Caleb Mull, FNU Archie, Harry Lee*
Mentors: Garam Kim

182 *Chinelo Nnatubeugo*
Mentors: William Graziano, Regina Henares

183 *Chelsea O'Donnell*
Mentors: Marcial Gonzalez

184 *Ronald Or*
Mentors: Erin Hennes, Taeik Kim

185 *Manas Paranjape, Harmya Bhatt*
Mentors: Romila Pradhan, Gaurav Nanda

186 *Abhirakshak Raja, Seungkeun Lee, Savreen Kaur*
Mentors: James Davis

187 *Alyssa Smith*
Mentors: Jonathan Pasternak, Erin Ison

188 *Kaitlyn Sycko*
Mentors: Alexander Kling

189 *Summer Thomlison*
Mentors: Jonathan (Alex) Pasternak, Devon Anderson, James Markworth

190 *Matthew Tolla, Soham Agarwal, Edison Liao, Marvin Lim, Yufeng Qian, Jordan Srinivasan, Mejebi Uwatse*
Mentors: Carla Zoltowski, Edward Delp

191 *MacKenzie Ulrey, Tze Yao Yap, Jill Merritt*
Mentors: Gregory Fraley, Jeff Lucas, Jenna Schober

192 *Vlada Volyanskaya, Ashvin Iyer, Colby Acton, Enze Jiang, Jinen Setpal, King Yang, Mustafa Albahrani, Nishant Nair, Vinay Jagan*
Mentors: Zichen Miao, Wei Zakharov, Qiang Qiu

193 *Alexandria Warren*
Mentors: Daniel Suter, Gentry Andrews

194 *Ziqi Yao, Haley O'Neal*
Mentors: Zhixu (Rick) Yang, Franki Kung

195 *Madison Yates*
Mentors: Peristera Paschou, Pritesh Jain

196 *Sydney Clifford, Elizabeth Hoffman*
Mentors: Claire Pfeffer, Gagan Mall, Brittany L. Allen-Petersen

## AFTERNOON POSTER SESSION | 1:00PM-2:30PM

200 *Zoe Alexander*
Mentors: Ximena Arriaga

201 *Steven Andreas, Xinyu Yang, Zhaoyu Jin*
Mentors: Mark Johnson, Matthew Swabey, Cole Nelson

202 *Anthony Bovenschen, Nicholas Pecoraro*
Mentors: Jae Hong Park, Li Liao, Subin Han

203 *Reni Boyarov*
Mentors: Estuardo Robles

204 *Chris Buntin*
Mentors: Greg Michalski

205 *Emma Carosone*
Mentors: David Purpura, Patrick Ehrman, Inga Nordgren

206 *Rachel Chen, Matthew Leight, Xipeng Wang, Yuting Xiao, Mengting Xu, Mason Chung, Max Yee*
Mentors: Minghao Sun, Abolfazl Hashemi

207 *Joley Clodfelter, Natalia Figueroa*
Mentors: Genell Ebbini

208 *Brandon Cole*
Mentors: Cole Nelson

209 *Grace Cook*
Mentors: Katie Jarriel

210 *Benjamin Deadman*
Mentors: Katie Jarriel

211 *Emily Deldar, Sophia Hagedorn*
Mentors: Francoise Brosseau-Lapre, Itzel Matamoros Santos

212 *Rugved Dikay*
Mentors: Konstantina Gkritza, Konstantinos Flaris

213 *McKenna Eichenauer*
Mentors: Robin Tanamachi, Jacob Bruss

214 *Maya Federle*
Mentors: Deva Chan, Douglas Brubaker

215 *Michaela Fennell, Annie Johnson, Celia Whisler*
Mentors: Genell Ebbini

216 Withdrew.

217 *Mun Hong Fong*
Mentors: Gaurav Chopra

218 *Joy Gao*
Mentors: Chengcheng Tao

219 *Braden Garretson*
Mentors: Danny Milisavljevic

220 *Maya Godbole*
Mentors: Hyowon Lee, James Nolan

221 *Samuel J. Gray*
Mentors: Paige Frazier

222 *Thomas Greer*

223 *Marissa Hammett, Sydney Terrell, Abrianaa Kidd, Angela Atwell*
Mentors: Inna Abramova

224 *Caden Helfrich*
Mentors: Alex Pasternak

225 *Sarah Hofmann, Noelmi Ulloa, Erica Long*
Mentors: Timothy Johnson, Eunice Centeno, Tessa Sheets, Carmen Wickware

226 *Kal Holder*
Mentors: Daniel Fajardo

227 *Daniel Hristov*
Mentors: Hugo Samayoa Oviedo, Julia Laskin

228 *Zachariah Hunt*
Mentors: Alexander Francis

229 *Blake Iftiger, Mihika Saxena, Sriranga Kaluvakala, Meghan Gron, Adit Shah, Conor McCarthy, Saichandana Pothireddy, Hongyi Shen*
Mentors: Nachiket Vatkar, Wenzhou Wu

230 *Julian Kang, Hana Wong, Hansoo Kim*
Mentors: Joerg Appenzeller, Mark Johnson

231 *Logan Kitts, William Lock Falcon*
Mentors: Gudrun Schmidt

232 *Mikayla Klemp*
Mentors: Adriana Harmeyer, Amy Childress

233 *Xilin Li*
Mentors: Bhunia Arun K, Dongqi Liu, Nicholas Leo Frank Gallina

234 *William Lock Falcon, Logan Kitts*
Mentors: Gudrun Schmidt

235 *Erica Long*
Mentors: Timothy Johnson, Eunice Centeno

236 *Alec Lucas*
Mentors: Ana Ulloa Gomez, Lia Stanciu

237 *Meredith Lucero, Payton Hartman, Ava Torrance, Deforest Williamson*
Mentors: Sandra Sydnor, Zachary Carlson

238 *Drew Lundin, Nathan Arnold, Alex Hanna, Amir Issa, Stanley So, Rohan Rajesh, Shrijan Swaminathan*
Mentors: James Goppert, Nicole Adams, Nan Kong

239 *Micaela Menchaca*
Mentors: Signe Kastberg, Helen Bentley, Stephanie Oudghiri

240 *Emma Miller*
Mentors: Robin Tanamachi

241 *Maisha Mumtaz*
Mentors: David Warsinger, Andrew Fix, James Braun

242 *Robert Murphy, Pranav Jagada, Jimmy Jin*
Mentors: Mark Johnson, Mitch Arndt, Cole Nelson

243 *Ryan Navarre*
Mentors: Robin Tanamachi

244 *Elbek Nazarov, Akshat Verma*
Mentors: Guofan Shao, Keith Woeste

245 *Long Nguyen*
Mentors: Sarang Pramod

246 *Tyler Nord, Vebjorn Moskvil, Abhirama Rachabattuni, Ata Toraman*
Mentors: Katherine Fowee Gasaway, Alina Alexeenko, Steven Pugia, Jesus Meza Galvan

247 *Matthieu Opdyke, Eric O'Keefe, Diego Montes, Hadi Ahmed, Corey Auerbach, Joao Paulo Ymayo, Andrew Swanback, Evan Kamm, Leonard Jung, Jake Mohler*
Mentors: Shreyas Sundaram, Charles D'Onofrio

248 *Kayla-Marie Otero*
Mentors: Lana Newhart-Kellen, Harold Cooper, Erika Kvam

249 *Akif Ozer*
Mentors: Umit Karabiyik, Mohammad Meraj Mirza

250 *Lucas Papai*
Mentors: Catherine Searle

251 *Conner Partaker, Josephine Haydock, Larkin Nickle, Lily Peck, Annabelle Pitt, Palak Prashant, Nicholas Ryan*
Mentors: Kristen Bellisario

252 *Nicholas Pecoraro, Anthony Bovenschen*
Mentors: Jae Park, Subin Han, Li Liao

253 *Stanislav Pelipad*
Mentors: Lucas Cohen

254 *Thwandall Philemon, Daanish Suhail, Zijie Mai, Ryan Sui, Elbek Nazarov, Vanessa Farrell*
Mentors: Chih-Chun Wang, David Love, James Krogmeier, Sameer Mathad

255 *Saichandana Pothireddy, Meghan Gron, Blake Iftiger, Conor McCarthy, Mihika Saxena, Hongyi Shen, Sriranga Kaluvakala, Adit Shah*
Mentors: Nachiket Vatkar, Wenzhou Wu

256 *Graham Ragland*
Mentors: Deva Chan, Rahaf Salim

257 *Kendall Raley, Ashley Buening, Emerson Ladig, Mark DeLeon*
Mentors: Inna Abramova

258 Moved to virtual presentation #317.

259 *Britney Ramos*
Mentors: David Rollock, Adilene Osnaya

260 *Erik Raume, Vedha Srigiri, Lucas Manalo, Anna Rosha, Hyunseok (Chris) Hong*
Mentors: Dionysios Aliprantis, Dakota Hamilton, Loraine Navarro

261 *Madilyn Reid*
Mentors: Shihuan Kuang, Xiyue Chen

262 *Becca Reinecke, Katherine Kneeland, Usman Chaudhary, Andy Le, Vishnu Pillai, Benjamin Roeder, Elliot Wong, William Whitsitt*
Mentors: Katherine Fowee Gasaway, Andrew Binder, Alina Alexeenko, Anthony Cofer

263 *Becca Reinecke, Ishaan Rao, Mark Kosmerl, Ashwin Limaye, Samuel Smith, Sathvik Srikanth, Sophie Witters*
Mentors: Katherine Fowee Gasaway, Alina Alexeenko, Andrew Binder, Anthony Cofer

264 *Elizabeth Riegle, Nicholas Powers, Kayla Comer, Jiwoo Kim, Krishna Bendishankara, Shaan Chanchani, Megan Parsons, Lydia Stinnett*
Mentors: Amy Reibman, Haoyu Chen

265 *Alexia Rodrigues, Alex Liu*
Mentors: Pengyi Shi

266 *James Rooney, Jacob Lindsey*
Mentors: Tony Hazbun

267 *Ibrahim Saeed, Pongpatapee Peerapatanapokin, Matuesz Romaniuk*
Mentors: James Davis, Wenxin Jiang

268 *Mihika Saxena, Conor McCarthy, Saichandana Pothireddy, Hongyi Shen, Meghan Gron, Blake Iftiger, Adit Shah*
Mentors: Nachiket Vatkar

269 *Revanth Krishna Senthilkumaran*
Mentors: Byung-Cheol Min, Wonse Jo

270 *Joshua Sexton*
Mentors: Emma Vanderlaan, Sherry Harbin, Adrian Buganza Tepole

271 *Audrey Shirley*
Mentors: Gouri Prabhakar

272 *Nathan Skripac, Charan Senthil Kumar, Yuvraj Dahiya, Rachel White, Nicholas Rasmusson*
Mentors: Shreya Ghosh, Richard Ajagu

273 *Colby Smock*
Mentors: Aaron Thompson

274 Withdrew.

275 *Shashank Sridhar, Amritanshu Ranjan, Pranav Kolady, Aaditya Pai, Sanjeev Kummarapurugu, Harsh Ajwani*
Mentors: Shreya Ghosh, Samuel Labi, Richard Ajagu

276 *Sophie Stahl*
Mentors: Leanne Nieforth, Sarah Leighton

277 *Hasan Sultan, Aakanksha Shripal, Manas Paranjape, Disha Maheshwari, Miyu Hino, Kalyan Salkar, Minrui lu*
Mentors: Charles D'Onofrio

278 *Julia Suter, Anna Strong*
Mentors: Carolyn McCormick

279 *Julia Suter, Anna Strong*
Mentors: Carolyn McCormick

280 *Erik Sveen*
Mentors: Miranda Weigand

281 *Emily Testin, Maverick Broviak*
Mentors: Liang He

282 *Emily Testin, Maverick Broviak*
Mentors: Liang He, Karthik Ramani

283 *Mason Trenaman Jr., Shep Dick, Evan Holland, Jack Filpi*
Mentors: Richard Dionne

284 *Isabel Turner*
Mentors: John Radcliffe, Jonathan Pasternak, Brian Richert

285 *Jacob Valdez, Aubrey Gatewood, Max Lantz, Pruthvi Patel*
Mentors: Katherine Fowee Gasaway, Alina Alexeenko, Steven Pugia, Jesus Meza Galvan

286 *Marissa Van Sickle*
Mentors: Olga Lyanda-Geller

287 *Muhan Wang, Conrad Otterbacher, Trang Nguyen*
Mentors: Maria Olivero, Yang Yang

288 *Ruth Wei*
Mentors: Caitlin Proctor, Aliya Ehde, Liam Johnson

289 *Tyler Williams, Andrew Ferrer*
Mentors: Dianne Little, Paula Sarmiento

290 *Sydney Williams*
Mentors: Estuardo Robles

291 *Anastasia Wong, Giovanni De Geronimo, Delany Koi, Aryan Shahu, Yashashwini Singh*
Mentors: Abraham Koshy, Andreas Jung

292 *Joseph Woo, Arav Tewari, Saad Sharief*
Mentors: James Davis, Purvish Jajal

293 *Kayla Wrobleski*
Mentors: Richard Kuhn, Jacqueline Anderson

294 *Kunal Zalani*
Mentors: Katie Jarriel

295 *Wenjia Zhang*
Mentors: Qian Wang

296 *Lejia Zhou*
Mentors: Qian Wang

297 *Xingmei Zhu, Yuto Tanaka*
Mentors: Kate Gasaway, Jesus Meza, Steven Pugia

# SEE YOU IN THE SPRING!

**February 2: Spring Undergraduate Research Roundtable – Virtual via Discord**

**Mid-March: Undergraduate Research Pitch Competition – In-person**

**April 11-18: Spring Undergraduate Research Conference**
Poster symposium on April 11 and Research talks on April 13
*Submission site opening soon.*

**April 20: Celebrate Thinkers, Creators, & Experimenters – In-person**
*More information coming soon.*

**Spring 2023 Undergraduate Research Seminars – Virtual via Zoom**
*Topics and dates announced January 2023. Submit potential topics to ugresearch@purdue.edu.*

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

# MORNING POSTERS

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

# FEMTA Suborbital: Propellant Management Experiment


Author(s):

Olukunle Akinleye, College of Engineering

Wyatt Alexander, College of Engineering

Philip Voronin, College of Engineering



Abstract:

FEMTA (Film Evaporation MEMS Tunable Array) is a micropropulsion system for altitude control for CubeSats. The FEMTA Suborbital Flight Experiment consists of a Propellant Management Experiment (PME) and a full-scale thruster experiment. The PME verifies the ability of a pressure-driven pump to provide propellant to the thruster. In contrast, the thruster experiment collects data on the thrust characteristics of the FEMTA in a 0G environment. This nanosatellite propellant unit will be tested in a 0G environment aboard Blue Origin's New Shepard Vehicle. The focus of the propellant management experiment is to address the issues with the previous propellant tank design by implementing and testing the redesigned components and making continuous improvements to increase efficiency based on testing results.

The propellant management subteam is tasked with aiding the Manufacturing and Avionics subteams, manufacturing flight hardware, and developing a system to aid in testing and data processing of the PME. Completing the flight hardware will allow the team to test the redesigned propellant tank by performing a flow test in a vacuum chamber. The pressure and uniformity of the flow out of the propellant tank will be measured. The flow test will verify that the redesigned diaphragm and gaskets create a leak-tight system, providing a steady flow of propellant. The new test data will be used to advise any changes necessary to improve the current design of the two experiments. Flow testing completion will enable the team to shift to environmental testing upon the maximization of the efficiency of the PME.


Mentor(s):

Katherine Fowee Gasaway, AAE

Steven Pugia, AAE

Jesus Meza Galvan, AAE

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

## A Psychological Investigation of Crisis Center Volunteer Well-being and Retention

Author(s):

Sierra Allen, College of Science, College of Science, Honors College

Abstract:

The goal of this research (which is currently in progress) is to examine (a) how volunteering at a suicide and crisis intervention program (i.e., ‘crisis center’) can impact people in both positive and negative ways; (b) why volunteers are considering leaving or staying at a crisis center; and (c) ways that a crisis center can improve the volunteer experience. Crisis centers serve their communities by offering confidential and non-judgemental support to individuals who are experiencing a crisis. Most of the people who keep the lines running are trained volunteers. These volunteers usually work remotely and are required to take shifts (usually around 4 hours each) to cover the line 24 hours a day, 7 days a week, every day of the year.

The data collection plan involves two separate sets of surveys with volunteers at a local crisis center. The survey questions will help investigate various psychological and situational factors involved in volunteer turnover, such as burnout and stress. Through this, the research aims to identify reasons why some volunteers choose to stay with a crisis center and why others choose to leave, and how those reasons change over time.

During the expo presentation, we will present our study design, goals, and review of existing research on this subject. This study seeks to contribute to an emerging body of research on volunteer retention and mental health professionals’ psychological burdens (e.g., compassion fatigue), while also informing key practices for retaining volunteers in the participating crisis center.

Mentor(s):

Sang Woo, Purdue University

**Poster Presentation Abstract Number: 102** :: Physical Sciences

## Entanglement Distribution on a Photonic Integrated Circuit

Author(s):

Gabriel Alminauskas, College of Engineering

Collin Campbell, College of Engineering

Runlin Wang, College of Engineering

Abstract:

Quantum technology is becoming a popular and reliable solution in communication and information processing. Compared to classical technology, quantum technology has some potential advantages: dramatic processing speed-up, ultimate safety, and efficient power consumption allow the quantum technology to be considered a contender to the classical technology. However, as matter-based qubit systems increase in size, counteracting decoherence becomes challenging, thereby placing limits on the size of standalone system. Consequently, unleashing the full potential of quantum information processing requires reliable distribution of entanglement as a resource between distant parties. In this work, we present the design, simulation and layout of a silicon photonic integrated circuit (PIC) capable of supporting successful entanglement distribution while being compatible with optical fiber telecommunications networks. The PIC is based on the micro-ring resonator – a device which enables both the generation of broadband entangled photon pairs and their subsequent filtering and demultiplexing. The designed PIC will be submitted for fabrication in early 2023 and experimental results will be presented in Purdue’s Spring 2023 research expo.

Mentor(s):

Luke Cohen, Purdue University

**Poster Presentation Abstract Number: 103** :: Innovative Technology/Entrepreneurship/Design

# Scheduling Dashboard Design for Home Health Agencies


Author(s):

Aidan Anastario, College of Engineering, Honors College

Manav Bhasin, College of Engineering

Chi-Jui Lin, College of Engineering

Dheepa Hari, College of Engineering

Jun Lim, College of Science

Xinyi Zhang, College of Science



Abstract:

With over 5 million patients being treated from home in the US alone (Center for Medicare & Medicaid Services, 2022), home health services continue to play a significant role in the country's healthcare landscape. However, with rising costs, a shortage of talent, and an ever-growing industry, home health agencies have long struggled to stay efficient. Our research team met with one such agency based in Lafayette in an attempt to address the issue. We determined that the agency's administrators often found it inconvenient to gather data about their nurses, schedules, and patients as information is scattered across multiple websites. Hence, we set out to design a modern, functional web application (or digital dashboard) to streamline administrative processes within this agency. The website will consolidate information about nurses, scheduling, and patients with one single database, allowing administrators to easily access and edit the data as needed. Our goal is to improve workflow within this home health agency and, ultimately, increase efficiency and productivity. Our tech stack consists of an Angular front end, a Node.js and Express.js backend, and a MySQL database for storage.



Mentor(s):

Nan Kong, Purdue University

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

## Recycling of carbon fiber reinforced thermoplastic composite for compression molding


Author(s):

FNU Archie, Polytechnic Institute

Harry Lee, College of Engineering, Honors College

Jacob Montrose, Polytechnic Institute



Abstract:

The use of fiber-reinforced polymer composite has been implemented universally due to its advantageous mechanical and physical properties. Consequently, there has been a significant increase in demand for the exploration and expansion of fiber-reinforced composites. The recycling aspect minimizes the waste of end-of-life composite parts averting environmental deterioration; furthermore, it ensures the optimum utilization and promotes the development of recycling technology for composite parts. The goal of this project is to illustrate the fiber-reinforced thermoplastic polymer composite recycling processes and opt performance of the recycled thermoplastic composite portion over tensile tests. The tests will utilize consolidated thermoplastic composite materials cut into small pieces and pressed in pin bracket compression molds at an elevated temperature. Reformation in the molecular chain at elevated temperatures is vital for thermoplastic material to eliminate premature secondary bonding. Various shapes and sizes of composite materials will be used through the implementation of design cuts and design assemblies throughout the project. The mechanical strength of the recycled pin bracket composite parts was tested through tensile tests to verify the viability of application in different recycling methods.



Mentor(s):

Garam Kim, Purdue University

**Poster Presentation Abstract Number: 105** :: Life Sciences

## Early Prediction of Cardiac Arrest Using Neural Networks


Author(s):

Lynley Arnholt, College of Health & Human Sciences

Alec Pannunzio, College of Engineering

Gloria Cheng

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Summer Fateley

Jackie Freeman

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Lucas Pedersen

Julie Wasyliw



Abstract:

More than 200,000 patients in the United States annually suffer an in-hospital cardiac arrest (CA). The heart ceases to pump blood to the vital organs when this event occurs. Under current circumstances, 76% of hospitalized patients do not survive. Research shows that patients demonstrate subtle changes in vital signs up to twelve hours before CA. However, these changes are often difficult for healthcare professionals to detect, leaving insufficient time to rescue the patient. This research aims to develop a neural network that uses clinical data easily obtained by a bedside nurse to predict a CA event four hours before it occurs. Information from 448,972 Emergency Department visits in the Medical Information Mart for Intensive Care (MIMIC) IV dataset will be analyzed. Consistent with prior research and clinical expertise, the selected candidate predictors will include patients' vital signs, age, and sex. These features will train a neural network to predict CA events up to 4 hours before they occur. The Institutional Review Board at Purdue University has approved this project (IRB-2020-410). This work strives to improve recognition of clinical decline leading up to CA, thereby, reducing morbidity and mortality.



Mentor(s):

Laura Moffat, Purdue University

**Poster Presentation Abstract Number: 106** :: Life Sciences

## GMPylation, a new post-translational modification carried out by a Fic Protein from Bordetella bronchiseptica


Author(s):

Rohan Aryan, College of Science

Rahul Saproo, College of Science



Abstract:

Fic (filamentation induced by cAMP) proteins regulate diverse cellular processes in bacteria. While Fic proteins predominantly utilize ATP to post-translationally modify target proteins, some utilize other nucleotide derivatives to alter the activity of their target. Bordetella sp. causes respiratory tract infections, including whooping cough in humans. A combination of waning immunity to B. pertussis and the emergence of human-adapted B. bronchiseptica strains have resulted in recent epidemics of whooping cough-like illnesses worldwide – highlighting the presence of novel Bordetella proteins critical for virulence and/or fitness. Such proteins would be key candidates for a more effective vaccine designed for newly circulating Bordetella strains. We discovered a Fic protein, BbFic in Bordetella bronchiseptica, that fits the transcriptional profile of such predicted virulence factors. Unlike most Fic proteins that preferentially bind and utilize ATP as a nucleotide source, BbFic weakly binds ATP, and instead shows increased preferential usage for GTP. We biochemically characterized BbFic as a bona fide guanylyltransferases and solved its crystal structure at 3.1 Å. Molecular docking and mutagenesis elucidated a mechanism for GTP recognition, which implicates two arginine residues within its nucleotide-binding pocket (Flap). The importance of our work is two-fold: 1) BbFic represents a new category of fitness genes predicted to play a role in new host-adaptations for Bordetella, and 2) BbFic frames the groundwork for understanding Fic-mediated GMPylation as a novel post-translational modification in signal transduction. Current work focuses on determining a role for BbFic in Bordetella pathogenesis, including the effect of BbFic translocation into bacterial cells.



Mentor(s):

Seema Mattoo, Purdue University

**Poster Presentation Abstract Number: 107** :: Mathematical/Computation Sciences

## Trajectory, Stability, and Dispersion Analysis of a 2-Stage Space-shot Rocket for PSP - High Altitude

Author(s):

Elliot Basem, College of Engineering

Alexander Suppiah, College of Engineering

Daniel Qi, College of Engineering, Honors College

Nachiketh Yellapragada, College of Engineering

Abstract:

Simulation of high-speed launch vehicle trajectories requires the formulation of equations of motions in 6 degrees of freedom (6DOF), as well as analytical calculations of supersonic aerodynamic coefficients. The primary objective of the Simulations subteam in the Purdue Space Program (PSP) High Altitude team is to develop a 6DOF simulation in MATLAB Simulink to accurately generate parameters and predict the performance of a rocket capable of reaching the Kármán line. This 6DOF simulation will predict the launch vehicle trajectory and stability with the goal of validating designs that fit within PSP High Altitude’s engineering requirements. Trajectory analysis will be able to input relevant operating conditions, including launch longitude and latitude, launch angles, staging parameters, and physical parameters such as rocket geometry and the motor thrust curve. The kinematics of the rocket with the effects of Earth’s rotation are then accompanied by the forces and moments on the rocket, which are calculated by incorporating an atmospheric model and gust model with the Air Force’s Missile DATCOM software. Additionally, this model incorporates a Monte Carlo simulation to analyze a chi-squared dispersion analysis. For future work, the simulation will be combined with other programs to ultimately feed into a launch vehicle parametric sizing algorithm, which will produce optimal designs for given operating conditions and engineering requirements.

Mentor(s):

Eric Williamson, Purdue University

**Poster Presentation Abstract Number: 108** :: Social Sciences/Humanities/Education

## Associations between Parent Feeding Practices and Infant and Toddler Dietary Variety

Author(s):

Grace Beehler, College of Health & Human Sciences

Abstract:

Eating a variety of foods is essential to achieve optimal intake of key nutrients, particularly during infancy (Kaar et al, 2016). Parents decide which foods to offer their infants, but predictors of dietary variety are understudied. The purpose of this study was to explore associations between maternal sensitivity and parent feeding practices with the total variety of foods and vegetables offered to infants.

Infant-mother dyads (n=56) participated in laboratory visits when infants were 6-24 months old. Maternal sensitivity was coded using the Mini Maternal Behavior Q-sort for video coding (Mini-MBQS-V; Moran et al., 2009). Mothers completed questionnaires to assess their feeding styles (Infant Feeding Styles Questionnaire ([IFSQ]; Thompson et al., 2009) and the total variety of foods and vegetables they offered their child. Subscales for responsiveness (satiety) and restriction (amount) from the IFSQ were created by averaging six and four items, respectively.

Regression models predicting total food variety (R2=0.599, F=14.64, p<0.001) and vegetable variety (R2=0.42, F=7.102, P<0.001) were significant after controlling for parent education and child age. Older children were offered more foods (β=0.70, SE=.13, p=0.00) and vegetables (β=0.47, SE=0.04, p=0.00). Restriction (amount) was inversely associated with vegetable variety (β=-0.31, SE=0.93, p=0.018). No other significant associations emerged.

In this study, mothers who reported restricting the amount of foods their infants ate also reported offering fewer vegetables to their infants. Educators can help parents understand how their feeding practices, such as restriction, may relate to foods they offer their children and the importance of promoting optimal nutrition, growth, and development.

Mentor(s):

Kameron Moding, Purdue University

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

## Achieving high-speed and high-resolution in additive manufacturing devices using CLIP technology

Author(s):

Ancy Biju, College of Engineering

Abstract:

Abstract redacted.

Mentor(s):

Yujie Shan, Purdue University

**Poster Presentation Abstract Number: 110** :: Mathematical/Computation Sciences

## Geospatially Resolved Model Of Heat Pump Life Cycle Costs

Author(s):

Elliot Bissman, College of Engineering

Abstract:

About 40% of home energy use in the United States can be attributed to space heating, which relies heavily on natural gas (EIA, 2018). Moving away from natural gas use in the residential sector is required to reduce greenhouse gas emissions and meet decarbonization goals. Heat pumps are the leading technology in space heating electrification, but adoption faces a variety of complex environmental and social barriers including climate factors, capital costs, electricity costs, and infrastructure. This study looks at the energy demand of R140A heat pumps in California and Colorado and combines the capital and operating costs in a high geospatial resolution model. Python was used to disaggregate data from the Homeland Infrastructure Foundation Level Database (HIFLD) Electric Service Territories and U.S. Energy Information Administration (EIA) Utility and Retail Marketer Sales to create a census-tract level model of electricity costs within the area of the case studies. Future iterations of this model can be expanded to include additional states and multiple heat pump technologies. Initial results, including average electricity rates in California, will be presented. This high resolution model can be used to draw comparisons between climate, regional characteristics, and demographic diversity based on statistics from the U.S. Census Bureau. Nearly 31% of households struggle to pay their energy bills (EIA, 2015) and further analysis is necessary to tell if increasing household energy electrification could create additional challenges.

Mentor(s):

Rebecca Ciez, Purdue University

**Poster Presentation Abstract Number: 111** :: Innovative Technology/Entrepreneurship/Design

## Intro-to-SoCET Team: Researching the Tools for System on Chip Development


Author(s):

Oliver Boettger, College of Engineering

Niels Van Ritbergen, College of Engineering

Lorenzo Cacciapuoti, College of Engineering

Wilson Wong, College of Engineering

Alexander Beal, College of Engineering



Abstract:

System on Chip Extension Technologies (SoCET) is a professor-led team of undergraduate and graduate students who follow a comprehensive system on chip design, fabrication, and test experience similar to industry practice. Contributing to this project typically requires technical prerequisites which are usually completed in late sophomore or junior semesters, however, anyone willing to learn can find work to be done. The Intro-to-SoCET sub-team within SoCET is tasked with introducing new members with little to no technical experience to the fundamentals of what each sub-team of SoCET does through presentations and labs, and prepares students to confidently contribute to a technical sub-team. The primary focus thus far has been on learning the basics of the many tools needed for system-on-chip development within SoCET's sub-teams. This is done through guided labs and instructional lectures, which discuss basic terminology and knowledge to be able to contribute to SoCET's ongoing projects. So far, information on sequential and combinational circuits, boolean logic, SystemVerilog, and post-verification have been covered. Computer architecture and the physical design of system-on-chips such as printed circuit boards have been looked at as well. In the future, the team will cover lessons in the realms of analog chip design, chip design flow, as well as printed circuit board design. Integrated into the entirety of the curriculum, members also learned how to utilize Git commands and gained familiarity with terminal/bash commands in a UNIX environment. Thanks to the time spent in the intro to SoCET subteam, members will have enough knowledge and experience to be able to branch off and contribute to technical projects in the upcoming semesters.



Mentor(s):

Mark Johnson, Purdue University

**Poster Presentation Abstract Number: 112** :: Life Sciences

## The harmful effects of e-cigarettes for health


Author(s):

Vladimir Bovkis, Exploratory Studies



Abstract:

Bovkis Vladimir

Qian Wang (Fiona)

The harmful effects of e-cigarettes on health problems are very relevant in our time because more and more intensive use of electronic cigarettes by adults and young people. The number of users is steadily growing every year, most likely due to insufficient awareness of young and old people about the dangers hidden in the device and the chemicals used in vapes.

The best way to find this out is to analyze what is put in e-liquid addictive substances like nicotine. How smoking e-cigs is different from smoking tobacco cigarettes and how it affects the human body. In this poster presentation, the author will examine medical journals and articles describing research on how e-cigarettes affect the human body both in the short term like nicotine addiction, and long term like cancer. As researchers presented that adolescents who vape are six times more likely to regularly smoke tobacco in young adulthood (Kay Lofgren, 2019).

More research evidence will also be presented on the issue of harmful substances in e-cigarettes and the short-long term effects of the topic of “the harmful effects of e-cigarettes for health.



Mentor(s):

Qian Wang, Purdue University

**Poster Presentation Abstract Number: 113** :: Life Sciences

## Accessing Viability of Fungal Cultures to Facilitate Mycological Research

Author(s):

Sean Brown, College of Science

Abstract:

In mycological research, access to fungal species/cultures is necessary for comparative and morphological studies. Within the lab of Dr. M. Catherine Aime, we house over 6600 fungal cultures, which represent over 20 years of research efforts, including new species from Guyana and, most recently, novel yeasts found on lettuce crops in the US. This collection is made possible with help from Aime lab graduate and undergraduate students, previous colleagues of Dr. Aime, and collaborations with Louisiana State University and Virginia Tech, among others. Approximately 1468 of these cultures need to be assessed for viability due to age or desiccation. We have begun to transfer these cultures to new potato dextrose agar (PDA) medium tubes to obtain fresh growth for prolonged, refrigerated storage. As we transfer, we check for fungal growth or contamination. If there is no growth observed, we will use cryopreserved specimens to inoculate new growth instead. Thus far, we have transferred roughly 530 cultures, of which 150 have proven viable and have replaced the older growth medium tubes. This information is being recorded in a new database to allow Aime lab members to quickly identify, annotate, and find cultures in a dedicated refrigeration space. This process will allow future research experiments to use the cultures and database more efficiently. We plan to continue transferring the remaining cultures to establish a 5-year transfer rotation, which will prevent further loss of cultures due to age or contamination.

Mentor(s):

Rabern Simmons, Purdue University

**Poster Presentation Abstract Number: 114** :: Social Sciences/Humanities/Education

**Basal cortisol levels are not associated with confrontational language in parent-adolescent conflicts at any stage of puberty.**

Author(s):

Gina Canino-Quiñones, College of Science

Abstract:

Both parent-adolescent conflict and the adrenal hormone cortisol increase during adolescence and have been associated with externalizing problems (e.g., aggression; Koss et al., 2017). Further, increasing parent-child conflict over two weeks is related to an increase in total cortisol output (Kuhlman et al., 2016). We hypothesize that higher cortisol could make adolescents more prone to confrontation with their parents during a conversation. Further, pubertal development may impact cortisol-related risk for externalizing problems (Ge & Natsuaki, 2009), including confrontational language. This study examines whether pubertal timing moderates the association between basal cortisol levels and adolescents' confrontational language during a parent-adolescent conflict.

Data are from 220 majority White (70%) adolescents aged 11-17 years (M=13.65, SD=1.53). Pubertal status was determined via Tanner stage (Marshall & Tanner, 1970). Parent-adolescent dyads completed a conflict task where confrontational language (i.e., frequency of strong emotion words, accusatory statements, and sarcastic/frustration words) were quantified in 30-second increments and summed. Salivary cortisol was collected prior to the conflict. Confrontational language was skewed and subsequently dichotomized (i.e.,0=None, 1=ANY). Logistic regression showed no effects x2(N=198)=1.15, p=0.76 for cortisol (OR=0.00, 95%CI[0.00, 0.00], p=0.56), pubertal status (OR=0.31, 95%CI[0.00, 102.46], p=0.69), or their interaction (OR=2.08, 95%CI[0.00, 71.85], p=0.69). Thus, cortisol levels prior to conflict is not associated with confrontational language during parent-adolescent conflict and puberty does not moderate the association.

Mentor(s):

Kristine Marceau, Purdue University

**Poster Presentation Abstract Number: 115** :: Life Sciences

## The Effects of Tau Phosphorylation at Serine 262 on Seed-Induced Tau Aggregation


Author(s):

Raul Castro, College of Science, Honors College



Abstract:

Alzheimer’s disease (AD) is a progressive neurodegenerative disorder for which there are no disease-modifying treatments. One of the neuropathological hallmarks of AD is the accumulation of aggregated, hyperphosphorylated tau within neurons. In AD brain, tau is phosphorylated at multiple pathological sites, and the hyperphosphorylation of tau is believed to occur in a sequentially ordered manner. The phosphorylation of disease-related sites such as S262 was frequently observed in AD brain at the early stage of the disease. Previous research reported that phosphorylation of residue S262 disrupts tau binding to microtubules and inhibits tau fibril formation and cellular seeding activity. However, the effects of phosphorylation at S262 on the aggregation of tau by seeds have not been studied. This research project focuses on expressing tau with a phosphomimetic glutamate mutation at S262 in rat primary cortical neurons and examining whether the tau mutant can be recruited into aggregates by internalized tau seeds. The methodology used in the study includes producing adenoviruses encoding human tau protein carrying a glutamate substitution at S262 with an HA tag at the C-terminus, and investigating whether seed-derived, tau insoluble aggregates have HA immunoreactivity by immunocytochemical analysis. The expectations of this study are to (i) identify the role of tau phosphorylation at S262 on its ability to be recruited into aggregates; and (ii) establish a foundation for targeted therapies for pathological tau in neurodegenerative diseases.



Mentor(s):

Chris Rochet, Purdue University

**Poster Presentation Abstract Number: 116** :: Life Sciences

## How menstruators use technology to track, monitor, and manage menstruation


Author(s):

Isabel Cava, College of Liberal Arts, College of Liberal Arts

Megan Morley, College of Health & Human Sciences

Dinah Waheed, College of Pharmacy, School of Management



Abstract:

Background: Managing menstruation is a global public health issue considering menstruation is a natural universal phenomenon amongst a majority of women around the world. Cultural issues such as period poverty and negative stigmas, alongside technological advancements, are often talked about in the menstrual care space. Technologies, such as mobile apps (e.g., Flo, Glow, iPhone Health) and devices (e.g., menstrual cups, intrauterine devices) have changed how menstruators monitor and manage their menses. Little research exists on how these tools could positively affect college-aged menstruators.

Methods: Virtual focus group discussions (n=32 across 5 focus groups) were conducted in February 2021. Eligible participants were student-menstruators attending a large Midwestern University. Thematic analysis techniques were used for data analysis, allowing for a constant comparative approach to data contextualization and theme identification.

Results: Participants revealed that they used a myriad of technologies to track, predict, and manage their menses, including mobile apps, birth control methods, and flow devices. Mobile apps aided in symptom tracking and period manipulation, which included predicting the time of menses, serving as a reference to communicate with healthcare providers, and alleviating menstrual pain and discomfort. Participants also highlighted factors influencing their decisions to utilize technologies, such as menstrual cups, which are economically and environmentally friendly.

Conclusions: Findings offer insights for researchers, app and tool developers, and practitioners regarding how menstruators utilize technologies to monitor, discuss, and make decisions about menstruation. Information can be used to make technological and public health advances in this area. Further, healthcare providers can use these findings to facilitate app-based, data-driven conversations with patients about their menstruation experiences.



Mentor(s):

Andrea DeMaria, Purdue University

Risa Cromer, Purdue University

**Poster Presentation Abstract Number: 117** :: Innovative Technology/Entrepreneurship/Design

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


Author(s):

Pou Hei Chan, College of Engineering

Wei Teng Sin, College of Science

Lei Chon Weng, College of Engineering



Abstract:

This research introduces the Indoor Navigating Survivor Emergency Response ROV (INSERR), a novel remotely operated vehicle (ROV) system designed to conduct search and rescue operations in flooded indoor environments. INSERR is designed with a compact form factor and is equipped with 6 thrusters for 5 degrees-of-freedom to fit through and allow for precise and swift maneuver at surface and submerged navigation through common choke points such as doors and windows. The bottom mounted 360° scanning imaging sonar enables the human pilot to locate submerged doorways or other entryways even in murky waters as floods often are zero-visibility waters. In rooms with air pockets, a 360° lidar scans above the water surface. The onboard gripper is designed to open doors and remove obstacles. Once a victim has been located, the onboard cameras and audio systems allow for a line of communication. INSERR is equipped with an oxygen tank and payload bays to carry first-aid or other survival supplies. This ROV platform is designed to be highly adaptable with additional mounting space and connection ports for additional peripherals to suit the specific situational needs. We expect that this proposed ROV plays as a comprehensive package for search and rescue for quick response and enhanced identification, and provides means of life support during a flood emergency.



Mentor(s):

Byung-Cheol Min, Purdue University

**Poster Presentation Abstract Number: 118** :: Social Sciences/Humanities/Education

## Girls Excelling in Math and Science (GEMS) Clubs: Stories of the Original GEMS Girls

Author(s):

Meredith Chasse, College of Education

Grace Gochnauer, College of Liberal Arts, College of Veterinary Medicine

Abstract:

Girls Excelling in Math and Science (GEMS) clubs were started in 1994 by Purdue alumna, Laura Jones, when her daughter came home and told her that math was hard. From the beginning, the goal of GEMS has been to ensure that girls see themselves as change agents, problem-solvers, technology entrepreneurs, engineers, scientists, and as people who make a difference. Since then she created a network of GEMS clubs and a website with resources for those interested in starting a club. In 2017, the founder bequeathed GEMS to Purdue's College of Education to continue her legacy and the work of promoting STEM to girls. To explore the impact of GEMS on the girls who have participated, we contacted the girls who participated in the original GEMS club (hereafter, we call them the OGGs) to collect their stories. We conducted individual and focus group interviews with nine OGGs, now women with careers and families of their own. We implemented a thematic analysis of the interview transcripts; several themes emerged related to GEMS: career, family, gender, and mathematics. All OGGs were able to identify particular aspects of their GEMS experiences which prepared for their current careers, and mentioned ways in which they have continued the mission of GEMS with girls (e.g., daughters, nieces) in their own lives. From our analysis, we intend to compile their stories into a book in which we highlight OGGs' voices and the impact of GEMS on their lives.

Mentor(s):

Jill Newton, Purdue University

**Poster Presentation Abstract Number: 119** :: Life Sciences

**Microglial response to hyperexcitability in cortical neurons derived from human iPSCs carrying epilepsy-associated sodium channel Nav1.2 genetic variant**

Author(s):

Ian Chen, College of Pharmacy

Abstract:

Rapid discovery of SCN2A genetic variants from patients with epilepsy and autism highlights the importance of understanding the pathophysiology of these variants. Voltage-gated sodium channel Nav1.2, encoded by SCN2A, is responsible for action potential firing and propagation in the brain. One variant, L1342P, has been reported in patients with epileptic encephalopathy and intractable seizures. To understand the phenotype of Nav1.2-L1342P in neurons, we used CRISPR/Cas9 gene-edited human induced pluripotent stem cells. Using patch-clamping and microelectrode array, we found that neurons with the heterozygous L1342P variant have enhanced intrinsic excitability and network activities \, suggesting hyperexcitability phenotype. Additionally, to alleviate the hyperexcitability from neurons carrying Nav1.2-L1342P mutation, we used antisense oligonucleotide (ASO) specifically targeting the mutation allele, which could serve as a possible therapeutic intervention.

Recent studies have shown the function of microglia in regulating neurodevelopment and neuronal excitability. To study how microglia would respond to the abnormal neuronal environment, we used a co-cultured system to investigate microglia’s role by adding by adding genetically modified microglia calcium response in the presence of L1342P neuron. We found greater microglial calcium activities in co-culture with L1342P neurons. Our data allows us to better understand the interaction between neurons and immune cells in pathophysiological conditions.

Mentor(s):

Yang Yang, Purdue University

**Poster Presentation Abstract Number: 120** :: Social Sciences/Humanities/Education

## Differences in babbling in infants with a range of neurogenetic disorders

Author(s):

Madison Chin, College of Health & Human Sciences

Abstract:

Infant vocalizations change rapidly during their first year. The canonical babbling stage, during which the infant produces consonant-vowel syllables like “ba” represents an important landmark within the first year. Most infants reach this stage by 10 months and, if infants are not producing canonical babbles by 10 months, they are more likely to go on to a speech or language disorder (Oller et al., 1999). For example, infants with neurogenetic disorders who are likely to have atypical language outcomes show a delay in canonical babbling (Patten et al., 2014; Belardi et al., 2014). Here, we investigated whether the proportion of canonical syllables (CP) produced differed across infants with a range of neurogenetic disorders (low-risk, Down Syndrome, Fragile X Syndrome, and Angelman Syndrome) sampled cross-sectionally for one year (6-18 months). Infants were recorded throughout one day in home environments using a wearable audio recorder. Three independent coders tagged each utterance for the number of syllables, and the number of canonical and noncanonical syllables which allowed us to calculate the CP. Results revealed that CP varied across diagnosis, with low-risk infants showing higher CPs than all other groups (p<.001). In sum, CP shows promise as an early diagnostic tool for identification of infants with neurogenetic disorders. This tool could have an advantage over standardizes assessments since daylong recordings are an ecologically valid, ability unbiased, low-cost, and accessible method that can be used by caregivers without having to visit clinicians who may be far away or have long waiting lists.

Mentor(s):

Amanda Seidl, Purdue University

**Poster Presentation Abstract Number: 121** :: Physical Sciences

## Systematic Study of the Electrochemical Properties of Viologens


Author(s):

Ronnie Cutler, College of Science



Abstract:

Viologens are molecules that consist of a bipyridine core, and an alkyl chain attached to each of the pyridine centers. Viologens can undergo up to two electron transfers with each of these different oxidation states conferring a particular color to the solution they are dissolved in. These properties make viologens suitable candidates for the preparation of electrochromic devices, many of which have been reported in the last decade. The performance of these devices is usually limited by the diffusion of the analyte in the electrolyte solution or its electron transfer at the interface of the electrode. In this work, we will systematically study the effect of the alkyl chain on the mass- and electron-transfer properties of 3 different viologen species that differ in the identity of the alkyl chain. Specifically, we will determine the electrochemical properties of methyl, benzyl, and heptyl-substituted viologens in water using potassium chloride as the electrolyte. To extract the electrochemical parameters, we will use three electrochemical techniques: cyclic voltammetry, square voltammetry, and electrochemical impedance spectroscopy. These three techniques are complementary to each other, and all together will provide a robust characterization of the electrochemical properties of viologens species. The data obtained in this work will be used as benchmarks for the evaluation of the performance of electrochromic devices prepared with such viologen species.



Mentor(s):

Hugo Samayoa Oviedo, Purdue University

**Poster Presentation Abstract Number: 122** :: Mathematical/Computation Sciences

## Neural Recorder Amplifier

Author(s):

Marissa Davide, College of Engineering

Azza Sumait, College of Engineering

Abstract:

Through the SoCET team, we are aiming to design a low power, low noise neural amplifier with a biotechnology focus. Direct neuronal measurements are necessary for medical devices. It must be able to boost weak signals detected by the microelectrodes and filter out the undesired frequency components under constrained power consumptions. Our Initial design model consists of two stage fully differential neural amplifiers and a low pass filter with capacitive feedback.  We will research, simulate and analyze the effects of replacing the traditional capacitive feedback topology with an effective chopper amplifier technique using Cadence Virtuoso TSMC 180nm PDK. The motivation of using a chopper amplifier instead of the capacitive feedback would be to produce less noise and reduce the imperfections of the operational amplifier including flicker noise and DC offset. The low noise amplifier will be designed to have a supply voltage of 1.8V, a power consumption of less than 0.74 uW, a current supply of less than 0.4 uA, a referred noise of less than 3u Vrms, and a nominal gain between 200 and 1000. The signal frequency of the chopper should be in the range of hundred Hz and several kHz and the input frequency must be much less than one half of the chopping frequency. This project will help the SoCET team to tape out a chip with the ability of measuring low noise neural signals.

Mentor(s):

John Peterson, Purdue University

**Poster Presentation Abstract Number: 123** :: Life Sciences

## Change in Bird Population in Australia through Trap-Neuter-Return Polices

Author(s):

Maggie Dong, College of Pharmacy, Honors College

Abstract:

Cats are one of the most pervasive invasive species in many places like Australia. Outdoor or feral cats often hunt many native species and give birth to dozens of other cats. Research has shown that solutions like Trap-Neuter-Return, or TNR, do little to curb the feral cat population. Its efficacy is often questioned and often changes depending on the perspective and purpose of TNR. Many animal shelters and cat welfare programs often vouch for TNR as an effective method of feral cat control, while research has shown that, and environmental conservationists will point out, how little TNR has done to diminish the feral cat population. Consequently, how have TNR policies affected the communities outside of, but corollary to, the problem, like the bird population? Previous research has often focused on TNR programs as having insular effects, most in their ability to slow or stop feral cat population growth. Here, I hope to draw a more prominent link between TNR policies and the broader ecosystem to evaluate the effectiveness of TNR as a solution to feral and stray cats. This research will focus on Australia as their nationwide ban of TNR policies, previous feral cat research, and bird survey data allow for a clear point of comparison for how TNR policies have affected the bird population. By overlaying these sets of data in a program like ArcGIS it is possible to produce a time map of these changes.

Mentor(s):

Katie Jarriel, Purdue University

**Poster Presentation Abstract Number: 124** :: Innovative Technology/Entrepreneurship/Design

# Software development via AFTx06

Author(s):

Samantha Dreussi, College of Engineering, Honors College

Jinrae Kim, College of Engineering

Abstract:

The System-on-chip Extension Technology (SoCET) team has developed multiple chips in the past, the latest being AFTx06. The current task of the software subteam is to develop software for AFTx06. Hence, our subteam is developing a demo application to be run on a simulated version of AFTx06 providing a proof of concept using the simulated chip and software driver libraries.These demo simulations are crucial to develop complex software for AFTx06 later on. For the demo, we are developing a simple animation that will require both the code to generate the animation, as well as the code needed to connect to a peripheral display. The demo application will be coded in Rust. Rust is being used for this project, as it prioritizes “safe” features such as safe memory control and potentially could overtake the classic embedded software programming languages, C++ and C. Once the Rust code is compiled, the object it generates will be linked with the object generated by the driver library for AFTx06, resulting in an executable. Then, this executable will be run on a simulated version of AFTx06 using Verilator, a virtual chip designed as a program in replacement of an actual chip, which will translate the Verilog code of the chip into a C++/SystemC model.

Mentor(s):

Cole Nelson, Purdue University

**Poster Presentation Abstract Number: 125** :: Innovative Technology/Entrepreneurship/Design

## Comparison study of deep-learning models for automated transcription of child speech

Author(s):

Adrien Dubois, College of Engineering

Aarohi Panzade, College of Science

Jasper Koliba, College of Engineering

Rosemary Ajish, 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 rarely have an accuracy of over 15% on children's speech. Over the course of the last 3 years, the Children Automated Speech to Text (CAST) team’s goal has been to create an automatic speech recognition solution that will accurately transcribe child speech and fill the gap in this field. This year, the team has tuned the preprocessing pipeline and built multiple classification models. The current phenome transcription algorithm is a Recurrent Neural Network (RNN) primarily used in time series applications. To differentiate between child and adult speakers, which will be needed in the application, we developed a binary classification convolutional neural network. Despite a validation accuracy of 15%, we are continuing to tune hyperparameters with Bayesian optimization. The team is also comparing multiple architectures like transformers and gated recurrent units, data augmentation, and integrating the phoneme classification model with the rest of the pipeline, including Hidden Markov Models (HMM), word correction algorithms, and N-gram sentence correction. We expect to have multiple deep-learning models by the end of the semester. We will evaluate the accuracy of each under different conditions to see which ones should be in the final pipeline.

Mentor(s):

David Purpura, Purdue University

**Poster Presentation Abstract Number: 126** :: Life Sciences

## Changes in Electrocardiogram (ECG) Parameters as a Result of Autonomic Dysreflexia Events


Author(s):

Molly Dye, College of Engineering

Emilie Chadwell, College of Engineering



Abstract:

Autonomic dysreflexia (AD) is a condition which commonly occurs in patients with a spinal cord injury (SCI) above the sixth thoracic vertebrae. AD occurs when there is a noxious stimulus below the level of injury, triggering an uncontrolled sympathetic autonomic reflex resulting in paroxysmal hypertension. To detect an AD event, persons with SCI rely on common symptoms of sympathetic hyperactivity, such as headache, flushing of the skin, sweating, and blurred vision. To determine the correlation between AD and cardiovascular disease, we aimed to understand changes in cardiac electrophysiology during AD events through analysis of electrocardiogram (ECG) data in rats with SCI. A high thoracic spinal cord injury was performed on each rat to disrupt the sympathetic autonomic nervous system from supraspinal control. To imitate the onset of AD in humans, 3 trials of colorectal distension (CRD) were conducted on days 5, 7, 9, 11, 14, 16, 19, and 21 after injury. During these procedures, implanted radio telemetry was used to collect ECG data. A t-test was performed analyzing all trials that elicited AD, which showed statistically significant changes in three ECG parameters during AD events. RR interval showed a difference of 0.3998 ms ($p = 5.62e\text{-}21$), P wave height showed a difference of 0.0046 mV ($p = 1.95e\text{-}5$) and QRS width showed a difference of 0.1643 ms ($p = 2.75e\text{-}28$). These results suggest that cardiovascular function is impaired during AD events.



Mentor(s):

Zada Anderson, Purdue University

Thomas Everett, Indiana University

Bradley Duerstock, Purdue University

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

## Workplace Safety Enhancement with IoT Edge Nodes using Machine Learning (SOFTWARE TEAM)

Author(s):

garret eatinger, College of Engineering

pedro pinto, College of Engineering

Abstract:

Safety is the number one concern in all fields of work. All devices that can give warnings and report dangerous situations are a requirement in any building. The smoke detector being the most famous of these devices, used for the simple task of alarming when smoke is detected in a room. In its more complicated forms, it can alarm all connected detectors and even immediately notify a local fire department about the situation. Our motivation with this Safety IoT device is to further the function of the famous smoke detector via a higher number of high quality sensors measuring a multitude of different data points.

This branch of the project is focused on the software side of the device, therefore we won't focus on the physical or machine learning aspect of the project. The major bridge to cross in this branch was the communication between the RaspberryPi and BlackPill microcontroller. This is accomplished using a library for Arduino called TinyProto.

The results of this branch is the collection and storing of the sensor data in a useable database. The database is given to the machine learning team for them to further their models for our team to later implement as a danger prevention method. Our team is confident that this project has been a good display of what can be improved in safety devices with a path for further improvements.

Mentor(s):

Matthew Swabey, Purdue University

**Poster Presentation Abstract Number: 128** :: Life Sciences

## Protective Effects of Blueberry Phenolic Compounds in IPEC-J2 Cells Challenged with Post Weaning Diarrhea Pathogens

Author(s):

Sarah Eckrote, College of Science

Abstract:

Weaning is a stressful event in a piglet life and marks the transition to an adult diet. The process is accompanied by impaired gastrointestinal tract (GIT) function, inflammation, and a dramatic decrease in body weight, resulting in post-weaning diarrhea (PWD). PWD can lead to an immunocompromised piglet, thus making the animal more susceptible to bacterial infections. Common pathogenic bacteria associated with PWD include Enterotoxigenic Escherichia coli (ETEC) and Salmonella enterica serovar Typhimurium (ST). Currently, antibiotics are used as a precautionary measure, but the concern of antibiotic resistance in veterinary medicine has increased the need for a nutraceutical approach. Anthocyanins are bioactive compounds found in various fruits and vegetables and are proven to improve gut health and contain antimicrobial properties. In this preliminary study, we investigated the prophylactic effects of blueberry phenolic compounds, rich in anthocyanins, on Intestinal Porcine Epithelial Cells (IPEC-J2) challenged with ETEC and ST.

Mentor(s):

Lavanya Reddivari, Purdue University

**Poster Presentation Abstract Number: 129** :: Mathematical/Computation Sciences

## Landsat Network Literature Study with Text Keyword Analysis

Author(s):

Joseph Eisenberg, College of Engineering, Honors College

Abstract:

For the last fifty years, the United States has been launching nine Landsat satellites with the purpose of observing the lands and waters around the entire globe. A substantial amount of imagery data has been collected by this Landsat project, leading to numerous publications on the subject. In 2008, data from the Landsat project became open for all to access, causing a large share of articles on the subject – about 72.5% – to have been published within the last 13 years. This project collected bibliometrics data on 30,164 articles from the Scopus database. The data was organized into ten different year groups, each containing approximately 3,000 articles. By analyzing this data in Python using Natural Language Processing and text analysis, this project has investigated article keywords for each of the year groups in four areas: Article study area, research topics, research techniques, and Landsat products, In order to better visualize this data, Python network creation tools were used to create five different networks – each for two consecutive year groups – which show keyword frequency by node size, which area a keyword corresponds to by node color, and the frequency terms appear together by edge width. By analyzing patterns in articles throughout time and presenting them with networks, this project aims to demonstrate how the analysis on Landsat data has changed over time.

Mentor(s):

Gang Shao, Purdue University

**Poster Presentation Abstract Number: 130** :: Physical Sciences

# Studies on autoregulation of oncogenic RhoGEF Trio


Author(s):

Aya Elhag, College of Science



Abstract:

Trio is a guanine exchange factor (GEF) downstream of Gαq/11-coupled seven-transmembrane receptors that activates small GTPases including Rac and Rho subfamilies through its two different GEF modules, Trio N and Trio C respectively. In addition, Trio has a putative kinase domain and different regulatory domains including two SRC Homology 3 (SH3), and an immunoglobulin (Ig) domain. Previous studies from our lab determined the structure of TrioC revealing the molecular mechanism of its inhibition by the PH domain and found that regions downstream of TrioN have increased Rac1 GEF activity. However, there is an information gap about the role of regulatory regions comprising SH3 and Ig domains downstream of TrioC. This project aims to investigate whether these regulatory domains interact with TrioC and affect its activity using biochemical and structural tools. We expressed and purified biologically active TrioC-SH3 and TrioC-SH3-Ig variants from Escherichia coli. We subsequently attempted to image the proteins using single particle cryo-electron microscopy (cryo-EM) and preliminary assessment of the images does not show discrete structural features. Furthermore, we would try to optimize the conditions for imaging of the variants and evaluate their in vitro GEF activity for comparative analysis with TrioC. Gαq/11- Trio activation plays a critical role in the development of uveal melanoma and other cancers and Trio is a potential drug target which makes our study important for future drug development.



Mentor(s):

Sandeep Ravala, Purdue University

**Poster Presentation Abstract Number: 131** :: Physical Sciences

## Low Cost Remote Sensing of Methane Flux

Author(s):

Anya Emerson, College of Engineering

Abstract:

Wetlands produce around 30% of global emission of methane, a significant greenhouse gas (GHG) that significantly contributes to global warming (according to USGS). The purpose of our project is to design and build a low cost, portable system to remotely measure methane flux on the surface of wetlands. We developed a method of collection utilizing a chamber, containing the sensors, to trap air. An attached air pump will be used to flush air at a set time interval.

The current prototype consists of an 8 L bucket kept afloat with foam pool noodles. Two electrical housing boxes are attached to the top of the chamber containing the electronic boards and air pump. The boards used are STM32F103RB boards with an attached custom PCB board. These boards and the code used to operate them was developed by the River Restoration Intelligence and Verification (RRIV) project. The methane flux chamber system required additional development of code for actuators (air pumps are a type of actuator). The electronics are powered by 4 D cell, rechargeable batteries.

This study shows potential use of low cost sensing devices for GHG monitoring. These remote sensing systems could be widely deployed by scientists and citizen-scientists to collect data consistently, and over larger time windows than by manual sampling currently in use.

Mentor(s):

Jake Hosen, Purdue University

Zaven Arra, RRIV, Bluebot

**Poster Presentation Abstract Number: 132** :: Life Sciences

## Environmental Health in Hartford City, Indiana

Author(s):

Rebecca Eyrick, College of Health & Human Sciences

Abstract:

Metal recycling plants are a concern for their potential ability to release metal contaminants into the environment, potentially resulting in negative health impacts for communities. A concern in environmental justice is that communities with fewer resources face the brunt of environmental health impacts. Citizens in Hartford City, Indiana, were concerned about a metal recycling plant in their community and possible health impacts. The objective of this analysis was to conduct an ecological analysis of socioeconomic disparities of citizens living closer to the metal recycling plant in Hartford City and possible associations with higher levels of pollution and worse health outcomes. Census level data were collected from the United States Census Bureau (sociodemographic data), the US Centers for Disease Control and Prevention (health data), and the US Environmental Protection Agency (pollution data). The data were from census tracts 9752, 9753 (with the recycling plant), and 9754. Data were analyzed using t-tests. Census tract 9752 had significantly higher prevalence of cancer (except skin), chronic kidney disease, and high blood pressure (p<0.01 for all). Tract 9752 had a significantly higher proportion of people with at least a bachelor’s degree (p=0.014) and dental visits (p=0.001) compared to tract 9753. Tract 9753 had a significantly higher proportion of chronic obstructive pulmonary disease (p=0.037), current asthma (p=0.001) and health insurance coverage (p=0.020) compared to tract 9754. High-polluting facilities were found in tracts 9752 and 9753. Overall, there were several significant health disparities across Hartford City; the census tract with the metal recycling facility had poorer health indicators than tract 9754, but had slightly better health indicators than tract 9752. While this work cannot identify the cause of the disparity, further research on these health disparities is warranted.

Mentor(s):

Ellen Wells, Purdue University

**Poster Presentation Abstract Number: 133** :: Life Sciences

**The impact of methimazole-induced hypothyroidism on liver function in swine.**

Author(s):

James Fazioli, College of Science, Honors College

Abstract:

Anti-thyroid medications, including methimazole (MMI), suppress the production of necessary thyroid hormones. Previous research indicates that MMI may contribute to increased liver weight, nonalcoholic fatty liver disease (NAFLD), liver toxicity, and cell-cycle dysregulation. The objective of this study was to evaluate the 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 to assess circulating triiodothyronine (T3) and thyroxin (T4) levels. Organs were weighed in proportion to body weight at day 28. Liver samples were snap-frozen, and thyroid glands formalin-fixed for histological and nuclei-density assessment. Images of liver were taken for tissue colorimetric analysis. Liver RNA was extracted, and the expression of genes associated with NAFLD, apoptosis, thyroid metabolism, and cell-cycle regulators evaluated by qPCR. MMI treatment led to significantly decreased T4 levels in TRT. Thyroid tissue weight increased significantly in TRT($\bar{x}$ 0.051%) relative to CON($\bar{x}$ 0.015%). Histological analysis showed varying degrees of abnormality, including reduced eosinophilic colloid and disorganized columnar epithelium. Microscopic image analysis of fluorescent histology was used to assess nuclei size and density in the liver and showed no significant difference between TRT and CON. TRT showed no significant difference in liver weight, and gene expression analysis showed no evidence of NAFLD, liver toxicity, apoptosis, or cell-cycle dysregulation. A 10mg/kg MMI dose is sufficient to significantly suppress thyroid hormone production and create goitrous pathology in swine. However, swine liver function proves largely unaffected.

Mentor(s):

Jonathan Pasternak, Purdue University

Margaret Mulligan, Purdue University

Ryan Cabot, Purdue University

**Poster Presentation Abstract Number: 134** :: Life Sciences

**Effects of developmental methylmercury exposure on eIF2 signaling pathway in the presence of secondary stressors**

Author(s):

Mia Fleisher-de Kozan, College of Science

Abstract:

Eukaryotic initiation factor 2 (eIF2) plays a critical role in mRNA translation as the phosphorylation of eIF2ɑ subunit inhibits translational initiation. Commonly categorized as a stress response, phosphorylation of eIF2ɑ is associated with changes in healthy aging, memory, behavior, and nervous system development making it critical to the understanding of neurodegenerative disease. To understand the effects of developmental methylmercury (MeHg) exposure on human induced pluripotent stem cell (iPSC)-derived neuronal cultures, eIF2 regulation was analyzed via western blot assays. Investigation of MeHg developmental exposure has shown no effect on regulation of the eIF2 pathway in mature neurons via western blot, despite genome-wide gene expression changes seen in the eIF2 pathway. To further assess the long-lasting effects of the primary MeHg exposure, sodium arsenite (NaAsO2), known to impact eIF2 regulation, was used as a secondary stressor. Preliminary results of NaAsO2 secondary exposure show no effect on eIF2 activation across all samples, including prior MeHg exposed cells. Future experimentation with changes in exposure duration and NaAsO2 concentration are necessary to further evaluate the effects of a secondary stressor.

Mentor(s):

Aaron Bowman, Purdue University

Jennifer Schmitz

**Poster Presentation Abstract Number: 135** :: Social Sciences/Humanities/Education

## Impacts of the Justice System on the Family

Author(s):

Kallie Fox, College of Liberal Arts

Abstract:

My project will examine the impacts of the criminal justice process on the families of justice-involved people through a synthetic literature review. I will study the impacts starting from the initial arrest, followed by the court process, then to the punishment, and finally to post-release. The significance of this project is due to events, both recent and past, that have caused tensions with police and minority communities. I will focus mainly on Black communities and their relationship with the police and the justice system.

Mentor(s):

David McElhattan, Purdue University

**Poster Presentation Abstract Number: 136** :: Life Sciences

## Discernment of Biofilm Formation Capabilities in Novel Bioengineered Probiotics Compared to Commercial Probiotics as a Therapeutic for Inflammatory Bowel Disease

Author(s):

Yang Fu, College of Agriculture

Abstract:

Bioengineered Lactobacillus casei probiotic (BLP) can form biofilm on inflamed tissue within the mouse gut (Drolia et al. 2020). Based on our unpublished data, BLP can resist the symptom of Inflammatory Bowel Diseases (IBD) in a chemical-induced mouse model. As a treatment option for IBD, we will compare the ability of BLP and wild-type Lactobacillus casei (LbcWT) and other Lactobacillus species to form biofilms. We hypothesize that BLP has a better ability to form biofilms than LbcWT and other Lactobacillus species in a cell culture model of IBD. To confirm the ability of BLP and LbcWT to form biofilms, we performed crystal violet staining and probiotic biofilm cell counts experiments. The experimental data of crystal violet showed that the amount of biofilm formed by BLP was significantly higher than LbcWT but lower than other Lactobacillus species (L. rhamnosus) tested. However, the bacterial counts were more for BLP than other Lactobacillus species. To further verify our hypothesis, we will perform ATP Luminescence and Biofilm Composition Analysis including extracellular DNA, carbohydrate, and protein release. Finally, we will verify BLP biofilm in an in vitro IBD cell culture model.

Mentor(s):

Nicholas Gallina, Purdue University

**Poster Presentation Abstract Number: 137** :: Innovative Technology/Entrepreneurship/Design

## Adjustable Laptop Stand for VIP 17911


Author(s):

Brooklynn Fugate, College of Engineering

Jessica Kofman, College of Engineering

Luke Lenz, College of Engineering

Thomas Greer, College of Engineering



Abstract:

The posture one becomes accustomed to after using a laptop can result in tension and strain on one's neck and back. In fact, careers such as office jobs where daily laptop use is commonplace, often have a large percentage of their workforce who experience chronic pain. Therefore, it was established that there exists a demand for a device to correct this issue. This device would allow for laptop users to adjust what height and angle they use their laptop at, making laptop use more accessible.

The goal of this project was to design, model and print an adjustable laptop stand using Fusion 360 and Ultimaker Cura. This laptop stand would angle the laptop up or down without interfering with the typical daily use of a laptop. The laptop stand needed to be versatile, able to be used on laptops of varying models. Initial designs constructed a full model laptop stand, but to save both materials and time, this design was converted into a small two-fold concept where one of each laptop stand would be used at each front corner of the laptop.



Mentor(s):

Alejandro Benítez De la Riva, Purdue University

**Poster Presentation Abstract Number: 138** :: Innovative Technology/Entrepreneurship/Design

**VIP Iot and Edge Processing Research**

Author(s):

David Gonzalez, College of Engineering

Peter Kim, College of Engineering

Abstract:

One of the biggest industries in the world is the manufacturing industry of goods and products. Around the world today, 340 workers die every day due to hazardous working conditions. Many of these cannot be detected unless a device is installed to record data regarding safe atmospheric conditions in the workplace. The VIP IoT Research Team is focusing on developing a device that will be able to detect a variety of different atmospheric conditions with the goal of preventing hazardous workplace conditions. The Hardware team is specifically focused on making a compact and reliable device that can be easily maintained and is an updated version of previous prototypes. Our goal is to design a printed circuit board for our device that will mount all necessary sensors and components in a compact manner that will read data accurately. We are planning to have multiple data-collecting devices that will forward device data to a machine-learning algorithm that is used to predict potential safety threats and notify the end user in real time. This involves having a stable voltage supply and a stable connection to the internet for storing device data on a database in the cloud.

Mentor(s):

Matthew Swabey, Purdue University

**Poster Presentation Abstract Number: 139** :: Physical Sciences

**Effect of the Gulf of Mexico on Precipitation Over the United States**

Author(s):

Shruti Goyal, College of Science, Honors College

Abstract:

The Gulf of Mexico is believed to be important for generating precipitation in the US. It serves as a warm-moist basin providing sufficient moisture and warm air into the inland region that is necessary for precipitation. However, this role of the Gulf of Mexico has yet to be examined explicitly, and hence we are uncertain about the quantitative influence of the Gulf of Mexico on rainfall over the United States. This leads to our research question: to what extent does the existence of the Gulf of Mexico affect U.S. precipitation. We conduct global climate model experiments to explicitly test the role of the Gulf of Mexico. In the experiment, we fill the Gulf of Mexico with land and then compare it to a real-earth historical control run, thus allowing us to truly quantify its influence. We look at both, the United States as a whole, as well as various, carefully chosen subregions and seasons to further evaluate the response. In totality, the outcomes from this project will advance our understanding of the fundamental controls of U.S. precipitation.

Mentor(s):

Funing Li, Department of Earth, Atmospheric, and Planetary Sciences, Purdue University

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

**Addressing the Pakistani Refugee Crisis**


Author(s):

Adyson Gregory, College of Liberal Arts



Abstract:

Due to the rise in Afghan immigrants and Pakistani refugees, caused by mass flooding and decades of military struggles, refugee housing communities in Pakistan are needed. Based on previous research from organizations, such as the Heritage Foundation of Pakistan and publishers such as Routledge, who published "Journals of Ethnic and Migration Studies", it became clear which aspects of the country could use the most assistance. To investigate, several journals were consulted about the internal workings of Pakistan and various case studies were referenced to understand what methods have had previous success in the hopes that it could be integrated into the refugee housing for Pakistan. Drawing from this research, a design was formulated for a stilted two-story family home. By ensuring that important spaces, such as the bedroom and kitchen, were on the second floor, it protected residents from flooding, ensuring the families' safety. Consideration of materials was also carefully researched. Ensuring that all materials used could be locally sources means that this house could be easily replicated for other families. Ideally, Pakistan would be able to mass produce these houses for their citizens while stabilizing their economy once again.



Mentor(s):

Barbara Young, Purdue University

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

## "It happens in every woman": Generational Differences in Menarche through Menopause in Florence, Italy


Author(s):

Mackenzie Greulach, College of Health & Human Sciences, Honors College

Sofia Hrubiak, College of Health & Human Sciences

Elizabeth Salwitz, College of Health & Human Sciences



Abstract:

Background: Individuals who menstruate typically encounter menarche at 12.5 years old and menopause at 51.2 years old, on average. These experiences vary widely depending on environmental factors, genetics, available resources, and education.

Objective: The purpose of this investigation is to understand menstruation experiences, from menarche through menopause, among a sample of cross-generational women in Florence, Italy.

Methods: In-depth interviews (n=28) were conducted in English in May and June 2022 to investigate different aspects affecting menstruation throughout a woman's lifetime. These aspects included healthcare and COVID-19, policy and education, body image, communication and marketing, generational experiences, and cultural constructs.

Results: Most participants reported receiving limited preparation for menarche, menstruation, and menopause. Education typically came from the participants' mothers rather than school, which can be attributed to the culture and religion ingrained within Italian society. Menstrual health is still seen as taboo by older generations, however, discussion over these topics with friends and family is becoming more common among younger generations. Menstrual health management varies by type of doctor, frequency of visits, use of birth control, and pain management methods. Lastly, the data showed increased personal hygiene while menstruating to promote cleanliness.

Conclusion: Results indicated Italian women's experiences surrounding menarche, menstruation, and menopause, including preparation, education, openness, and discussion. Findings revealed the changing perceptions and generational differences within Italian culture regarding menstruation. This will allow educators, healthcare providers, and families to better understand what education is being provided and where more is needed.



Key Words: Italy, Menarche, Menopause, Generational



Mentor(s):

Andrea DeMaria, Purdue University

**Poster Presentation Abstract Number: 142** :: Life Sciences

# Northern Red Oak Survivorship Assessment

Author(s):

Leah Griffin, College of Agriculture

Abstract:

Throughout the decades, climate change has negatively affected eastern U.S. forests through assisted migration, increased pest devastation, and more frequent and intense weather events. Understanding how trees, such as northern red oak (Quercus rubra), have survived is critical. The purpose of this study was to understand the survivorship of Quercus rubra. Using data from a 1964 northern red oak provenance study located in Purdue University's Martell Forest with 32 seed sources across its natural range, we evaluated the survivability by comparing the data from 1964, 2004, and 2022 and performed an ANOVA test to determine the relationship between seed source and survivability. We found that between 1964 and 2004, only 4 of 32 seed sources had a significant negative change in survivorship (p<0.01). From 2004 to 2022, 27 of 32 seed sources had a significant negative change in survivorship (p<0.01). From 1964 to 2022, 30 of 32 seed sources had a significant decrease in their survivability (p<0.01). From 2004 to 2022, there is a sharp increase in tree mortality, which is a cause for concern considering mortality rates from 1964 to 2004 were so low. It is possible that natural disturbances such as drought seasons during this time period greatly affected mortality. The increase in mortality within the last 20 years implies that many seed sources were unable to adapt to rapidly changing conditions of this portion of the natural range as a result of climate change and its accompanying environmental pressures.

Mentor(s):

Rebekah Shupe, Purdue University

**Poster Presentation Abstract Number: 143** :: Innovative Technology/Entrepreneurship/Design

**Establishing Renewable Energy in Tippecanoe County, Indiana**

Author(s):

James Grimm, School of Management, Honors College

Abstract:

For decades, scientists have been warning humanity about the substantial use of fossil fuels to power our day-to-day lives as it is causing significant changes in our planet's climate. A solution that has been presented to stop increasing carbon emissions is to transition our electric grid to sources of renewable energy such as wind turbines and solar panels. According to WINDExchange, the state of Indiana gets 59.06% of its electricity from coal and another 30.22% from natural gas. This project aims to use ArcGIS to identify land within Tippecanoe County, Indiana that would be suitable to construct sources of renewable energy. Major factors such as average wind speed, elevation, infrastructure, and zoning regulations will be considered to present acceptable areas. Transitioning Tippecanoe County to more sustainable practices, it will ultimately make the state a better contributor to making the world a greener society.

Mentor(s):

Katie Jarriel, Purdue University

**Poster Presentation Abstract Number: 144** :: Innovative Technology/Entrepreneurship/Design

# Triboelectric Nanosensors for Health Monitoring


Author(s):

Meghan Gron, College of Engineering

Conor McCarthy, College of Engineering

Saichandana Pothireddy, College of Engineering

Blake Iftiger, College of Engineering

Mihika Saxena, College of Engineering

Hongyi Shen, College of Engineering

Adit Shah, College of Engineering



Abstract:

Triboelectric nanogenerators (TENG) offer an environmentally-friendly approach for the development of self-powered wearable sensors. TENG devices convert mechanical energy into electrical energy through the transfer of surface charges [1]. TENG devices can help reduce the reliance on traditional batteries as the key power source for such devices. TENG can assist batteries in harvesting wasted mechanical energy. Additionally, TENG can help recharge batteries without charging stations. Batteries use toxic, non-renewable materials, such as lithium. Lithium extraction harms soil and causes air contamination [2]. TENG devices consist of two dielectric layers that interact with each other. These materials are capable of producing electricity through electron transfer between each other, making them electron donors or acceptors. There are several different material classes of dielectric layers, such as MXenes, 2D materials and biomaterials. Our main focus is on bio-materials for TENG dielectric layers. Bio-materials can be used to make dielectric layers that are biocompatible, flexible, and recyclable. Biomaterials offer the benefit of biocompatibility, which allows us to make sensors that can be applicable to wearable devices. The flexibility of biomaterials makes for a more robust and versatile TENG device. The device can be put on any surface without affecting the mechanical properties of the biomaterials. Lastly, we can make waste more useful with the recyclability of biomaterials for TENG. These properties allow us to produce versatile sensors that can be used in a wide range of applications.



Mentor(s):

Nachiket Vatkar, Purdue University

**Poster Presentation Abstract Number: 145** :: Life Sciences

## Detection of Sub-Patent Plasmodium falciparum Infections in PfSPZ Vaccine Recipients and the Impact on Vaccine Efficacy

Author(s):

Mahesh Gupta, College of Science, Honors College

Abstract:

Malaria is most commonly caused by the parasite Plasmodium falciparum (Pf), transmitted by female anopheles mosquitos. Malaria in pregnancy causes maternal, perinatal, and infant mortality. The PfSPZ Vaccine (Sanaria, Inc) is composed of sterile cryopreserved irradiated Pf sporozoites. LMIV/NIAID and Mali partners have conducted multiple double-blind, randomized, placebo-controlled trials of PfSPZ Vaccine and observed significant protections against P. falciparum infection and clinical malaria.

PfSPZ Vaccine efficacy against natural infection in endemic regions appears lower compared to that of malaria-naïve vaccinees against controlled human malaria infections. We hypothesize that individuals with concurrent or recent parasite infections will have a poorer immune response, thereby leading to a less effective vaccine response. Using a highly sensitive and standardized quantitative PCR assay, we measured the rates of Pf infection at baseline (~14 days prior to receiving the first dose of the vaccine). Kaplan-Meier curves were analyzed to determine a correlation between parasite positivity at baseline and vaccine outcomes (protected or unprotected) in the malaria season after vaccination. There was a significant difference in vaccine efficacy for baseline qPCR- individuals, but no significant difference in efficacy among baseline qPCR+ individuals.

Mentor(s):

Patrick Duffy, National Institutes of Health

Jill Neal, National Institutes of Health

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

## Weaving Warfare

Author(s):

Emma Hall, College of Liberal Arts

Abstract:

This project, using the medium of crochet, aims to answer the questions: Is there any connection between presidential political party, military involvement, and time? If so, what is the connection? These questions will be answered through research into the political party of each president and the amount of US military involvement during his presidency which will be translated into a crocheted blanket through a color-coded pattern, along with a short paper breaking down the blanket's code and findings. This project will provide important insight into the effects that a president's political party can have on the level of US military involvement and how US military involvement has changed over time. The conclusions that can be drawn from the data represented in this project will allow those who see it to better understand the various factors that contribute to US military involvement, and therefore better understand US international policy as a whole. The results of the project, much like history as a whole, are highly subjective, and each viewer might have a different take away from viewing the blanket. Though, with this in mind, it appears that there is no clear connection between the politics of a president and the level of involvement in warfare in the US, bringing into question whether the US national identity itself is entangled in warfare.

Mentor(s):

Kathryn Brownell, Purdue University

**Poster Presentation Abstract Number: 147** :: Life Sciences

## Synthesis of Laminar Biofluid 4D Flow MRI Database


Author(s):

Moses Hamm, College of Engineering



Abstract:

Three-directional phase-contrast MRI flow imaging (4D flow MRI) allows for in vivo measurements of fluid flow to aid investigation of cardiovascular and cerebroventricular pathologies. Recently, deep learning (DL) models have become popular tools to combat the errors of 4D flow MRI caused by its low resolution and signal-to-noise ratio. The purpose of this project is to synthesize a publicly available, diverse dataset of paired high-resolution ground truth flow cases and corresponding low-resolution, noisy 4D flow MRI measurements. This data would enable pre-training and benchmark validation of DL models. High-resolution ground truth data is generated with computational fluid dynamics (CFD) simulations based on medical images and generalized anatomical geometries. This ground-truth data is used to generate synthetic 4D flow MR data that is spatiotemporally downsampled and injected with Gaussian noise. The obtained complex MRI signal is then converted back to a velocity field to be used as low-resolution data. The resulting data will contain 300 CFD simulations in over 100 unique geometries. Laminar flows in geometries representative of peripheral vasculature, cerebroventricular system, aneurysms, atherosclerotic arteries, and fibromuscular dysplasia will be included. To the best of our knowledge, a dataset of this size and diversity has not been generated to this point. By making such data public, we aim to accelerate DL model development in the field of biomedical flow imaging and promote standardized comparison between models.



Mentor(s):

Vitaliy Rayz, Purdue University

**Poster Presentation Abstract Number: 148** :: Life Sciences

## The Role of Nuclear EGFR in Cancer Diseases

Author(s):

Nina Hawkins, College of Pharmacy

Abstract:

The expression of epidermal growth factor receptor (EGFR) has clinical utility in oncology to predict the efficacy of chemotherapies. In fact, treatment of difficult lung cancers targets EGFR to block its role in promoting cell survival and proliferation. Drug resistant tumors emerge from mutations in EGFR that restore function and prohibit drug binding. However, a clear association of EGFR function to DNA repair pathways remains poorly defined. A recurring set of observations in a variety of tumor cell models observe EGFR translocation from the plasma membrane to the cell nucleus. These studies show an increase in the nuclear form of EGFR (nEGFR) after irradiation or repeated drug treatments. This project aims to investigate the necessity of nEGFR for the survival of tumor cells. The approach uses a new generation of drug-peptoid conjugate molecule that will act as an irreversible inhibitor to only the nuclear localized nEGFR receptors. These molecules were modeled in the inhibitor binding site using knowledge of previously approved EGFR inhibitors. Additionally, previous work of the laboratory has shown success in conjugating drug molecules with polycationic amide and NLS sequences to allow subcellular compartmentalization. A fluorescent reporter feature will be added to this linker to enable optical tracking of the molecule in vitro and in vivo. After synthesis, the inhibition activity can be evaluated using kinase assays and breast cancer tumor cell models. These new probe molecules will open new avenues for understanding and targeting noncanonical pathways associated with EGFR dependent tumors.

Mentor(s):

Jo Davisson, Purdue University

Vallabh Suresh, Purdue University

**Poster Presentation Abstract Number: 149** :: Innovative Technology/Entrepreneurship/Design

**Integrating Global Navigation Satellite Systems (GNSS) for Precision Forestry**


Author(s):

Max Hess, College of Engineering

Audrey Ward, Temporary



Abstract:

Locating individual trees spatially is a critical component of efficient forest management. However, conventional forest inventorying procedures provide limited to no information on the location of individual trees. Using Global Positioning System (GPS) units within a forest requires multiple expensive base stations outside the forest perimeter while resulting in limited accuracy due to interference from the tree canopy. Survey techniques for mapping and storing individual tree positions need to be both robust and cost-efficient. In this study, we use multiple Global Navigation Satellite System (GNSS) equipment models to obtain clusters of GPS coordinates on the perimeters of forest plots. These coordinate measurements will be used to compare the precision and accuracy of the GNSS units and understand the effects of survey equipment placement relative to the trees. This study will contribute to the development of cost-effective location-tagged tree inventory systems by determining the optimal distance from the perimeter of a forest plot for GNSS measurements, choosing the best survey equipment to be used, and demonstrating a method for the placement of benchmarks.



Keywords: Global Navigation Satellite System (GNSS), Global Positioning System, Precision forestry, Cost-efficient, Tree inventory systems.



Mentor(s):

Guofan Shao, Purdue University

Aishwarya Chandrasekaran, Purdue University

**Poster Presentation Abstract Number: 150** :: Life Sciences

# 5-Aza-dC-Mediated Crosslinking Improves Specific Identification of DNA Methyltransferase 3a Catalytic Sites

Author(s):

Ben Holland, College of Agriculture, Honors College

Abstract:

DNA methyltransferases (DNMTs) are enzymes that perform the epigenetic modification of DNA methylation to establish genomic DNA methylation patterns; DNMT3s are responsible for de novo methylation. Determining where DNMT3a and DNMT3b bind on a target DNA strand is critical to better understanding disease and developmental processes. Chromatin immunoprecipitation (ChIP) is a method used to investigate specific DNA-protein interactions like these. ChIP-sequencing (ChIP-Seq) adds the step of Next Generation Sequencing (NGS) to determine the specific DNA sequence where the crosslinked protein binds. The current ChIP method uses formaldehyde to crosslink DNMT3a with DNA. The problem is that noisy, low-resolution NGS data is created. The Gowher Lab is developing and refining a novel ChIP method for DNMTs in which cytosine nucleotide analog, 5-aza-2'-deoxycytidine (5-aza-dC) is incorporated into cultures of mouse embryonic stem cell (mESC) E14 with overexpressed Flag-tag DNMT3a. This optimizes DNMT3a-DNA crosslinking, producing less noisy, higher resolution, higher quality DNA sequence data. The data obtained up to this point emphasizes the improvement of data quality from the novel ChIP +Aza method. Complex bioinformatics analysis of the NGS results must still be performed to determine the specific DNMT3a binding site.

Mentor(s):

Humaira Gowher, Purdue University

**Poster Presentation Abstract Number: 151** :: Life Sciences

## Genotypically Sexing X. laevis for Use in Toxicokinetics Analysis

Author(s):

Sophia Horn, College of Science

Abstract:

The purpose of this project was 1) to genetically determine the sex of larval Xenupus laevis involved in a perfluorooctanoic acid (PFOA) toxicokinetic reference value study and 2) to evaluate the covariability of sex and PFOA exposure regarding depuration and larval growth and development.

X. laevis larvae (n=576) underwent aquatic exposure based on a standardized amphibian metamorphosis assay protocol. DNA was extracted using Qiagen DNA extraction kits from tail and toe tissue collected upon euthanasia of larvae. Polymerase chain reactions were performed on extracted larval DNA with RNA primers designed using two genes linked to X. laevis sex chromosomes: the DMRT1 gene expressed in both ZW (female) and ZZ (male) gonads, and a sex-determining W-linked DM-domain gene DM-W. Using gel electrophoresis, we identified the presence of the DMRT1 gene and the indicator DM-W gene whose exclusive presence in females thereby determined the sex result upon detection. Covariability of sex and PFAS effects will be determined using ANOVA and mixed model statistical analysis. We hypothesize that there will be a difference in depuration as well as larval growth between sexes, with males expected to be more affected than females based on existing research regarding sex-specific PFOA effects.

Mentor(s):

Meredith Scherer, Purdue University

**Poster Presentation Abstract Number: 152** :: Mathematical/Computation Sciences

**DiffBOM: Do SBOMs Accurately Reflect File System Status of IoT Devices?**

Author(s):

Zhirui Hou, College of Engineering

Abstract:

Modern IoT devices running embedded Linux often include various software packages providing key functionalities. However, it has been repeatedly shown that by compromising these software packages, attackers can take control of the whole device. A powerful tool against such software supply chain attack is a software bill of material, or SBOM. An accurate SBOM can help users quickly identify and mitigate potentially compromised software package in an IoT device. But whether SBOMs accurately reflects the content of file systems of IoT devices is largely unknown, hindering our ability to defend against such attaks with SBOMs. The goal of this paper is to determine SBOM coverage, defined as the percentage of files in a file system claimed by an SBOM in common IoT devices running embedded Linux, to show the accuracy of SBOMs. We develop DiffBOM, a tool that automatically collects package manager information as the SBOM for the device, compares the information against the file system, and outputs metrics about the coverage.

Using this tool, we collected and analyzed select embedded Linux firmware. We found consistently low or even decreasing SBOM coverage across multiple versions of target firmware, especially on regular files. This suggests worrying software package management practice in development of IoT devices.

Mentor(s):

Santiago Torres Arias, Purdue University

**Poster Presentation Abstract Number: 153** :: Mathematical/Computation Sciences

## RISCV DV


Author(s):

Yi-Fang Hsiung, College of Engineering

Troy Wu, College of Engineering



Abstract:

ASIC chips are highly complicated therefore the chance of having a flaw in the chip design is very high. Ensuring the ASIC is bug-free in the pre-silicon stage is extremely important as any undetected error in the post-silicon stage, after manufacturing, may cause undesirable behavior and would be very costly to fix.

The project's end goal is to implement a UVM-based verification platform for an in-house RSIC-V core (processor). The Universal Verification Methodology (UVM) is a standardized methodology for verifying integrated circuit designs in the pre-silicon stage. Our approach will be utilizing existing open-source projects (RISCV DV) and incorporating custom UVM components to accommodate cutomize designs such as specific interfaces and extension assembly instruction sets. With UVM implemented, the total number of man-hours dedicated to verification may not decrease, but verification quality will be dramatically improved, and the verification process will become far more transparent and predictable.

The project will provide the verification team with a reusable and extendable testing platform to support current and future RISC-V process design. A great verification workflow and coverage can provide valuable and critical feedback to the digital design team. And increase confidence as an entire team in yielding a successful tape-out.



Mentor(s):

Sarang Pramod, Purdue University

**Poster Presentation Abstract Number: 154** :: Mathematical/Computation Sciences

## SoC verification: SPI and I2C interfaces

Author(s):

Guillaume Hu, College of Engineering

Chun Yi Liu, College of Engineering

Abstract:

The goal of the SoCET (System-on-Chip Extension Technologies) verification team is to develop an industry standard framework for verifying RTL (Register Transfer Level) designs, also known as UVM (Universal Verification Methodology). Unlike software, hardware design bugs are irreversible once the chip is fabricated. The role of verification in the development process of a new design is to ensure that such design flows are detected before the chip is sent to the fab. UVM provides a standardized and reusable method for verifying RTL blocks, leading to a more cost-effective process while ensuring the same, if not higher, quality of verification for catching bugs.

SPI (Serial Peripheral Interface) and I2C (Inter-Integrated Circuit) are both peripheral interfaces of the current SoC (System-on-Chip) being developed by SoCET. SPI is a short-distance full-duplex communication protocol commonly used for data transmission between a microcontroller and small peripherals such as SD cards or sensors. I2C is also a well-known serial communication protocol that is commonly used in the SoC. It is a two-wire transmission protocol that supports multiple masters and multiple secondary devices. Both interfaces are connected to the CPU by an APB (Advanced Peripheral Bus) bridge. Our verification testbench's structure includes two parts: an APB agent and a peripheral specific (SPI or I2C) agent. The testbench will utilize SystemVerilog's constrained random stimuli functionality and UVM to complete an extensive verification process of all RTL design blocks involved. This approach using UVM leads to a more complete and flexible verification process for ever-growing, more complex designs.

Mentor(s):

Sarang Pramod, Purdue University

**Poster Presentation Abstract Number: 155** :: Innovative Technology/Entrepreneurship/Design

**Slip Ring Implementation on Robot with Rotatory Gimbal**


Author(s):

Rongbo Hu, College of Engineering, College of Liberal Arts



Abstract:

RoboMaster is a robotic competition where teams build various robots to launch projectiles to hit against the opponent's robot armor plates, with pressure sensors embedded to detect incoming damage. Under this fundamental rule, teams have developed a strategy in which the robots spin their chassis to elude damages from enemy robots. While spinning, a two-axis gimbal can still be simultaneously manipulated to target enemies and to launch projectiles against opponent robots. However, with the traditional wire connecting method, wires will twine up around the gimbal and eventually break after several rotations by the yaw axis. In this work, we implemented a slip ring device to allow the transmission of power and the electrical signal from the rotating chassis to the stationary gimbal. Moreover, due to the limited channels on the slip ring, the amount of signal wire is significantly reduced by the conversion of communication protocols. Before applying slip ring, we used UART serial communication which needs four channels in one motor, that is, sixteen channels in total. After applying the CAN bus and slip ring, the number of channels is reduced to two. Motors, encoders, and sensor communication are redesigned into CAN and formed a bus to receive and transmit data from and to the central controller. More than ten channels have been saved with this approach and the implementation of slip ring has been successfully tested on the robots. This design can be adopted to upgrade machines which includes rotation devices.



Mentor(s):

Abolfazl Hashemi, Purdue University

**Poster Presentation Abstract Number: 156** :: Innovative Technology/Entrepreneurship/Design

## Plant Identification

Author(s):

Joseph Huang, College of Engineering

Neil Brown, College of Engineering

Julia Eifert, College of Engineering

Andrew Hufford, College of Engineering

Bruna Jasinowodolinski, College of Science

Raveena Manivannan, College of Engineering

Kaleb Lee, College of Engineering

Tanishaa Shah, College of Engineering

Aditya Sinha, College of Engineering

Abstract:

The purpose of this project is to create an app that is able to recognize different types of plants. Our team created an Android app that prompts the user to take a picture of a plant. After the image is taken, it is sent to a server where the image is processed on our algorithm and the type of plant is sent back to the app to be displayed to the user. We have two sub-team working on this project: the algorithm team and app team.

The algorithm team is developing the process that will identify the uploaded flower images. The algorithm is composed of preprocessing, segmentation, and feature identification. We intend to achieve preprocessing and segmentation with techniques including blurring, greyscaling, edge enhancement, and thresholding. We will subsequently implement feature identification via a convolutional neural network to produce the flower's name as the final result. To begin, we have constructed an image library of three species of flowers to train and test our algorithm.

The app team is working on building the user interface of the application. The application has a camera function built in which allows the user to take an image of the plant in the app. The image is then uploaded to a server using volley. The server uses php to look for requests to process images. Once the server finds the request, it runs the algorithm on the uploaded image and sends the result of the algorithm back to the app.

Mentor(s):

Edward Delp, Purdue University

**Poster Presentation Abstract Number: 157** :: Social Sciences/Humanities/Education

## Exploring the role of salon professionals in identifying sex trafficking victims in Indiana

Author(s):

Alexandra Hughes, College of Science

Meagan DeMark, College of Health & Human Sciences

Ashley Bolen, College of Health & Human Sciences

Kayra Ucpinar, College of Science

Abstract:

Background: Salons may offer opportunities for violence intervention as they are often used by those conducting sex trafficking in the US for “grooming phases” such as waxing and styling. Some states have administered laws requiring salon professionals to receive domestic violence-related training; however, no state, to date, requires training on identifying sex trafficking. During the pandemic shutdown, some salon professionals sought virtual continuing education opportunities.

Objective: The primary purpose of this study was to understand how salon professionals have witnessed sex trafficking in the workplace. A secondary purpose was to understand what a successful training program may entail.

Methods: In-depth interviews were conducted with salon professionals (n = 10) and law enforcement professionals/policymakers (n = 5) from October 2021 – February 2022. Content and thematic analysis techniques were used for data analysis in July 2022.

Results: Some individuals who experienced domestic violence or human trafficking exhibited signs of their experiences in salons. Few salon professionals were trained to identify and intervene. Often, professionals responded to suspected violence by talking with the client, sharing concerns with salon leadership, directly intervening on the client’s behalf, or contacting the police. Law enforcement and salon professionals had many suggestions about how to improve salon professionals’ recognition of and response to violence, including training on victim-focused resources, creating a safe environment, and building relationships with law enforcement.

Conclusions: Salon professionals, especially one-on-one services by estheticians, may provide a unique opportunity to intervene and identify victims of sex trafficking, especially when empowered through additional training and collaborative partnerships with community-oriented policing initiates.

Mentor(s):

Andrea DeMaria, Purdue University

Kathryn Seigfried-Spellar, Purdue University

**Poster Presentation Abstract Number: 158** :: Social Sciences/Humanities/Education

## Examining the Examiner: An Amicus Brief on Conflicts between Forensic Technology and Indigenous Religious Freedoms Conflict in Favor of Virtual Autopsies


Author(s):

Peyton James, College of Liberal Arts



Abstract:

This project presents a hypothetical amicus brief to the US court system about handling conflicts between American Indian Religious Freedom Act and medical forensics. Based on research conducted for a creative project in a cultural anthropology course on Technology and Culture, this brief offers an evidence-based solution supporting virtual autopsies. This brief focuses on the case of Mushkooub Aubid, a member and spiritual leader of the Mille Lacs Band of Ojibwe, whose death in a single-vehicle car accident in 2015 became the center of controversy when legal authorities insisted on a medical autopsy against the traditions of Aubid's tribe. Due to Aubid's history of cardiac issues, his family concluded that he experienced a medical event while driving. While the state patrol did not request an autopsy, the local Minnesota medical examiner insisted on one, against Aubid's religious traditions. The primary concern of this brief is how forensic investigations are often handled in ways that infringe on Indigenous people's rights to religious freedom. I argue that virtual autopsies are a viable option, given the current technology available in some hospitals. Virtual autopsies avoid the need to dissect the decedent without infringing on broad-reaching religious traditions, including time-sensitive practices related to death and burial.



Mentor(s):

Risa Cromer, Purdue University

**Poster Presentation Abstract Number: 159** :: Life Sciences

## Examining antitumor efficacy of small molecule C3, a mimic of the glycoprotein pigment epithelium-derived factor laminin receptor interaction

Author(s):

Lucas Johnson, College of Engineering

Abstract:

Laminin receptor, 67 LR, and its precursor, 37 LR (collectively LR), are upregulated in various tumor types where LR is thought to aid in proliferation, metastasis, and reduced survival, including prostate cancer. LR has been shown to interact with the glycoprotein pigment epithelium-derived factor (PEDF), an anti-angiogenic factor, and this interaction is promising in reducing tumor growth. However, current delivery of PEDF in recombinant form involve peptide formulation or gene delivery which are expensive, unscalable, and complicated. Thus, a small molecule that could mimic the function of PEDF and interacts with LR to promote anti-tumorigenic and anti-angiogenic phenotypes could be of high interest and potential for cancer therapy. In our previous in silico work, a novel small-molecule, C3, showed promise as a candidate PEDF mimic. In vitro studies were conducted to analyze the efficacy of C3 through the criteria of anti-viability, anti-wound healing, anti-cancer signaling properties, and activation of PEDF signaling-related genes. In the present project, we have begun to validate the efficacy of C3 in vivo against prostate tumor growth using a syngeneic model of immune competent C57BL/6 male mice. Mice were implanted with TRAMP-C2Ras (TC2R) prostate cancer cells subcutaneously and C3 efficacy was assessed by reduction in tumor size relative to the vehicle control group (2.5% DMSO) delivered intraperitoneally at two doses, 5 and 10 mg/kg. The overall health of mice was continuously monitored through qualitative observations as well as quantitative measurements such as weight as a function of time. RNA sequencing, histological evaluations, and pharmacokinetic studies are planned in the future to measure the transcriptional changes and types of infiltrating immune cells, phenotypic changes, and drug metabolism relative to control groups.

Mentor(s):

Marxa Figueiredo, Purdue University

**Poster Presentation Abstract Number: 160** :: Life Sciences

## Population Diversity and Density Framework: DNA Barcoding of Indiana Predators


Author(s):

Megan Johnson, College of Science, College of Liberal Arts



Abstract:

Predators play a crucial role in maintaining a healthy ecosystem. Sitting on top of the food chain, predators keep prey population under control, thus initiating a cascade effect for maintaining biodiversity in an ecosystem. In Indiana, reported predators include coyotes, bobcats, and gray and red foxes. The data on the exact estimate of these predators' population in Indiana is lacking. This project was proposed to supply valuable information regarding predator diversity and population density. Predator species were identified using a DNA barcoding approach. DNA was first extracted from noninvasive samples of scat and hair of predators in Indiana using the QIAamp Fast DNA Stool Mini Kit. PCR was then performed using primers HCarn200 and CanidL1 and Taq 5X Master Mix. PCR products were purified using Zymo Genomic DNA Clean and Concentrator kit and samples were then sequenced by Genewiz. Finally, individuals were identified using a SNP based assay and the genotypes of each sample were used for calculating population genetic statistics, such as allele frequency, heterozygosity, and FST, which are indicators of population genetic health. The new knowledge generated through this study will be used in a broader modeling framework to estimate predator density and predator home ranges.



Mentor(s):

Safia Janjua, Purdue University

**Poster Presentation Abstract Number: 161** :: Life Sciences

## Nuclear power

Author(s):

Saniya Kamuni, Exploratory Studies

Abstract:

Nuclear power has always been on the list of prospective "alternative sources" with low carbon emissions. But over the years, it has consistently served as the focal point for debates. It is more contentious than other forms of energy due to the alleged hazards attached to it. Public opinion addressing this issue decides the future of nuclear energy.

Nuclear energy's "fear" stems from the three nuclear disasters—Chernobyl, Fukushima, and Three Mile Island. Studies demonstrate that following these tragic incidents, the public's perception of nuclear energy began to shift substantially. Radioactive waste, operational safety, and proliferation risks are all topics of constant discussion.

The International Atomic Energy Agency (IAEA) was established to promote the peaceful use of nuclear energy. It prioritizes safety above all else. It has 175 member countries. It holds public webinars to solicit their feedback. Over the course of the year, it has addressed numerous concerns about the safety of nuclear energy.

The majority of worries about nuclear energy have already been addressed. Contrary to what was reported in the news, the Fukushima tragedy had a far less impact. This misled the public and instilled fear in them. Nuclear power has no discernible impact on weapon proliferation. The debate over nuclear waste is unnecessary. Many "safe" methods of disposing of radioactive waste have been developed. Nuclear energy has the potential to bring about revolutionary changes and significantly change the fate of energy if the public is willing to accept it and put these "fears" to rest.

Mentor(s):

Dr. Fiona Wang, Purdue University

**Poster Presentation Abstract Number: 162** :: Physical Sciences

## Exploring the Application of Machine Learning to the Analysis and Classification of Dark Matter Data

Author(s):

Grace Katz, College of Science

Srihitha Kurapati, College of Science

Abstract:

The goal of this research is to assess data from the particle detector XENONnT and improve the ability to distinguish between interactions with potential dark matter candidates and background. Electron Recoils (ER) and Nuclear Recoils (NR) are the two main types of interactions the detector is sensitive to, so being able to distinguish between them is necessary to perform accurate evaluations of results. Scientists looking for dark matter are interested in studying NRs as they are indicative of a weakly interacting massive particle (WIMP), one of the current theories for the size and state of dark matter. When either ERs or NRs occur, photons are produced and are registered by photomultiplier tubes (PMTs) at either end of the detector within hundreds of nanoseconds. After this initial signal, electrons produced from the same interaction rise to the top of the detector and are also registered. These two signals are referred to as scintillation signals, S1 and S2 respectively. The current method of defining interactions as ERs or NRs is to compare the ratio of the two peak areas, but we hope to improve this. The purpose of the research currently being conducted is to design a new method of better analyzing this data through the use of an artificial intelligence structure, Dense Neural Networks. By introducing multiple parameters on top of the S1 and S2 measurements it may be possible to determine the potential improvement in efficiency of classifying dark matter data.

Mentor(s):

Rafael Lang, Purdue University

**Poster Presentation Abstract Number: 163** :: Physical Sciences

## Optimization of G-Code For Maximizing Interlayer Bonding

Author(s):

Ethan Kessel, College of Engineering

Abstract:

This study demonstrates a method of adapting G-Code files for additive manufacturing to maximize interlayer bonding. The mechanical strength of the bond between subsequent layers is a key process parameter in additive manufacturing and is driven by the crystallinity of the substrate layer when a new layer of molten material is deposited on it. Unmodified G-Code files do not take layer bonding into consideration, resulting in variable crystallinity and therefore inconsistent layer bonding throughout the part. The temperature of a substrate layer is a good predictor of its crystallinity, therefore targeting a constant substrate temperature for each layer during the additive manufacturing process provides a simple means of achieving consistent layer bonding. This was achieved using a lightweight one-dimensional heat transfer model of the temperature in a vertical wall. Using an unmodified G-Code file as an input, the model extracts parameters for the heat transfer simulation, finds the necessary layer times to achieve a desired constant substrate temperature, then propagates the updated layer times into the modified G-Code by varying the printing travel rate. The modified G-Code files were validated in a high-fidelity 3D simulation of the additive manufacturing process. This demonstrated that the updated G-Code produced a substantially more consistent crystallinity profile and was robust to steady-state error in the predicted substrate temperature. This method permits the rapid optimization of existing G-Code files to achieve superior part strength without requiring time-intensive simulations, thus enabling the production of higher-quality additively-manufactured parts with reduced time and effort.

Mentor(s):

Eduardo Barocio, Purdue University

**Poster Presentation Abstract Number: 164** :: Mathematical/Computation Sciences

## Improving Consistency of Vision Transformers


Author(s):

Paing Khant, College of Engineering

Junpei Ota, College of Engineering

Jaya Hari, College of Engineering

Akshata Manjunatha, College of Engineering

Akash Kumar, College of Engineering

William Jiang, College of Science

Stephen Iwu, College of Engineering

Yunfeng Jia, College of Engineering

Qingwei LI, College of Engineering



Abstract:

Object detection is a key technology for many modern computer vision applications. For applications that require strict performance to guarantee the safety of people, such as in autonomous vehicles, it is critical that object detectors are not only accurate but also provide consistent performance. An object detector can make different predictions on two similar images because of small image distortions, such as lighting changes or camera sensor noise. This problem is called inconsistency. Consistency is defined as a metric of how well an object detector detects the same objects in similar images. The research community has put much focus on improving accuracy and efficiency, but not much has been studied of consistency of object detectors. In our work, we explore the consistency of vision transformers and methods to make transformers more robust against natural image distortions.



Mentor(s):

Yung-Hsiang Lu, Purdue University

**Poster Presentation Abstract Number: 165** :: Innovative Technology/Entrepreneurship/Design

## Investigation of Human Preference with Customizable Robot Facial Interface

Author(s):

Soomin Kim, Polytechnic Institute

Abstract:

This study is to investigate the relationship between human choices made for robots' facial modules that they would like to communicate without explanation for the study and their characteristics such as gender, race, and appearance. Rather than having the developer decide on the face of the robot, we wonder what it would be like to have the people who use the robot create the face of the robot. Given a situation where participants are charged with designing a robot's facial module to interact, they select facial components among items, including eyes and nose. We hypothesize that each person would make unique decisions, which would be associated with aspects of aforementioned human characteristics. To prove the hypotheses, we build an Android application to utilize the mobile interface as a facial module and to collect responses from participants to conduct the experiment. After customizing the robot's facial module in their preferred manner, participants fill out a survey and questionnaires for quantitative analysis. The survey asks questions about the robot they have created, and there are questions about the characteristics of the participants.

Mentor(s):

Byung-Cheol Min, Purdue University

**Poster Presentation Abstract Number: 166** :: Innovative Technology/Entrepreneurship/Design

## Investigation on Active Aerodynamic Devices using Image Processing

Author(s):

Erik Kocinare, College of Engineering

Abhishek Kini, College of Engineering

Austin Adkins, College of Engineering

Caden Kuang, College of Engineering

Abstract:

The topic of autonomy has penetrated the mainstream and become increasingly more and more prevalent in almost every facet of life. For example, the topic of autonomous vehicles such as cars has had a heavy focus in recent years.Our research is centered around the background of autonomous racing and we will investigate image detection and active aerodynamic devices used to create downforce when navigating turns. Firstly, we looked at the history of these types of devices and if they had made an impact at all. Our next part of our research describes the use of a wing design to increase downforce helping the racer travel turns with ease. We will implement an airfoil with similar purpose as an horizontal stabilizer found in airplanes, which will be to provide negative lift suctioning the vehicle to the ground. The airfoil that we find most relevant will be created on SolidWorks. This wing will be active as it will go up and down depending on its location on the track. Additionally, in order to determine when the wing should go up or not, we will use image processing to check for turns. For research regarding image detection, we will investigate 3 algorithms for processing when a turn is imminent. The algorithms are a sum of squared differences, normalized cross correlation, and correlation coefficient. We will use python to implement these algorithms and sense upcoming obstacles.

Mentor(s):

Shreya Ghosh, Purdue University

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

## Efficacy of the Pedagogical, Cultural, and Advocacy Programming at the Purdue University Asian American and Asian Resource and Cultural Center

Author(s):

Michael Kuczajda, College of Health & Human Sciences, College of Liberal Arts

Abstract:

This article describes and analyzes the efficacy of the pedagogical, cultural, and advocacy programming that the Asian American and Asian Resources Cultural Center (AAARCC) provides. Founded in 2015, the AAARCC carries on the work of past groups and individuals in the goal for pedagogical, cultural, and advocacy programming to help educate everyone on campus. Through survey analysis, archival study, and participant observation, my research

shows that the AAARCC has contributed in meaningful ways in areas of pedagogy as well as areas of history and more current issues. Research was conducted in multiple ways. After the data was collected, the researcher compared the programming to other programs that similar cultural centers are doing in the BIG 10. The results found that the AAARCC had similar programming to other schools in the Midwest, though were lacking in some of the resources provided and that the post-event surveys did not always indicate that individuals were more knowledgeable after the events.

These results are significant because they can allow for better program efficacy in the future as well as reach more students. Efficacy could be improved by increasing the amount of space, such as by providing a larger and more encompassing facility, increasing the number of scholarships and awards, both national and campus-wide and increasing the visibility on campus. These extra resources would not only aid the AAARCC in providing better and more effective support for students, but it would also allow for more community engagement, both on and off campus.

Mentor(s):

Pamela Sari, Purdue University

**Poster Presentation Abstract Number: 168** :: Mathematical/Computation Sciences

## Traffic Sign Detection for Autonomous Vehicles

Author(s):

Anshul Kulkarni, College of Engineering

Suyash Mishra, College of Engineering

Aayush Patel, College of Engineering

Abstract:

Traffic sign detection is a focal point of autonomous driving and any autonomous vehicle must be extremely accurate in detecting traffic signs as someone's life could depend upon the correct recognition of a sign. In today's world, autonomous vehicles are becoming more and more prevalent and current research has shown that autonomous driving reduces accidents that would have been caused by human error. A recent study conducted by Indiana University shows that 93% of accidents were caused by human factors, while only 12%-34% of accidents were caused by environmental factors. The purpose of our research project is to create a program in Python that can identify traffic signs in real time. Specifically, our research will combine a simulation with an object detection system that utilizes a neural network. This research explores which common object detection system works best for real time applications and visualizes it with a python simulation to make results easier to interpret. While our research focuses on traffic sign detection for vehicles, the software could be applied to many different devices such as a scooter or bicycle. The end goal we hope to see is a drastic reduction in the number of car accidents due to human factors, specifically missed traffic signs.

Mentor(s):

Shreya Ghosh, Purdue University

**Poster Presentation Abstract Number: 169** :: Life Sciences

# Vetopoly


Author(s):

Anne Kutemeier, College of Agriculture, Honors College



Abstract:

This is a game which will teach K- 12 graders the importance of owning a pet. It will teach them the hardships of owning pets and many medical issues that pets can have. It will also teach them responsibility and awareness before owning a pet. I will also present some statistics about the animal industry and average costs of common vet visits and surgeries.



Mentor(s):

Rod Allrich, Purdue University

**Poster Presentation Abstract Number: 170** :: Social Sciences/Humanities/Education

## Investigating Elementary Teachers' Use of Mathematics Curriculum Materials

Author(s):

Jueqing Li, College of Education

Abstract:

Investigating Elementary Teachers' Use of Mathematics Curriculum Materials is a collaborative research project across four universities. The primary goal of the project is to explore teachers' use of mathematics curricular materials in the context of the proliferation of online resources and the COVID-19 pandemic, with a focus on curricular coherence, teacher autonomy, and the use of teacher-developed curriculum from sites such as Teachers-Pay-Teachers and Pinterest. We used individual and focus group teacher interviews at several schools representing diverse curricular contexts to explore both the quantitative and qualitative aspects of the teachers' mathematics curricular decision making. Preliminary findings indicate teachers' use of multiple (as many as 14) mathematics curricular resources to provide rigorous and engaging mathematical experiences for their students, including (a) traditional online textbook resources (e.g., Envision); (b) supplementary applications (e.g., BrainPOP); (c) assessment resources (e.g., Edulastic); (d) online lessons created by teachers (e.g., Teachers Pay Teachers); and (e) self-created teacher materials. Results from this study highlight the complex curriculum work enacted by elementary teachers as well as the need for teacher support to assist in the navigation of mathematics curricular resources. In addition, this exploration of mathematics materials used by elementary teachers has the potential to provide valuable insights for curriculum designers in terms of the aspects of the materials which were most helpful and practical, challenges encountered by teachers in using the materials, and possible modifications based on the teacher feedback.

Mentor(s):

Jill Newton, Purdue University

**Poster Presentation Abstract Number: 171** :: Mathematical/Computation Sciences

# Model Based Object Detection Dataset Auto Label Generator

Author(s):

Yichi Liu, College of Science, College of Science

Colin Mcgeary, College of Engineering

Samuel Yang, College of Engineering

Connie Kang, College of Engineering

Abstract:

The recent advance in object detection models has dramatically improved model accuracy and inference time. However, quality labeled data are needed, and the process of labeling large datasets is costly. We developed and deployed a software system to reduce the cost of labeling new datasets. Through a web interface, the user uploads a new unlabeled dataset. An existing YoloV5 model inference on the new dataset, generates bounding boxes and respective confidence levels. The generated labels are then stored in an SQL server. A human user reviews and corrects the generated labels in the web interface. A VGG annotator format JSON file is generated, and images are archived in a publicly accessible web server. The resulting software is user friendly, lightweight, and accessible from anywhere. With an existing model, the software will greatly reduce the human cost of labeling new datasets.

Mentor(s):

Minghao Sun, Purdue University

**Poster Presentation Abstract Number: 172** :: Physical Sciences

## Compact Control System for Superconducting Qubits

Author(s):

Santiago Lopez, College of Science, College of Science, Honors College

Abstract:

Superconducting qubits are one way to implement quantum computers with relatively long coherence times and tunable frequencies allowing for high readout fidelity. Pulse-sending devices are being implemented to control, calibrate, and get information from superconducting qubits by sending fast, precise pulses. However, building these devices for implementing experiments is exceedingly expensive and is mainly affordable to larger corporate groups. This is not the only option as many groups can also build and program their control system, but this is time-consuming and can be hard to maintain or upgrade. Thanks to the development of the Quantum Instrumentation Control Kit (QICK) running these experiments have been made more affordable and accessible for academic labs and smaller companies. In this work, we set up a new control and readout system and developed the software to characterize single qubits with the short-term goals of conducting multi-qubit experiments with flux control. Through the characterization process, we will optimize the readout fidelity and use the QICK system as a robust, feasible device to introduce qubit characterization to beginners in the field. This will help in building the quantum community as well as provide a gateway for academic labs and startups to run their qubit experiments.

Mentor(s):

Alex Ma, Purdue University

**Poster Presentation Abstract Number: 173** :: Social Sciences/Humanities/Education

**The Impact of Indigenous Tourism: Case Study of the Indiana Dunes Indigenous Culture Trail**

Author(s):

Libby Loprete, College of Health & Human Sciences, College of Liberal Arts, Honors College

Abstract:

For the Indiana Dunes Tourism and the Indiana Dunes National Parks, tourism is a strength, and they want to use this to create a strong relationship with the Indigenous members of their community. The goal of the collaboration between the Pokagon Band of Potawatomi, the Miami Tribe of Oklahoma, Indiana Dunes Tourism, and Indiana Dunes National Park is incorporating the Indigenous culture through the addition of the Indigenous Trails which would cover the themes of water, sustainability and adaptation, seasons and cycles, connection, and how nature teaches us. This new addition to the Indiana Dunes would include signage with Indigenous translations for the Miami and the Potawatomi along with a relic to acknowledge the land and the Indigenous history which the land represents. The first objective for this case study is to observe the collaboration between the Indigenous parties and the western parties as the Indigenous perspective leans towards organic while the western perspective is more linear. The second objective is to examine the approach of the integration between the two cultural perspectives and the model created to succeed. The third objective to this case study is to determine the tourism impact and the sustainability impact of the Indigenous Trails. Both a qualitative approach and quantitative approach would provide desired results, for a qualitative approach would yield testimonials from the parties involved- their thoughts and opinions- while the quantitative approach would give numerical insight on tourism and sustainability impact.

Mentor(s):

Jonathon Day, Purdue University

**Poster Presentation Abstract Number: 174** :: Life Sciences

## The Regulation of Neutrophil Motility through miR-190


Author(s):

Madyson M Walker, College of Science



Abstract:

Abstract redacted.



Mentor(s):

Daniel Kim, Purdue University

**Poster Presentation Abstract Number: 175** :: Life Sciences

## Methodology Development for Spherification Utilizing Foodini 3-D Food Printer

Author(s):

Taylor Main, College of Agriculture, College of Agriculture

Abstract:

The utilization of 3-D printing programs and machines has revolutionized the world of technology. From basic printing of small gadgets that can be done from a laptop or tablet to medical devices and artificial organs, the integration of this technology has been seen in almost every aspect of human life except for one: food. A device developed by Natural Machines, Foodini 3-D Food Printer, has brought this technology into the worlds of food science and culinary arts. With this revolutionary device, intricate designs with different materials that would have been almost impossible to perform by hand now can be made in minutes automatically by pressing start. But the issue that arises with new technology such as the Foodini 3-D Food Printer is the lack of methodology to perform tasks. There are basic skills and instructions provided via user manuals, but beyond those few steps, much about the applications of this device are unknown, unexplored, and unbounded. Through research into the Foodini 3-D Food Printer, stepwise methods of performing advanced tasks like the spherification of oil-based liquids and other ingredients can be developed. Spherification is a technique that can create small edible spheres of different sizes, textures, and consistencies, utilizing alginate and calcium chloride with various liquids and flavors. Spherification can be used to create faux caviar and many types of flavored garnishes. Building and perfecting a method for the application of molecular gastronomy with 3-D printing will revolutionize the food and culinary sciences industry and its impact.

Mentor(s):

Senay Simsek, Purdue University

**Poster Presentation Abstract Number: 176** :: Social Sciences/Humanities/Education

## Identifying Underserved Communities Needing Palliative Care in the Greater Lafayette Area

Author(s):

Rachel Mendez, College of Health & Human Sciences, Honors College

Abstract:

Palliative care focuses on the treatment and comfortability of a patient's illness. Symptom relief is a common focus in those who receive palliative care services. As the population of the Greater Lafayette Area is continually aging, palliative care services are bound to be in use. Prior research suggests that socioeconomic challenges and physical transportation limitations are barriers to palliative care use. This project specifically aims to identify hotspots in the Greater Lafayette Area where palliative care services are needed, but not accessible due to the aforementioned barriers. A further look at the CityBus system will provide ample evidence of the importance of public transportation to the socioeconomically disadvantaged. Results are yet to be recorded, as this project is currently being conducted.

Mentor(s):

Katie Jarriel, Purdue University

**Poster Presentation Abstract Number: 177** :: Life Sciences

## Acclimation to novel saline conditions in an invasive treefrog

Author(s):

Addy Messerly, College of Science

Abstract:

Invasive species provide a valuable opportunity to examine physiological responses to novel environmental challenges as they colonize new areas. Salinity is an environmental stressor for anurans, as their highly permeable skin makes them prone to osmotic stress when exposed to saline conditions. However, certain anuran species have colonized areas within close proximity to saltwater habitats, suggesting a potential ability to acclimate or adapt to saline conditions. Here, we evaluated how exposure to saltwater affects salinity tolerance in the Cuban treefrog (Osteopilus septentrionalis), an invasive anuran distributed throughout Florida. Individual adult frogs were maintained in conditions reflecting either a freshwater (0.5 ppt) or brackish (8.0 ppt) environment during six weeks. At two-week intervals, the salinity tolerance of each individual was assessed by quantifying individual weight change, a common proxy for salinity tolerance in amphibians, when submerged in a brackish (8.0 ppt) salt treatment. We found that salt treatment significantly increased the weight change of Cuban treefrogs, which suggests that salinity is an environmental stressor for this species. Yet, different weight changes occurred at different time intervals, indicating that exposure to salinity may induce a plastic response in Cuban treefrogs. To further understand how this species responds to salinity, future studies investigating avoidance behavior towards saline environments will be conducted. As non-native species continue to colonize new areas and expand their newly established ranges, determining how species respond to novel environmental stressors has important implications for our understanding and management of invasive species.

Mentor(s):

Ximena Bernal, Purdue University

**Poster Presentation Abstract Number: 178** :: Life Sciences

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

Author(s):

Sydney Moeller, College of Science, College of Science

Abstract:

Among mosquitoes, host feeding specificity ultimately modulates disease dynamics and has relevant ecological and evolutionary implications. We synthesize current knowledge on the diversity of host-seeking strategies and host interactions in an understudied tribe of mosquitoes, Uranotaeniini (Diptera: Culicidae). To do so, we performed a systematic review and found that interest in this group has grown in the last two decades, with almost 60% (~2900) of studies published since 2000. While this tribe has a cosmopolitan distribution, of the 271 species identified, most are found in the tropics. The hosts of only 24 species (<9%) have been identified and include invertebrates as well as ectothermic and endothermic vertebrates. These species use diverse host-emitted cues to detect and locate their hosts for blood-feeding, including visual, thermal, olfactory, acoustic, and humidity. Several species (e.g., Ur. sapphirina and Ur. apicalis) harbor viruses like West Nile and Eastern Equine Encephalitis, which can potentially be transmitted to non-human and human animals. By integrating key natural history information on Uranotaeniini, we identify fertile gaps for future research. Ultimately, this review provides valuable insights into the feeding strategies used by mosquitoes.

Mentor(s):

Ximena Bernal, Purdue University

**Poster Presentation Abstract Number: 179** :: Life Sciences

## Defining Antiproliferative Mechanisms of Lippia Origanoides on Breast Cancer Subtypes in Vitro

Author(s):

Emily Morales Liddiard, College of Science, Honors College

Abstract:

It is crucial to develop effective therapeutics for the most prevalent cancer worldwide, breast cancer. Within breast cancer subtypes, triple-negative breast cancer (TNBC) lacks estrogen, progesterone, and HER2 receptors; this makes current therapeutics inadequate for proper treatment. Discovering therapeutics and mitigating TNBC aggressiveness and susceptibility to relapse are goals toward increasing positive outcomes against TNBC. Anti-mutagenic, anti-inflammatory, and antiproliferative components of LOE could potentially target exploited pathways seen in TNBC. Thus, we hypothesize antiproliferative actions of LOE on MDA-MB-231 (TNBC), MCF7 (Luminal A), LCTC (TNBC), and BCTC (TNBC) breast cancer cells. Therefore, this study aims to analyze the effects of LOE on cell viability in culture using the RealTime-Glo MT Cell Viability Assay. Preliminary findings show a dose-dependent decrease in the viability of the four cell lines tested. The quantitative data collected from cell viability assays provide evidence that LOE has the potential to be used as a tool to understand exploitative cancer pathways better. Further studies of the effects and mechanisms of LOE may provide valuable insight towards the development of new therapeutic options for TNBC.

Mentor(s):

Ignacio Camarillo, Purdue University

**Poster Presentation Abstract Number: 180** :: Life Sciences

# Can feeding a bifido bacteria that readily digests lactose and galactooligosacharides improve lactose digestion and tolerance through alteration of the microbiome?

Author(s):

Olivia Moreno, College of Science

Abstract:

Lactose maldigestion, the inability to fully digest lactose, is a normal mammalian trait caused by the genetically controlled post-weaning reduction of intestinal lactase. This developmental reduction in activity can result in intolerance symptoms such as flatulence, bloating, stomach discomfort, and fecal urgency after lactose maldigesters consume dairy products. Microbiome adaption of intestinal bacteria is an alternative pathway to digest lactose. The purpose of this study is to determine if the consumption of Bifidobacterium adolescentis IVS-1, a naturally occurring bacteria known to digest lactose and galactooligosaccharides, will improve digestion and tolerance of lactose by altering the gut microbiome. Participants are selected based on a preliminary screening and a 2-3 hour hydrogen breath test (HBT) conducted after ingestion of 8oz. of 2% fat milk. Participants are blindly divided into a control group (cellulose capsule ingestion) and an experimental treatment group (bifidus capsule ingestion). All participants refrain from dairy for the first 28 days and rate symptoms related to lactose intolerance for 43 days. On days 14 and 28, participants consume food-grade lactose (0.5g lactose per kg body weight) dissolved in water before completing an 6-hour HBT. Stool samples are collected 3 times throughout the study. The current study is in progress in the laboratories of professors Savaiano and Cross. Human subject recruitment is underway. We expect that the bifido bacteria will alter the intestinal microbiome. Whether or not it improves lactose digestion may depend on the presence of lactose or a prebiotic such as galactooligosaccharide in the diet.

Mentor(s):

Dennis Savaiano, Nutrition Science

Tracy Eaton, Nutrition Science

**Poster Presentation Abstract Number: 181** :: Innovative Technology/Entrepreneurship/Design

# Investigation of Mechanical Properties of Recycled Fiber-Reinforced Polymer Composites Reinforcing Concrete

Author(s):

Caleb Mull, Polytechnic Institute

FNU Archie, Polytechnic Institute

Harry Lee, College of Engineering, Honors College

Abstract:

The usage of fiber-reinforced polymer composites in various fields has increased significantly due to their advantageous physical and mechanical properties. However, the sustainability of composite parts has not been fully solved for a long time. Most end-of-life (EOL) composite parts have been landfilled without recycling due to the recycling cost and lack of application of recycled composites. Mechanical composite recycling that shred the EOL composite part and reuse it for fabricating the part is one of the most commonly used recycling processes for the EOL composite part. In this research, mechanical composite recycling process was demonstrated for the construction application. The recycled carbon fiber reinforced composite part was mixed with concrete and its mechanical properties were investigated. The size of the recycled composite additives was 25.4 mm x 25.4 mm. The flexural test specimens with different surface treated recycled composite additives and different additive contents were fabricated and tested. The test result showed how additive content and additive surface characteristic affect mechanical properties of the recycled composite reinforced concrete.

Mentor(s):

Garam Kim, Purdue University

**Poster Presentation Abstract Number: 182** :: Social Sciences/Humanities/Education

## Exploring the Interaction of Race and Agreeableness in Helping


Author(s):

Chinelo Nnatubeugo, College of Health & Human Sciences, Honors College



Abstract:

Factors that influence helping behavior have been looked at in the past in order to discover who helps in certain situations. Past research has found that those higher in agreeableness are more likely to help (Habashi et al., 2016) and that individuals are more likely to help those in their ingroup (Sturmer et al., 2006). The purpose of this study is to look at the impact of race and personality on helping. White participants were asked whether they would be willing to help a purported student in need. Participants were asked to either perspective-take with the target or not. They were also led to believe the target was either black or white. Finally, agreeableness was measured. We predict that on average, those high in agreeableness will help more than those low in agreeableness. Helping will be greater on average in the perspective taking condition than in the observer condition. We predict that when the target is the same race as the participant, on average helping will be increased. We predict that when the target is the same race as the participant and they are high on agreeableness, the participant will help the target about the same in either the perspective-taking condition or the observer condition. However, when they are low in agreeableness, the participant will help the same-race target more in the perspective-taking condition than in the observer condition, but less on average compared to high agreeable participants. We predict that when the target is a different race from the participant and high on agreeableness, the participant will help the target about the same in either the perspective taking condition or the observer condition. However, when they are low in agreeableness, the participant will help the dissimilar-race target more in the perspective taking condition than in the observer condition, but less overall compared to high agreeable participants and compared to when the target is the same race as the participant. We predict that there will be no significant differences in helping between high and low agreeable participants in the perspective-taking condition when the target is the same race as the participant. However, we predict a significant difference between high and low agreeable participants in the perspective-taking condition when the target is of a different race than the participant. We are in the initial stages of collecting data.



Mentor(s):

William Graziano, Purdue University

**Poster Presentation Abstract Number: 183** :: Mathematical/Computation Sciences

## Correlation Between Processing Defects and the Behavior of Energetic Materials Under Weak Impact Loads

Author(s):

Chelsea O'Donnell, College of Engineering

Abstract:

Defects inherent to the manufacturing of polymer bonded explosives (PBX) are a leading source of high sensitivity and the low predictability of their response under external stimuli. Under external loads, even the smallest blemish could produce a region of extreme temperatures, destabilizing the material and resulting in an untimely reaction. The widespread use of energetics for both civilian and military applications dictates the urgency for safe and resilient materials that retain their effectiveness. While there is much research identifying processing defects as a source of volatility in PBX, there remains no method to accurately predict the material behavior due to these defects and weak impact loads. A statistical analysis can be employed to characterize the connection between macroscopic evolution and local interactions as well as how the characteristics of these local interactions correlate with material sensitivity and hot spot formation. Our research investigated the impact of the degree of crystal-binder debonding and binder micro-sized voids on the evolution of an unconfined system under dynamic compression. The time-dependent evolution of microstructural features such as interparticle velocities, compressive contact pressures, debonding, binder rupture, and failure-related topological features was explored to determine whether there is a critical crystal-binder debonding size below which these effects are negligible. Such information may be useful in describing the evolution of hot spot probability distributions and PBX sensitivity to improve safety and performance.

Mentor(s):

Marcial Gonzalez, Purdue University

**Poster Presentation Abstract Number: 184** :: Social Sciences/Humanities/Education

## Do experiences of gender discrimination at work decrease career advancement aspirations among working women?

Author(s):

Ronald Or, College of Health & Human Sciences

Abstract:

Women are underrepresented in senior-level professional positions, despite consisting of nearly half of the total U.S. workforce. Past researchers have argued that these disparities are partially explained by gender differences in the extent to which women and men value professional advancement. These scholars show that, compared to men, women have more non-career-related life goals and view professional advancement as less desirable because it conflicts with other life goals. We argue that existing research did not adequately investigate mechanisms underlying this gender difference. The current project examines whether experiences of gender discrimination in the workplace influence women's life goals identification and professional advancement aspirations. We expect that when professional women are asked to recall experiences of discrimination, they will report increased non-career-related life goals and lower career aspirations, compared to those who are asked to describe general professional setbacks. Results supporting these hypotheses will illuminate alternative explanations, like discrimination, for gender differences in values surrounding career advancement.

Mentor(s):

Erin Hennes, University of Missouri

**Poster Presentation Abstract Number: 185** :: Mathematical/Computation Sciences

## Investigating Explainability of ML Model Decisions for Injury Surveillance


Author(s):

Manas Paranjape, College of Science, Honors College

Harmya Bhatt, College of Science



Abstract:

As part of injury surveillance and prevention by the public health agencies, accident narratives collected from workplaces and hospitals are analyzed by assigning diagnostic codes such as Nature of Injury, Body Part Injured, External Cause of Injury, and Major Injury Factor (Product involved). Historically, these codes were manually assigned by human coders after reading the narrative. Recently, machine learning (ML) and natural language processing (NLP) techniques have been used to automatically assign cause of injury codes to these narratives after being trained on manually coded data. However, the explainability of these ML models has not been well-studied. This work-in-progress study aims to use recent advances in Explainable Artificial Intelligence (XAI) to address this gap. Specifically, we aim to identify parts of the narratives that are the most responsible for the ML model decisions. XAI techniques can be used to explain the model behavior for the entire dataset (global explanations) or for individual narratives (local explanations).

We used two datasets— (1) the Occupational Safety and Health Administration (OSHA) dataset for occupational injuries, and (2) data about skateboard and scooter injuries scraped from social media platforms such as Reddit. Explainable feature sets are identified using state-of-the-art XAI methodologies such as LIME (Local Interpretable Model-Agnostic Explanations), SHAP (SHapley Additive exPlanations) and Integrated Gradients. Our initial explanations generated using LIME (local) and SHAP (global and local) indicate parts of the narrative that have the most predictive power. We are in the process of reviewing the explanations to quantify the quality of the generated explanations.



Mentor(s):

Romila Pradhan, Purdue University

**Poster Presentation Abstract Number: 186** :: Innovative Technology/Entrepreneurship/Design

## Engineering challenges in re-implementation of Mesh RCNN in TensorFlow

Author(s):

Abhirakshak Raja, College of Engineering

Seungkeun Lee, College of Engineering

Savreen Kaur, College of Science

Abstract:

Ever since the introduction of the revolutionary model AlexNet, there have been significant progress in the field of deep learning and computer vision. This rapid progress should also be attributed to the improvements made to deep learning frameworks such as Pytorch and TensorFlow. The TensorFlow Model Garden research team focuses on creating open-source TensorFlow re-implementations of state-of-the-art Deep Learning models, specifically those in computer vision. Researchers and developers can then conveniently reuse models from the Model Garden. Mesh R-CNN makes great advances in 3D object shape prediction by building off Mask R-CNN, which is a two-stage object detector for 2D images, to not only detect objects in images but to also output a triangle mesh for its predicted 3D shape. In this paper, we document the engineering challenges encountered when reproducing Mesh R-CNN in TensorFlow. The original implementation of the model was in Pytorch. These challenges include initial research and analysis, differences in TensorFlow and Pytorch, and errors encountered during model training and debugging. Documenting these challenges will aid other engineers to re-implement another model or modify an existing one to suit their needs.

Mentor(s):

James Davis, Purdue University

**Poster Presentation Abstract Number: 187** :: Life Sciences

## Effects of Hypothyroidism on Protein Content in Fetal Tissue

Author(s):

Alyssa Smith, College of Agriculture

Abstract:

The thyroid hormones thyroxine (T4) and triiodothyronine (T3) are critical for proper fetal growth and development in utero, and lack of these hormones (hypothyroidism) negatively affects fetal maturation. The objective of this study is to analyze the effects of hypothyroidism on protein content in fetal tissue using a non-pathogenic porcine model. Eight pregnant gilts were dosed with either Methimazole (MMI) or an equivalent negative control (CON) during days 85-106 out of 114 days of gestation. Tissue samples from two male and two female fetuses were taken from each gilt, and complete fetal hypothyroidism was confirmed via ELISA assay. Protein was then extracted from seven fetal tissues and assessed for total protein content using bicinchoninic assay (BCA). From this initial sample analysis, it was found that total protein content was significantly increased in liver (LVR) samples collected from MMI treated fetuses, while other tissues showed no significant findings. The LVR samples were further analyzed by performing total RNA extraction and reverse transcription to allow for analysis of gene expression by qPCR. Initial qPCR results showed no significant differences in the expression of PERP or SIVA1, both of which are genes related to cellular apoptosis. Currently, LVR histology slides are being stained with WGA-Fluorescein and DAPI to evaluate the tissue for evidence of morphological changes such as cellular hypertrophy. The results of this study will provide a better understanding of the impact of hypothyroidism on fetal LVR and seek to explain the increase in LVR protein content shown in the MMI fetuses.

Mentor(s):

Jonathan Pasternak, Purdue University

**Poster Presentation Abstract Number: 188** :: Physical Sciences

## Characterizing the affects of space weathering on lunar grains using scanning electron microscopy

Author(s):

Kaitlyn Sycko, College of Science, College of Science, Honors College

Abstract:

Space weathering is a process that occurs on all planetary bodies without atmospheres that are exposed to outer space. It is driven by multiple processes such as micrometeorite impacts and solar wind irradiation. Solar wind implantation of hydrogen ions is believed to form water on the lunar surface via interactions with oxygen present in minerals on the surface. This investigation looks at how the space weathering process of solar wind irradiation affects the surfaces of individual grains on the Moon’s surface using scanning electron microscopy (SEM). SEM imaging techniques allow us to characterize the individual grains based on composition and grain surface morphology. Backscatter electron (BSE) imaging gives a general assessment of the range of compositions present. Secondary electron (SE) imaging allows us to identify the morphology of the grains and differentiate between types of space weathering features on the grains surfaces and the processes that create these features. Energy dispersive x-ray spectroscopy (EDS) is used to identify the elements present in the grains and their spatial distributions which can be used to make assumptions about what minerals are present. These techniques will help classify grains based on their mineralogy and surficial space weathering features which can be inferred based on their chemistry and surface characteristics. Grains displaying evidence of solar wind irradiation and a lack of evidence of micrometeorite impacts will be selected for further analyses in the transmission electron microscope to look for evidence for the production of water from the solar wind.

Mentor(s):

Alexander Kling, Purdue University

**Poster Presentation Abstract Number: 189** :: Life Sciences

## CD3 and CD4 Response to Prolonged Progesterone in Uterine and Vaginal Tissues

Author(s):

Summer Thomlison, College of Agriculture

Abstract:

The objective of this study is to understand immune modulation within the upper and lower reproductive tract as well as the role of progesterone and estrogen in regulating this system. A multi-color immunohistofluorescent staining protocol was developed and validated using monoclonal antibodies against CD3 (Pan T-cells) and CD4 (T-helper cells). A pilot trial was initially conducted with six rabbits that were treated with either 100 IU of human chorionic gonadotropin (hCG) three times at 14-day intervals to induce ovulation (high progesterone) or given equivalent injections of PBS (high estrogen). Tissue samples were collected from the uterine horn (upper reproductive tract) and vagina (lower reproductive tract) 35-days after the initial treatment. Tissue cryosections were stained overnight with primary antibodies followed by isotype-specific fluorescently labeled secondary antibodies and digitally imaged to allow enumeration of resident T cell subsets. The preliminary data generated suggested that high progesterone decreased the abundance of CD3+CD4+ T cells in the vagina, but not the uterus. To follow up these results the main trial consisting of N=24 rabbits was carried out with half receiving 2 injections of hCG at 14-day intervals and tissues sample collected at day 28. In addition, N=16 rabbits received an intrauterine vaccine (N=8 hCG and N=8 PBS) with the remaining N=8 receiving a sham vaccination. This main experiment will allow for larger sample size and thus more statistical power which will lead to a better understanding of the endocrine regulation of the adaptive immune cell complement in the upper and lower reproductive tract.

Mentor(s):

Jonathan (Alex) Pasternak, Purdue University

James Markworth, Purdue University

**Poster Presentation Abstract Number: 190** :: Innovative Technology/Entrepreneurship/Design

## Detecting and Identifying Cars based on Mobile Phone Images


Author(s):

Matthew Tolla, Polytechnic Institute

Soham Agarwal, College of Engineering

Edison Liao, College of Engineering

Marvin Lim, College of Engineering

Yufeng Qian, College of Science

Jordan Srinivasan, College of Engineering, College of Engineering

Mejebi Uwatse, College of Engineering



Abstract:

The purpose of this project is to develop a mobile telephone application that can recognize and identify an automobile based on an image. There are many different varieties of automobiles, and it can be difficult for one to easily identify a car. Our team is working to develop an application for Android mobile phones that can image the backside of a vehicle and send that image to a server for remote image processing. The server will run an algorithm that will be developed by our team that will be capable of identifying the vehicle’s make, model, production year range, and will retrieve mileage statistics and other information from online databases. The algorithm first preprocesses the taken image to reduce the processing speed and computational requirements in future steps. Next, the algorithm utilizes a trained Support Vector Machine (SVM) model to identify the car according to the input image’s features. Once the server has successfully identified and retrieved this data, the results will be sent back to the user’s device for interpretation. It may then be stored along with the date and time it was taken so the user may request this data later.



Mentor(s):

Carla Zoltowski, Purdue University

**Poster Presentation Abstract Number: 191** :: Life Sciences

**Vocalizations as a flock welfare indicator in the poultry industry**

Author(s):

MacKenzie Ulrey, College of Science

Tze Yao Yap, College of Science

Jill Merritt, College of Agriculture

Abstract:

Sounds have been shown to affect the behavior and overall welfare of captive birds. We wish to build upon this knowledge to develop duck vocalizations to be used as environmental enrichment in commercial barns. However, we first need to develop a full repertoire of duck vocalizations.  To accomplish this, we utilized 23, 35-45 week-old pekin ducks to characterize their vocal repertoire. The ducks were put in a soundproof box with a microphone and Bluetooth camera used to monitor and record the vocalizations and behaviors of the ducks. We placed 1-4 ducks into the chamber for several minutes to record initial vocalizations and to acclimate the ducks to the chamber. Next, different enrichment objects (remote control dragon, preening cup, black light, led light, or dog toys) were used to encourage new vocalizations. Each enrichment was recorded for 20-30 minutes with variations of number and gender of ducks.  When completed, the video and audio were analyzed using Audition, Premiere Pro, and Praat, a phonetics software[FGS2] . When naming each vocalization, we listened and viewed the vocalization using a spectrogram and characterized them based on the number of pulses, shape of call, amplitude, and frequency. We found ducks can produce 36 different vocalizations.  Our results allow us to determine how playbacks of these vocalizations can affect ducks' physiology, such as heart and respiratory rate, or pupillary light reflex. We can then evaluate which sounds may produce calming effects on ducks could be used as environmental enrichment in commercial barns.

Mentor(s):

Gregory Fraley, Purdue University Animal Sciences

Jenna Schober, Purdue University

**Poster Presentation Abstract Number: 192** :: Innovative Technology/Entrepreneurship/Design

# Drone Video

Author(s):

Vlada Volyanskaya, College of Science

Ashvin Iyer, College of Science

Colby Acton, College of Engineering

Enze Jiang, College of Engineering

Jinen Setpal, College of Science

King Yang

Mustafa Albahrani, College of Science

Nishant Nair

Vinay Jagan

Abstract:

Autonomous Drones have wide applications ranging from search and rescue operations to structural analysis after natural disasters. Development of autonomous control systems can be accelerated with software simulations. In preparation for the 2022 UAV Chase Challenge, a set of tools to design and test vision-based autonomous control systems in the simulator, and in a real-world environment, has been proven effective. In addition to accelerating the process of testing and development, these tools provide opportunities to develop more advanced systems through refined path-planning techniques, improved vision, and even reinforcement learning. In this work, we propose refined control methods for the autonomous drone to chase a rover. The goal of our project is that the drone should try to catch the rover while the rover should run away from the drone. We first collected training data in the simulation for object tracking where both RGB and depth images are set as input, and a relative position vector between the drone and rover are set as output. Also, we adopt reinforcement learning for drone and rover agents. We plan to develop drone and rover agents to collect their data from the simulator and build a catch and run model for the drone and the rover. We apply collected data into a reinforcement learning model and find out the best strategy for the drone to catch the rover. Developing drone and rover agents, participating in competitions help students to test their solutions and come up with new ideas for autonomous control systems for drones.

Mentor(s):

Zichen Miao, Purdue University

Qiang Qiu, Purdue University

**Poster Presentation Abstract Number: 193** :: Life Sciences

## An exploration of a promising group of drugs impacting spinal cord axonal regeneration after injury in Zebrafish


Author(s):

Alexandria Warren, College of Science



Abstract:

This study examines the role of a promising group of drugs as potential therapeutics for spinal cord axonal regeneration after injury in zebrafish. These drugs inhibit a large family of enzymes involved gene expression and cytoskeletal dynamics and have been used as treatments for multiple diseases. Some of these inhibitors have been shown to aid nerve regeneration in both the peripheral and the central nervous system to varying degrees of success. A better understanding of the mechanisms of how these drugs affect axonal regeneration is needed if they are to be applied to humans one day. Our study involves eleven drugs selected from an FDA-approved drug library, which were applied to five-day old zebrafish larvae following injury to their spinal cords. A behavioral swimming assay was used to assess the functional recovery. After we had determined the optimal concentration for each of the candidate drugs, the regeneration of the fish was tracked for up to four days post injury. From this experiment we found several inhibitors for different classes of enzymes that have been shown to promote spinal cord axon regeneration in zebrafish after spinal cord injury. These findings could provide the framework for further testing in other organisms and eventually applying to humans, thereby changing how spinal cord injuries are treated.



Mentor(s):

Daniel Suter, Purdue University

**Poster Presentation Abstract Number: 194** :: Social Sciences/Humanities/Education

## A comprehensive literature review on the relationship between multitasking and intrinsic motivation

Author(s):

Ziqi Yao, College of Health & Human Sciences

Haley O'Neal, College of Health & Human Sciences, College of Liberal Arts, Honors College

Abstract:

With advanced technology and increased demands nowadays, it is not uncommon for people to engage in multitasking (i.e., doing multiple tasks simultaneously or switching between multiple tasks quickly) in day-to-day work and life. Existing research on multitasking mostly focuses on its performance effects, while much less research investigates psychological outcomes. Specifically, we know little about whether and how multitasking makes individuals feel interested and enjoy the tasks (i.e., intrinsic motivation). It is important because intrinsic motivation is a robust predictor of one's well-being and performance. To fill this gap, in this project we conducted a literature review that aimed to identify and integrate multidisciplinary research findings on the relationship between multitasking and intrinsic motivation. From multiple databases (e.g., APA PsycArticles, APA PsycInfo, Business Source Complete, Psychology and Behavioral Sciences Collection), we identified and reviewed 840 papers in total. Based on the initial review so far, we found that little research has studied the relationship between multitasking and intrinsic motivation, most of which evaluates this topic within the context of media multitasking and generates mixed results. Going forward in this project, we expect to further integrate the existing research and summarize the similarities and discrepancies in the findings. In doing so, we hope to identify potential implications and future research directions on the relationship between multitasking and intrinsic motivation.

Mentor(s):

Zhixu (Rick) Yang, Purdue University

**Poster Presentation Abstract Number: 195** :: Life Sciences

## Multi-omic Mendelian randomization identifies causal associations between plasma biomarkers and subcortical brain structure volumes

Author(s):

Madison Yates, College of Science, College of Science, College of Liberal Arts

Abstract:

Changes in the subcortical brain structure volume have been found to be associated with different neurodegenerative and psychiatric disorders. Genome-wide association studies (GWAS) have identified numerous variants associated with brain structure. In this study, we aim to expand on this knowledge to identify proteins, metabolites, and microbes that have a putative causal association with the subcortical brain structure volume using a two-sample mendelian randomization approach. This method uses genetic variants as instrument variables to identify potentially causal associations between an exposure and outcome. The exposure data includes genetic associations for 2994 plasma proteins, 430 Metabolites, and 97 Microbial genera. The outcome data included the GWAS data for 7 subcortical brain structure volumes including acumens, amygdala, caudate, hippocampus, pallidum, putamen, and thalamus. 11 proteins and 5 metabolites were found to have a significant association with subcortical structure volume after multiple testing correction. The strongest association was observed for Agouti Signaling Protein (ASIP) which was negatively associated with Putamen volume (Beta: -27.9, p:1.21x10-8). Other associations included Plasma protease C1 inhibitor (SERPING1) which had a positive association with Acumens volume (Beta: 6.4, p:6.95x10-7), and Granzyme A (GZMA) that was positively associated with amygdala volume (Beta: 16.9, p:1.43x10-5). Both these proteins have also been implicated in autism spectrum disorder (ASD) and major depression. Among Metabolites, Urate had the strongest association with thalamus volume (Beta: -458.7, p:3.7x10-5) and is also known to be found in higher levels in patients with ASD. No significant associations after multiple testing were observed between the various microbial genus and subcortical brain structure volume. Identification of these biomarkers offer new treatment targets for disorders linked to subcortical brain structure volumes and serves to identify the mechanisms by which these biomarkers may be linked to the pathogenesis of neurodevelopmental and psychiatric disorders.

Mentor(s):

Peristera Paschou, Purdue University

**Poster Presentation Abstract Number: 196** :: Life Sciences

## Utilizing PP2A-EGFR Crosstalk in Therapeutic Strategies in PDAC

Author(s):

Sydney Clifford, College of Science, Honors College

Elizabeth Hoffman, College of Science

Abstract:

Pancreatic Ductal Adenocarcinoma (PDAC) ranks 4th in leading causes of cancer deaths in the U.S. In PDAC tumors, epidermal growth factor receptor (EGFR) signaling is aberrantly active and aids in mutant KRASG12D signaling, a mutation found in ~60% of PDAC cases. Because KRASG12D drug targets have yet to be developed, there is a need for new therapeutic strategies. Erlotinib, an EGFR inhibitor, is one of four FDA-approved targeted therapeutics for PDAC, but provided minimal benefits alone in the clinical setting. Therefore, combination with other agents may be more effective, which has been validated in other cancer types.

PP2A is a major serine-threonine phosphatase that regulates KRAS and EGFR signaling by dephosphorylating downstream effectors. Small Molecule Activators of PP2A (SMAPs) are a promising cancer therapy to shut down KRAS- and EGFR- driven oncogenic pathways. A study in EGFR mutant lung cancer combined the SMAP DT-061 with EGFR inhibitors and found increased apoptosis and decreased oncogenic signaling.

Given the role of EGFR signaling in PDAC and the potential for PP2A activators, we sought to determine the relationship between these major signaling nodes in PDAC. By utilizing genetic and therapeutic methods, we found a novel role for PP2A in EGFR regulation where PP2A activation elicits a feedback loop for EGFR activation. To understand this relationship, we measured efficacy of PP2A activation combined with EGFR inhibition, demonstrating decreased cell viability and downstream EGFR signaling. Our findings suggest that PP2A crosstalk with EGFR is a critical signaling node in PDAC which can be therapeutically leveraged.

Mentor(s):

Claire Pfeffer, Purdue University

Brittany L. Allen-Petersen, Purdue University

# AFTERNOON POSTERS

**Poster Presentation Abstract Number: 200** :: Social Sciences/Humanities/Education

## Investigating Attachment Styles and How Insecurities Manifest in Couple Interactions

Author(s):

Zoe Alexander, College of Health & Human Sciences

Abstract:

Seemingly simple interactions can give a lot of insight into the inner psychological workings of an individual and a romantic relationship. Previous studies have found the correlation between certain insecure behaviors and facets of the attachment theory. The ARCC lab seeks to understand and evaluate these insecure behaviors in relation to using safe and soft strategies all while paving the way for future research involving couples and attachment theory. Participants were recorded and instructed to speak on an issue within their relationship. Couples were left alone in a safe and confidential environment to discuss. The lab then utilizes a coding schedule to interpret the video interactions between established couples discussing an issue. This coding schedule highlights the importance of negative/positive affect, partner involvement, and emotional expression when investigating an individual's attachment style. The analysis of the research is still ongoing but through the current accomplishments of the lab, it is understood that by watching a couple's interaction, one can open the door to understanding how insecure behaviors manifest and how to search for safe and soft strategies in communication inside and outside of the lab. This research is being conducted to help the field of psychology and the general public to understand how insecure behaviors manifest and what attachment theory is. To build on this idea, investigating how mental disorders affect attachment style might provide researchers with a better glimpse into where insecure behaviors stem from.

Mentor(s):

Ximena Arriaga, Purdue University

**Poster Presentation Abstract Number: 201** :: Mathematical/Computation Sciences

**RISC-V Hardware Support for Software Debugging**

Author(s):

Steven Andreas, College of Engineering

Xinyu Yang, College of Engineering, College of Science

Zhaoyu Jin, College of Engineering

Abstract:

The technical goal of the SoCET(System on Chip Extension Technologies) team is to produce a family of microcontrollers on custom silicon for which the architecture and implementation are entirely under the control of the SoC team so that it can be adapted to whatever needs arise. Our goal for this project is to design a complete hardware support for external debugging on the RISC-V platform. It allows the users to gain a better understanding of what is going on within the hardware, enabling them to better write and debug software. We will be designing these modules using SystemVerilog, a Hardware Description Language which allows us to design hardware by describing it in a software-like syntax. Also, we will be using testbenches and FPGA (Field-Programmable Gate Arrays, a type of reprogrammable logic circuit) to fully test and demonstrate our design. The entire design includes the debug module, a memory-mapped program buffer that interfaces with both the system bus and debug module, the debug module interface, and the debug transport module. The deliverables will be the Wiki documentation for the design, RTL(Register Transfer Level) diagrams, and SystemVerilog code.

Mentor(s):

Mark Johnson, Purdue University

Cole Nelson, Purdue University

**Poster Presentation Abstract Number: 202** :: Physical Sciences

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

Author(s):

Anthony Bovenschen, College of Health & Human Sciences, Honors College

Nicholas Pecoraro, College of Health & Human Sciences, Honors College

Abstract:

Bioaerosols are aerosols of biological origin (e.g. viruses, bacteria, fungi, etc.). 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 evaluated the lower limit of the detection (LOD) of the dry spot test kit. Specifically, we used the known concentrations of L. pneumophila suspension. An optical density of each L. pneumophila suspension was measured and then the concentration was calculated. 10 µL of each suspension was dispensed on the test strip and the aggregation was observed. After diluting the sample to the point of no aggregation, the lower LOD was estimated. In future studies, the LOD will be used to estimate the concentration of airborne L. pneumophila.

Mentor(s):

Jae Hong Park, Purdue University

Subin Han, Purdue University

**Poster Presentation Abstract Number: 203** :: Life Sciences

## Spatial and temporal frequency selectivity of pyramidal neurons in zebrafish optic tectum

Author(s):

Reni Boyarov, College of Science

Abstract:

The optic tectum is the largest brain region in fish and plays a central role in visually-guided hunting behavior. However, little is understood regarding how specific neuron types in tectum are specialized to process visual information with different spatial or temporal frequencies. One of the best-defined neuron types in tectum is the pyramidal neuron (PyrN), a local cholinergic interneuron thought to serve a neuromodulatory function by raising tectal acetylcholine levels when the visual scene is dynamic. In this study we will use multiphoton imaging of the genetically-encoded calcium sensor GCaMP6s to monitor PyrN activity during presentation of visual stimuli. One way in which PyrNs could track visual scene dynamics is by functioning as 'mean luminance detectors' that respond to changes in average scene brightness. We will test this hypothesis by monitoring PyrN responses to visual stimuli with different spatial frequencies but constant overall brightness. Initial trials using static high-contrast square wave gratings and brightness-matched gray whole-field stimuli, revealed a robust response to the presentation of gratings. This data suggests that PyrNs do not function as mean luminance detectors. Experiments are currently under way using static gratings with a range of spatial frequencies to determine the optimal spatial frequency for PyrN activation. Experiments are also underway using drifting gratings to test whether PyrN responses are sensitive to stimulus motion and if so determine their optimal temporal frequency. Future experiments will examine spatial and temporal frequency selectivity in PyrNs using naturalistic visual stimuli.

Mentor(s):

Estuardo Robles, Purdue University

**Poster Presentation Abstract Number: 204** :: Physical Sciences

# Understanding the Pliocene-Pleistocene Transition in the Southwestern US Through a New, Novel Proxy: Paleosol Nitrate Δ17O


Author(s):

Chris Buntin, College of Science, College of Science, College of Liberal Arts



Abstract:

The Pliocene-Pleistocene transition's global climate change went from a relatively warm, wet global climate state with no ice sheets in the northern hemisphere, to a cooler and drier climate with greater pole-equator temperature gradient and cyclical glaciation in both hemispheres. To evaluate the changes in precipitation in Death Valley, CA between 1.6 and 2.4 million years ago using paleo-lake deposits in the Confidence Hills Formation, a new precipitation proxy, nitrate 17O anomalies (Δ17O), was developed. To address the question of wetness in the southwestern US, as future water resources may be limited due to the Earth warming from anthropogenic greenhouse gas emissions, geochemical and isotopic proxies in the deposits were analyzed. Samples were collected in an exposed drainage and soluble ions were extracted, mineralogy determined, and isotopic analyses of nitrate were performed. The study of changes in ion content (NO3-, Cl-, SO42-) and isotopic ratios (δ15N, δ 18O, and Δ17O) over time suggest changes in local precipitation including shifts in erosional regimes. Changes in δ15N, δ 18O, and Δ17O suggest a changing nitrogen cycle connected to water availability.



Mentor(s):

Greg Michalski, Purdue University

**Poster Presentation Abstract Number: 205** :: Social Sciences/Humanities/Education

## Learning Math Through Storybooks: Pre-testing RA Experience


Author(s):

Emma Carosone, College of Health & Human Sciences


Abstract:


Abstract redacted.



Mentor(s):

David Purpura, Purdue University

Inga Nordgren, Purdue University

**Poster Presentation Abstract Number: 206** :: Innovative Technology/Entrepreneurship/Design

## Utilizing Data Augmentation to Train YoloV5 Object Detection for Armor Plates for Purdue RoboMaster Robotics Team


Author(s):

Rachel Chen, College of Engineering

Matthew Leight, College of Engineering, Honors College

Xipeng Wang, College of Science, Polytechnic Institute

Yuting Xiao, College of Science

Mengting Xu, College of Engineering

Mason Chung, College of Engineering

Max Yee, College of Engineering



Abstract:

Data augmentation has been commonly implemented in machine learning to diversify and expand existing datasets: in turn, this data will improve the accuracy, eliminate loss, and prevent overfitting within the final trained model. Data augmentation consists of altering elements including but not limited to: scale, rotation, shear, position, brightness, saturation, and more. Recent applications include medical imaging for MRIs, clinical speech therapy, even vision based surveillance systems such as autonomous driving. For this project, data augmentation was utilized to increase the precision of armor plate detection for the RoboMasters NA competition. An effectively augmented set of data should improve the detection and tracking of armor plates on opposing equipment to more accurately determine a firing solution. Since there are many methods of augmentation, projects were conducted to determine the best fit methodology for this goal. Through various testing with Google Colab, Roboflow, and local machines, it was found that local machine training was the most efficient. By using Python and two of its libraries, openCV and Augmentor, new data sets are created through scripts augmenting the original data. A new Yolov5 model is then created from the augmented data, which is compared to a control model made with raw data. While the project was ultimately completed locally, Colab and Roboflow methods have been proven to be possible and could be subject to further consideration in future projects. Generating synthetic dataset by utilizing modeling software is another step Purdue RoboMasters can take to further expand dataset size and improve model accuracy.



Mentor(s):

Minghao Sun, Purdue University

**Poster Presentation Abstract Number: 207** :: Life Sciences

## How Purdue Can Implement the 17 SDGs Into Campus Lifestyle


Author(s):

Joley Clodfelter, College of Agriculture

Natalia Figueroa, College of Liberal Arts



Abstract:

College campuses are a great place for quality education to impact what students know about sustainability and how they approach it. While Purdue University's vision for sustainability does match with a few of the 17 Sustainability Development Goals (good health and well-being, quality education), there are several areas in which the university is lacking. As students, we are interested in the engagement and education of other Purdue students about the 17 SDGs. Being a college student is difficult and trying to make lifestyle changes can turn some people away from what we are trying to achieve. We empathize with students and believe that educating others about the SDGs is a beginning step to making bigger lifestyle choices, first starting on campus and then into our adult lives. From our research, we hope to learn how other campuses around the world are applying the 17 SDGs to their campuses and how they are giving students the resources to practice the SDGs in their own lifestyle. Keeping Purdue's facilities in mind, we will apply the methods of awareness and action from other universities to Purdue's campus. We want to know how these practices happen on our campus and how students would engage with the implementation. The goal is for Purdue to practice the 17 SDGs (especially the ones they are lacking in now) in hopes that it will encourage students to also engage in these practices.



Mentor(s):

Genell Ebbini, Purdue University

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

## SoCET Digital Design Audit


Author(s):

Brandon Cole, College of Engineering



Abstract:

SoCET is a team designed to give students experience with industry quality System on chip design flow by creating an opensource microcontroller. We are currently laying groundwork for our 7th chip, the AFTx07.

I am a part of the digital team that is responsible for creating the System Verilog code for the hardware in the chip. I am a member of the sub-team focused on auditing old Verilog code and bringing it up to date with current System Verilog standards and tools. We are aiming to lay the groundwork for AFTx07 and future chips. Our plan is to create FuseSoC cores for each repository that allows for simulation with Verilator as well as other common simulators like Questa and Xcelium. We will Update existing code with improved quality, implement digital library modules to reduce repeated code, replace APB/AHB interfaces with a bus module from our digital library, and eliminate bidirectional I/O ports. We plan to update existing testbenches to demonstrate full functionality, but this this will be handed off to the verification team for further improvements. We will also create minimal TB for Verilator Simulation. Throughout this process we will be updating outdated or incorrect documentation to ensure that new students can continue where we left off.

This semester we decided to begin the audit by updating the more complex modules first, starting with the I2C module. At the time of writing this we have updated all submodules to be synthesizable and have begun constructing the SoCET core.



Mentor(s):

Cole Nelson, Purdue University

**Poster Presentation Abstract Number: 209** :: Life Sciences

## Geospatial Analysis of Bacteriophage Found On and Near Purdue University's West Lafayette Campus


Author(s):

Grace Cook, College of Engineering, Honors College



Abstract:

The discovery of novel bacteriophage is an ongoing research initiative in the field of biotechnology. Bacteriophages are viruses that infect bacteria, they are very diverse biological entities and are host-specific and highly numerous. Phage discovery aims to curate a library of genes that can be used to design and find solutions to problems pertaining to human health, such as battling antibiotic resistance from so-called "superbugs". Spatial analysis is a methodology that combines data sets with spatial components in order to draw conclusions and visualize them in a way that is clearer to understand. Previous work has indicated that the soil quality of an area is related to the presence of phage in that area. Through the use of spatial analysis tools such as ArcGIS Online, soil quality data from the USDA is compared with the locations of bacteriophages found on and near Purdue University. The aim of this work is to create a visual tool to highlight soil types that are likely to yield new phage and to expand that knowledge to create a predictive "phage-hunting" tool for Tippecanoe County.



Mentor(s):

Katie Jarriel, Purdue University

**Poster Presentation Abstract Number: 210** :: Social Sciences/Humanities/Education

**The Spatial Impact of Local Parades**

Author(s):

Benjamin Deadman, College of Education, Honors College, Honors College, Honors College

Abstract:

Parades are a staple of many communities big or small, or even multiple at once. Parades happen frequently throughout the year, so this project is to help elaborate these staples. Parades not only take planning from the hosting city to decide routes, but how do these routes affect everybody and their ways of living? Therefore, the question of this project is: How does the pathing of parades correlate with the zoning of buildings, as well as the effect of noise pollution on either Purdue Campus or the Greater Lafayette Area? These aspects of parades are not apparent when partaking or viewing, but it is something that could be addressed to see if there are any positive or negative impacts for companies, drivers, or those staying in their homes.

Mentor(s):

Katie Jarriel, Purdue University

**Poster Presentation Abstract Number: 211** :: Social Sciences/Humanities/Education

## Initial Consonant Deletion in Bilingual Children with Speech Sound Disorders

Author(s):

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

Sophia Hagedorn, College of Health & Human Sciences, Honors College

Abstract:

Children who present with speech sound disorders (SSD) are particularly at-risk for academic and literacy difficulties (e.g., Raitano et al., 2004). Whereas there is a wealth of information regarding typical and atypical phonological development in English, there is little, but increasing, information regarding such development in other languages. Although previous studies have described the phonological skills of Spanish-speaking preschoolers with typical speech or with SSD (e.g. Brice et al., 2009; Fabiano-Smith & Godlstein, 2010; Goldstein, 2007; Goldstein et al., 2005; Jiménez, 1987), only one recent study specifically examined initial consonant deletion in these children. Fabiano-Smith & Cuzner (2018) recorded single word samples from 8 bilingual Spanish-English children with SSD and 5 monolingual English-speaking children with SSD. While monolingual children did not omit initial consonants, bilingual Spanish-English children omitted 5,7% of initial consonants and 1,5% of English initial consonants.

The goal of the study was to investigate initial consonant deletion in similar words produced by bilingual and monolingual children with SSD. Six bilingual Spanish-English children with SSD, ages 4 to 6 years, were matched to six monolingual English-speaking children with SSD. Participants completed a battery of speech and language tests, and produced a list of words one to five syllables in length which are similar in Spanish and English. Monolingual English-speaking children omitted initial consonants at a significantly lower rate than bilingual children. Bilingual children were more likely to omit initial consonants in Spanish, but they also omitted consonants in their English productions. Implications for assessment and intervention will be addressed.

Mentor(s):

Francoise Brosseau-Lapre, Purdue University

**Poster Presentation Abstract Number: 212** :: Social Sciences/Humanities/Education

## Environmental Justice Metrics Research

Author(s):

Rugved Dikay, College of Engineering, Honors College

Abstract:

Environmental justice (EJ) in the context of infrastructural development refers to the equity of environmental conditions and implications of any social change, amongst different segments of a regional population, often stratified on the basis of income and demographic factors. In this study, the notion of EJ and its relation to social equity is explored for a proposed road electrification initiative that enables electric vehicle (EV) charging as they are driven, and thus, aspires to incentivize EV adoption. First, a literature review of current methods of assessing environmental justice was conducted, with a larger focus on assessing the energy demand related to previous road electrification projects, and optimizing EV deployment to reduce pollution equitably for all community members. Next, this study determined quantifiable metrics and methodologies that could be used to perform novel EJ analysis of electrified roads, as well as informing relevant stakeholders of the equity factors that should be evaluated during the design and implementation process. Through a thorough review of close to 30 papers, this research offers close to 45 useful EJ metrics, including but not limited to an analysis of energy networks, community pollution indicators, EJ communication strength, corporate partnerships for project implementation, and rebates for EV ownership. Beyond this, this study has revealed key insights about optimizing EJ equity for projects through government policies and performing feasibility studies, while providing access to numerous EJ data sources to support future EJ analysis of electrified roads.

Mentor(s):

Konstantina Gkritza, Civil Engineering Department, Purdue University

**Poster Presentation Abstract Number: 213** :: Life Sciences

## Effects of Beam Occultation on Radar-Based Precipitation Estimates

Author(s):

McKenna Eichenauer, College of Science

Abstract:

The X-band Teaching and Research Radar (XTRRA) at Purdue University is a weather radar located 210 meters above sea level. Despite its placement, the radar is still not tall enough for its beam to clear tall buildings and trees at its lowest elevation angles, so oftentimes radar data are contaminated by these blockages. This contamination causes inaccuracies in the estimated precipitation values when compared to actual ground level measurements, such as those from rain gauges. We hypothesized that filtering blockage-contaminated data will help improve the radar-based precipitation estimates. To map beam blockage, occultation fractions were calculated using high-resolution LiDAR elevation data from Purdue University's Integrated Digital Forestry Initiative. Afterward, the occultation array was used to mask the XTRRA-based precipitation estimates from 2021. The new masked precipitation estimates were then compared to ground observations from 110 rain gauges spread across Tippecanoe and surrounding counties.

Mentor(s):

Robin Tanamachi, Purdue University

**Poster Presentation Abstract Number: 214** :: Life Sciences

## The Role of Vitamin D Metabolism Pathways in Osteoarthritis Risk and the Gut-Joint Axis

Author(s):

Maya Federle, College of Engineering

Abstract:

Project Abstract:

Osteoarthritis, a degenerative joint disease, impacts over 32.5 million adults in the U.S with hallmarks of joint pain and activity limitation [1]. Though treatment options to temporarily mitigate the pain exist, the only current cure is joint replacement.  Consideration of the gut microbiome as a factor in numerous physiological systems has resulted in closer examination of the gut-joint axis as a potential component in the progression of osteoarthritis. This study considers how physiological concentration of Vitamin D, involved in inflammation regulation and gut microbiome composition, modulates gut bacteria in the host to influence pathways that are differentially activated in osteoarthritis patients [2]. Human colorectal cells from the line HT29 are grown in conditions with and without an additional 40mg/mL of calcipotriol, a Vitamin D derivative, added to their media. We apply conditioned media from the HT29 cells to bacterial cultures of Streptococcus Mitis and Lactobacillus casei. Streptococcus microbes have been shown to be proinflammatory and more abundant in patients with hip or knee osteoarthritis[3,4]. In comparison, osteoarthritis patients have had a decrease in Lactobacillus bacteria compared to healthy patients [4]. The supernatant from these bacterial strains is then applied to SW982, a synoviocyte cell line, to represent the response of the joint to bacterial molecular pattern. We will measure cell growth and perform bacterial growth assays and cytokine panels to identify changes in synoviocyte secretions. Determining the effect of Vitamin D in osteoarthritis progression through the gut-joint axis would provide potential preventative measures to patients who face an otherwise chronic condition.

Sources:

[1] United States Bone and Joint Initiative. The Burden of Musculoskeletal Diseases in the United States (BMUS). In: In. Fourth ed. Rosemont, IL. 2018: Available at https://www.boneandjointburden.org/fourth-edition. Accessed June 12, 2019.

[2] Waterhouse, M., Hope, B., Krause, L. et al. Vitamin D and the gut microbiome: a systematic review of in vivo studies. Eur J Nutr 58, 2895–2910 (2019). https://doi.org/10.1007/s00394-018-1842-7

[3] Favazzo, Lacey J., et al. "The gut microbiome-joint connection: implications in osteoarthritis." Current opinion in rheumatology 32.1 (2020): 92.

[4] Chisari, Emanuele, et al. "The relation between the gut microbiome and osteoarthritis: A systematic review of literature." PloS one 16.12 (2021): e0261353.

Mentor(s):

Deva Chan, Purdue University

**Poster Presentation Abstract Number: 215** :: Innovative Technology/Entrepreneurship/Design

## Feasiblity Study of a Composting Program at the Purdue Honors College Residence Hall


Author(s):

Michaela Fennell, College of Agriculture, Honors College

Annie Johnson, College of Engineering

Celia Whisler, College of Engineering



Abstract:

Students at Purdue do not have access to a composting program, and many students are unaware that composting their food waste is possible. Composting provides an opportunity to reduce methane emissions from landfills, lower carbon emissions, sequester carbon and can be used in place of chemical fertilizers. To promote composting at Purdue, our team proposed a feasibility study for a composting program at the John Martinson Honors College. For our research, our team investigated several opportunities associated with project implementation and success. Currently, trash and recycling is collected once a week at the Honors College. In keeping with the current schedule, our team suggests the organic waste also be picked up once a week. After touring the Honors College and speaking with the faculty, placing collection bins in areas where students gather as well as on each residential floor would be ideal. Additionally, our team investigated different options for using the collected food waste in order to better understand implementation feasibility. Some of the options considered included traditional composting and using the organic waste as biomass to generate energy. One goal of our research is to compile our information in a meaningful way to involve current and future Honors College students. Our team hopes that Honors College students would be able to adapt the project to best fit the residence hall. Ideally, using this project as a pilot for composting at Purdue University, the success and feasibility of a composting program on campus could be determined.



Mentor(s):

Genell Ebbini, Purdue University

**Poster Presentation Abstract Number: 216** ::

**Withdrew**

**Poster Presentation Abstract Number: 217** :: Mathematical/Computation Sciences

## Cliquify: Robust representation of molecular graphs to trees structures

Author(s):

Mun Hong Fong, College of Science

Abstract:

Abstract redacted.

Mentor(s):

Gaurav Chopra, Purdue University

**Poster Presentation Abstract Number: 218** :: Life Sciences

## Life cycle assessment for infrastructure vulnerable to flood hazard in the Great Lake region

Author(s):

Joy Gao, College of Science

Abstract:

Flooding in the Great Lakes region has continued to affect millions of people through damage to infrastructure. Climate change has been observed to cause the lakes' water levels to change more rapidly and cause more frequent and higher severity of storms. Therefore, ensuring the security of coastal infrastructure and users' safety in this region is crucial to maintaining sustainability and resilience against frequently occurring inclement climates. To assess the risk of flooding for certain types of infrastructure, we examined and analyzed a large dataset from the Southeast Michigan Council of Governments (SEMCOG) that focused on four asset types: bridges, culverts, pump stations, and roads. This dataset included multiple indicators for flooding risk, from sources such as the Federal Emergency Management Agency (FEMA), that included flood zone location, pavement condition, traffic volume, and more. We developed a life cycle assessment model by applying machine learning algorithms and mathematical models with the public data to help determine the impact and risk of flooding on various types of infrastructure. The results can be used to provide recommendations for stakeholders and decision makers on minimizing the effects of future hazardous flooding events.

Mentor(s):

Chengcheng Tao, Purdue University

**Poster Presentation Abstract Number: 219** :: Physical Sciences

**Data mining supernova from the Zwicky Transient Facility**


Author(s):

Braden Garretson, College of Science



Abstract:

The upcoming Vera C. Rubin Observatory will provide exciting opportunities to investigate hundreds of thousands of supernovae and their host galaxy environments. However, this large influx of data also comes with numerous technical challenges due to sparse data and limited spectroscopic resources, including the identification and classification of supernova using photometry alone. Because of this, we were motivated to create a value-added catalog of over 10,000 photometrically classified supernova-like light curves and candidate host galaxy associations from the Zwicky Transient Facility, which is a current all-sky survey operating at 1/10th the capacity of Vera Rubin. Our work represents a pathfinder effort to supply massive data sets of supernova light curves with value-added information that can be used to enable population-scale modeling of explosion parameters and investigate host galaxy environments.



Mentor(s):

Danny Milisavljevic, Purdue University

**Poster Presentation Abstract Number: 220** :: Innovative Technology/Entrepreneurship/Design

## Brain on a Chip: Studying the Mechanisms of Parkinson's Disease through Multi-Modal Biosensors


Author(s):

Maya Godbole, College of Engineering



Abstract:

Parkinson’s disease (PD) is a progressive disorder impacting 2-3% of those 65 years and older. The central nervous system is targeted, leading to symptoms such as rigid muscles, tremors, chronic pain, cognitive impairment, and bradykinesia. There is a need for better tools for high-throughput study of casual mechanisms of environmental and hereditary factors in the development of PD through epigenetic modifications that change gene expression. To this end, we have developed a multi-modal lab on a chip. This device incorporates both optical recombinant biosensors and electrochemical sensors into a single microfluidic channel suitable for neuronal cell culture. The optical biosensors can measure intracellular neurotransmitters (e.g., L-glutamate and dopamine) and epigenetic changes, and the electrochemical sensors can measure extracellular neurotransmitters and metabolites (e.g., lactic acid). At this point we have confirmed the functioning of each component part of the device and that we can culture neurons on top of the glutamate sensors in a microchannel. What remains is integrating them together into one system that can measure neuronal cells culture through each mode simultaneously in real time. Towards this end, we need to study the effect of cell cultures, Matrigel, and cell culture media on the glutamate sensors over time under incubator conditions (37°C and 5% $CO_2$). These conditions may degrade sensor performance (detection limit and sensitivity) over time, interfere with sensing mechanisms or block the target analyte from reaching the sensors. We have incubated glutamate sensor microchannels under various combinations of cell culture conditions and used amperometry (current v. time with fixed potential) to regularly calibrate the sensors and track changes to detection limit and sensitivity. Then, we examined devices with microscopy, probe electrical measurements, and electrochemical techniques, to investigate failure mechanisms. This study is important to realizing a multi-modal lab on a chip for PD, and better understanding the failure mechanisms of enzymatic electrochemical sensors in cell culture systems.



Mentor(s):

Hyowon Lee, Weldon School of Biomedical Engineering

**Poster Presentation Abstract Number: 221** :: Social Sciences/Humanities/Education

**Culturally EnGRIND: An analysis of the socio-cultural impact of Grindr**

Author(s):

Samuel J. Gray, College of Health & Human Sciences, College of Liberal Arts

Abstract:

The social networking application Grindr, a platform launched in 2009 intended for queer male users, is now widely considered to be at the forefront of cultural corrosion in the gay community. Empirical work by researchers Tien Ee Dominic Yeo and Tsz Hin Fung (2018) offers support for the concern that Grindr exerts a detrimental influence over the gay community due to the tempo the platform imposes on social interactions. However, the concept of an entirely queer platform for users to forge connections in a safe virtual setting is enormously beneficial to this social group. Theorist Sharif Mowlabocus (2010) explores the dichotomy of the potential for digital gay communication platforms, acknowledging the promise of increasing connectivity within a minority group, while simultaneously warning of the subcultural proliferation of cybercarnality. This article examines the damage and animosity the structure of Grindr inflicts on the gay community by making sexual objectification a pervasive part of the gay experience, the encouragement of anonymity in intimate interactions, and the increasingly transactional view of others. I propose that it is through the design and structure of Grindr that we observe the mechanisms that encourage objectification and perceived invisibility of self, subsequently promoting these increasingly transactional interactions amongst users. While Grindr is designed to foster communication between members of the gay community, in reality, the nature of these interactions serves to sever feelings of connectivity within this subcultural group. Exploring these shortcomings may elucidate avenues to better forge positive communication methods within this minority community.

Mentor(s):

Paige Frazier, Purdue University

**Poster Presentation Abstract Number: 222** :: Innovative Technology/Entrepreneurship/Design

## Laptop Stand

Author(s):

Thomas Greer, College of Engineering

Abstract:

Abstract redacted.

**Poster Presentation Abstract Number: 223** :: Social Sciences/Humanities/Education

## How Challenged and Banned Books influence Critical Thinking and Inquiry in the Classroom

Author(s):

Marissa Hammett, College of Education

Sydney Terrell, College of Education

Abrianaa Kidd, College of Education

Angela Atwell, College of Education

Abstract:

The purpose of this project is to focus on the phenomena of challenged and Banned Books, and how it impacts critical thinking and the ability of inquiry in the elementary classroom.  The method to do this was the group consulted a magnitude of published literature over critical thinking in the elementary classroom (Hooks, 2010). We analyzed the book “Jacob’s New Dress” by Ian and Sarah Hoffman to come up with our conclusions. Our group took this, and then compared it to other published works that investigated the power of student inquiry and critical thinking. After becoming well informed on the subject, we looked at a real-world example of a banned book and the process that happened to cause it to be banned. This resulted in a critical breakdown of the process of the book ban and the negative impacts it potentially had on the student base it affected. The implications of this research is to prove that not only is banning books a crime against freedom of speech, but it is also a detriment to school districts and the ability for students to relate to non-traditional literature.

Additional resources include the article Culturally Responsive Teaching (Gay, 2002), Critical Thinking (Hooks, 2010), Jacob’s New Dress (Hoffman and Hoffman, 2014) American Library Association website (ALA), Top 10 Most Challenged Books by Years website, and Banned Books Week website.

Mentor(s):

Inna Abramova, Purdue University

**Poster Presentation Abstract Number: 224** :: Life Sciences

## Hypothyroidism as a Model for the Impact of Porcine Reproductive and Respiratory Syndrome Virus Infection on Fetal Development

Author(s):

Caden Helfrich, College of Agriculture

Abstract:

Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) infection of pregnant gilts has devastating effects on the developing fetuses during late gestation. The infection leaves fetuses severely hypothyroid and disrupts proper organ development. The objective of this research study is to further evaluate the relationship between hypothyroidism and the PRRSV infection using a model system based on the goitrogen Methimazole (MMI) to recreate effects of PRRSV in the absence of infection. The tissue samples collected included Ileum (ILE), thyroid (ROID), liver (LVR), kidney (KID), spleen (SPLN), and loin muscle (MUS) of fetuses which were taken from gilts given either MMI or a negative control (CON) on days 85-106 of gestation. Cross sections of Ileum samples were embedded in a paraffin wax and sliced into sections using a microtome to create histology slides of the gut. These slides were stained with Alcian Blue and Nuclear Fast Red to analyze various intestinal metrics using Image J software to gather data such as goblet cell count and villi/crypt areas. Other tissue samples underwent total RNA isolation and reverse transcription allowing for evaluation of MUC genes through qPCR. Using the statistical analysis software R, differences between Control and Methimazole fetuses gut morphology and gene expression were evaluated. Further research is needed to fully understand the effects of hypothyroidism on the developmental pathways of various fetal organs.

Mentor(s):

Alex Pasternak, Purdue University

**Poster Presentation Abstract Number: 225** :: Life Sciences

**Quantifying common epidemiological sources of bovine respiratory disease in beef feedlots in Idaho and Indiana.**

Author(s):

Sarah Hofmann, College of Agriculture

Noelmi Ulloa, College of Agriculture

Erica Long, College of Agriculture

Abstract:

Bovine respiratory disease (BRD) is a disease complex and a major concern among cattle farms across the United States. It is a substantial cause of economic loss through death, weight loss, decreased carcass quality, reduced weight gain, decreased dairy production, and increased treatment costs. Because BRD is a disease complex, it can stem for multiple different factors be it environmental, epidemiological, or genetic. Epidemiologically, BRD is caused by one or multiple pathogens, predominately Pasteurella multocida, Mannheimia haemolytica, Histophilus somni, and Mycoplasma bovis. Currently, farmers rely on clinical signs which often do not appear until it is too late and do not accurately reveal the cause of the disease. The objective of this study is to quantify the amount of each bacterium present in nasal swabs of healthy and BRD affected animals collected from two farms, one in Indiana and one in Idaho. We will use quantitative polymerase chain reaction (qPCR) to quantify each pathogen. We hope to develop an accurate test that farmers can use to identify cattle affected by BRD to decrease economic loss.

Mentor(s):

Timothy Johnson, Purdue University

Tessa Sheets, Purdue University

Carmen Wickware, Purdue University

**Poster Presentation Abstract Number: 226** :: Life Sciences

## Growth Kinetics Characterization of Luminescent L. monocytogenes in Screening Germicides

Author(s):

Kal Holder, College of Science, College of Liberal Arts, Honors College

Abstract:

Listeria monocytogenes is a foodborne pathogen, capable of causing Listeriosis. Therefore, there is a need for intervention protocols reducing contamination. A component of these protocols is the use of germicides for inactivation of target pathogens. This study characterized the growth kinetics of a luminescent L. monocytogenes in a microtiter plate format for future use in a screening germicides.

Overnight cultures of LM Xen32 were prepared from freezer stocks inoculated into 250 mL flasks containing 100ml of Luria Broth (LB) at 37°C,100 rpm. Serial dilutions were prepared from the overnight cultures in LB, brain heart infusion broth (BHI), and minimal salts media with 1% glucose, with and without kanamycin 100mg/L.(MSM).One hundred microliter aliquots were then placed in clear bottom microtiter plates. The plates were monitored for optical density (OD) and luminescence in a Victor nivo plate reader at 37°C every 15 minutes. Specific luminescence was calculated and growth curves were generated for each treatment.

Although experimentation is ongoing, results suggest that the addition of kanamycin has minimal effect on the growth. Furthermore, LB and BHI, with and without kanamycin displayed a faster growth rate than MSM glucose with and without kanamycin.

Bioluminescence is a tool to quantify cell numbers as an alternative to plate count methodology. Current methodology requires serial dilutions to be plated and readings cannot be taken until several days later. With bioluminescence methodologies, readings can be taken in real time. Refinement of this tool can allow for the automation of efficacy and detection testing.

Mentor(s):

Daniel Fajardo, Purdue University

**Poster Presentation Abstract Number: 227** :: Physical Sciences

## Gas-phase Fragmentation of Viologen-based Host-Guest Complexes


Author(s):

Daniel Hristov, College of Science, Honors College



Abstract:

Viologens, a class of molecules composed of a doubly charged bipyridium center and two hydrocarbon-based side chains, have been extensively studied in condensed phase as versatile building blocks for molecular electronics. Host-guest chemistry is commonly used to control the environment around viologens making it possible to stabilize different redox states and prevent dimerization of these species in solution. Studies of host-guest complexes of viologens in the gas phase may be used to characterize their intrinsic properties in the absence of solvent. Although many doubly charged viologens are unstable in the gas phase, previous studies have shown that these species can be stabilized by encapsulation in a host molecule, or molecular container. We present a systematic study of the fragmentation pathways of host-guest complexes of viologens with cucurbiturils and cyclodextrins to gain insights into their structure and stability in the gas phase. Tandem mass spectrometry (MS/MS) experiments were conducted in positive mode on an Agilent 6556 IM-QTOF Mass Spectrometer for accurate m/z determination. We observed that the stability of the doubly charged host-guest complexes of viologens in the gas phase is dependent on the complexity of their side chains, and the host-guest intramolecular interaction. Stronger host-guest interactions result in the loss of a side-chain alkyl cation while keeping the bipyridium center intact. Meanwhile, weaker interactions facilitate the loss of the guest molecule from the host. Furthermore, more complex alkyl side chains fragment more readily. Overall, these results provide a step towards understanding the gas-phase stability of viologen based host-guest complexes.



Mentor(s):

Hugo Samayoa Oviedo, Purdue University

**Poster Presentation Abstract Number: 228** :: Social Sciences/Humanities/Education

**Friendship and the Dormitory Environment**

Author(s):

Zachariah Hunt, College of Science, Honors College

Abstract:

It is often claimed that residence halls without air-conditioning have a much more active and welcoming community than ones with air-conditioning. However, this claim has never been scientifically investigated, and thus this paper seeks to put that statement under scrutiny. Students at Purdue University were invited to fill out a survey at the beginning of the year to obtain preliminary data. Freshmen that chose to opt-in received a follow-up survey after two months. Their residence hall and amount of friends before and after was measured, and a brief personality quiz was given so that introversion/extroversion could be accounted for. Results include estimated number of new friends made in 2 months, as well as overall satisfaction with living conditions.

Mentor(s):

Alexander Francis, Purdue University

**Poster Presentation Abstract Number: 229** :: Innovative Technology/Entrepreneurship/Design

# Flexible and stretchable electrodes for TENG wearable sensors

Author(s):

Blake Iftiger, College of Engineering

Mihika Saxena, College of Engineering

Sriranga Kaluvakala, College of Engineering

Meghan Gron, College of Engineering

Adit Shah, College of Engineering

Conor McCarthy, College of Engineering

Saichandana Pothireddy, College of Engineering

Hongyi Shen, College of Engineering

Abstract:

Wearable sensors have gained prominence for their use in health monitoring and internet of time sensors, by providing useful data in accordance with the body. Electrodes have become a dominant factor in the performance of these sensors. Wearable sensors are usually biocompatible devices, placed on or off the body, that send signals based on how the user acts (1). Having a reliable electrode on these sensors is essential to ensure proper sensor functionality since the electrode determines how well data can be transferred from a wearable sensor to an external circuit, and how well signals transfer. Utilizing flexible and stretchable materials for the electrodes is important to maximize reliability when the device is placed in coordination with the human body. The human body moves in a variety of different ways. For wearable sensors to function optimally, they must adapt to the movements of the body. Flexibility refers to how elastic a material is, and stretchability refers to how much a material can be elongated (2). Metals are commonly associated with good conductors, but semi-metallic polymers are also good candidates for electrodes due to their increased flexibility and stretchability. For the application of wearable sensors, an ideal electrode can be classified by high conductivity and a high degree of flexibility and stretchability. Finding the correct material is imperative to allow these sensors to function at a high degree. This presentation explores common electrode materials and characterizes their applicability to wearable sensors by evaluating their performance within three essential categories: conductivity, flexibility, and stretchability.

Mentor(s):

Nachiket Vatkar, Purdue University

**Poster Presentation Abstract Number: 230** :: Mathematical/Computation Sciences

## Analyzing the Effects of External Magnetic Fields on Commercial MRAM Module

Author(s):

Julian Kang, College of Engineering

Hana Wong, College of Engineering

Hansoo Kim, College of Engineering

Abstract:

External magnetic random-access memory (mRAM) is a type of non-volatile memory that stores bits through magnetic tunnel junctions arrays. mRAMs are of great interest to hardware developers because mRAM has the potential to replace sRAMs (static random access memory), dRAMs (dynamic random access memory), and HDD(hard disk drives) because it’s non-volatile, has high processing speeds, and has a high density for RAMs. The goal of this project is to test the security of commercial mRAM modules when different levels of magnetic fields are applied, as the data stored in the magnetic tunnel junctions present in the mRAM are susceptible to be modified by external magnetic fields.  Further progression of this project is to create and implement methods to make a mRAM module a more secure non-volatile memory by adjusting the individual magnetic tunnel junctions susceptibility to indicate when magnetic fields are present in the mRAM’s environment and control the operation of the mRAM based on that condition.

Mentor(s):

Joerg Appenzeller, Purdue University

**Poster Presentation Abstract Number: 231** :: Physical Sciences

## Lap Shear Testing of Adhesives Made from Corn Protein and Tannic Acid


Author(s):

Logan Kitts, College of Science

William Lock Falcon, College of Science



Abstract:

Corn zein is generally regarded as safe, thus there are several uses in the food, pharmaceutical and biomedical industries. Zein protein is resistant to heat, humidity and abrasion. Coatings can be fast and easy to prepare. We are interested in developing coatings and adhesives for applications in packaging. In our previous research, we have presented adhesive systems made from corn zein and tannic acid. Tannic acid stood out for cross-linking properties and potential for high strength adhesive bonding. Here we show how adhesives made from zein and tannic acid work on aluminum substrates when glutaraldehyde is added. Glutaraldehyde is used to i) coat the aluminum surfaces and ii) is added during formulation.  We use lap shear testing for determining the adhesive performance and evaluating failure modes. The aim is to investigate how adhesive failure (observed for the zein only control) and cohesive failure (observed for a zein tannic acid) change when glutaraldehyde is added. Adhesive failure is observed when the bulk adhesive is retained on only one aluminum surface. Cohesive failure is observed when the adhesive bulk is ripped apart during lap shear testing, and the adhesive is retained on both surfaces. Control over the failure modes may allow for removal of the adhesive from packaging after it is not needed any more. With high strength bonding and the ability to separate substrates after use, our zein-tannic acid adhesives may help transition to sustainable materials and a cleaner environment.



Mentor(s):

Gudrun Schmidt, Purdue University

**Poster Presentation Abstract Number: 232** :: Social Sciences/Humanities/Education

## A Collection of Case Studies on the Prevalence and Impact of Undergraduate Research at Purdue

Author(s):

Mikayla Klemp, College of Liberal Arts

Abstract:

Purdue was founded for undergraduate researchers. Rather than a means to employing professors and other academic professionals, the point of a university is to allow students to gain knowledge and expand upon it in a way that benefits not only themselves, but the world they enter upon graduation. I've been researching the history of undergraduate research at Purdue since January 2022 with the help of the Office of Undergraduate Research and Purdue's Archives and Special Collections. This comprehensive survey was commissioned to discover just how undergraduates have conducted research at Purdue from its founding in 1869 to the present. My main methods of investigation were searching digitized Purdue Exponents and other newspapers from the 1890s through the present. Purdue Board of Trustees minutes, Purdue history books, and photographs were also used for this research. The end goal of this project is to create a timeline of undergraduate students and their contributions to research over the course of Purdue's history, which will be released in April 2023. In the meantime, this poster will highlight several case studies of the more interesting individuals discovered during my research. These will be presented with respect to four topics: exceptional women, transportation, agriculture, and surprising finds. Presentation of this topic is meant to stir students' curiosity and inspire research of their own during their time enrolled at Purdue University.

Mentor(s):

Adriana Harmeyer, Purdue University

**Poster Presentation Abstract Number: 233** :: Life Sciences

## Anti-Listeria monocytogenes (Lm) Activity on Cheese by bioengineered Lactobacillus probiotics (BLP)

Author(s):

Xilin Li, College of Agriculture

Abstract:

Listeria monocytogenes (Lm) is a rare but deadly foodborne pathogen usually associated with dairy products, such as soft cheese. Listeria adhesion protein (LAP) can bind pathogenic Lm with high affinity. Based on this observation, we assume overexpressing LAP on Lactobacillus casei (Lbc) cell surface can effectively bind and restrain the growth of Lm cells. We tested the Lm inhibitory effect of LbcLAP by co-culturing Lm and LbcLAP together in cheese broth for 7 days. Lm, Lbc WT, LbcLAP , Lm + Lbc WT and Lm + LbcLAP were inoculated at 3 x 103 CFU/ml on mozzarella cheese broth (0.49%) at 25°C. Lm counts in different treatments were plated and pH of the cheese broth was measured daily for 7 days. The results show a significantly lesser Lm count in Lm + LbcLAP co-culture group, but not the Lm + LbcWT on Day 4 or thereafter. However, both groups maintained a similar pH of about 6 starting from day 2. To further investigate the molecular basis of how LbcLAP inhibits the Lm growth on cheese products, we will look for other metabolites produced by LbcLAP that could modulate the environment to become unfavorable for Lm growth.

Mentor(s):

Bhunia Arun K, Purdue University

Nicholas Leo Frank Gallina, Purdue Universit

**Poster Presentation Abstract Number: 234** :: Physical Sciences

## Plant-Based Adhesives made from Corn Protein and Lignin

Author(s):

William Lock Falcon, College of Science

Logan Kitts, College of Science

Abstract:

Books that contain synthetic adhesives cannot be easily recycled, and metals are hard to separate from electronics due to the adhesive being permanent. Many plastics that pollute the oceans are glued together by permanent adhesives that do not fail after they are not needed anymore. Replacing some synthetic adhesives with plant-based ones that perform equally well, may lead to an increase in sustainability and better materials ecosystems. Adhesives made from corn protein zein have shown significant potential. These new systems can be formulated from plant-based materials, without the use of time-intensive and expensive synthetic chemistry. Here we show that two adhesive systems made from the components i) zein and lignin and ii) zein and tannic acid work well on aluminum substrates. We present the properties of selected formulations that show trends in bond strengths when the compositions are changed. To achieve near Super Glue strength, each system requires different sample preparation and adhesive formulation. We evaluate temperature-dependent curing, pH changes, and crosslinking variables that influence adhesion. Performance from lap shear testing of samples cured at room temperature is compared to samples that were cured at high temperatures. Zein–lignin based adhesives formulated at a low pH are stronger than those prepared at a neutral or basic pH. Different crosslinking agents are tested with selected formulations. Adhesion data are correlated with changes in color, age, and pH of adhesives. With these new adhesives, we aim to be closer to a sustainable environment.

Mentor(s):

Gudrun Schmidt, Purdue University

**Poster Presentation Abstract Number: 235** :: Life Sciences

## Quantifying the abundance of Mannheimia haemolytica, Pasteurella multocida, Histophilus somni, and Mycoplasma bovis 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 and viral disease that affects both the lower and upper respiratory tract in both beef and dairy cattle. There is also a high economic impact due to treatment, death, and decreased feed efficiency. There are four bacteria normally present in the upper respiratory tract of healthy cattle; Mannheimia haemolytica, Pasteurella multocida, Histophilus somni, and Mycoplasma bovis. Elevated levels of the bacteria have been observed in isolated lung tissue samples of sick cattle, but in most of the cases, isolation can only be done post-mortem. The objective of this project is to quantify the abundance of Mannheimia haemolytica, Pasteurella multocida, Histophilus somni, and Mycoplasma bovis present in nasal swab samples of beef cattle diagnosed with BRD clinical signs compared to visually healthy animals. Nasal swabs were collected from two different farms in Texas and Colorado, 96 samples from BRD cattle and 98 samples from healthy cattle. We performed a Quantitative polymerase chain reaction (qPCR) test to measure the prevalence and difference in abundance of the four bacteria in the nasal cavity between BRD clinical cattle and visually healthy animals. We hope to determine if nasal swabs could be an accurate site to take samples to test for BRD in cattle. Quantifying the amount of bacteria in BRD positive animals will potentially identify a threshold that can be used to identify animals that have BRD or not.

Mentor(s):

Timothy Johnson, Purdue University

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

# Simultaneous colorimetric and electrochemical detection of mercury using a portable and miniaturized aptasensor

Author(s):

Alec Lucas, College of Engineering, Honors College

Abstract:

In this work, a mercury sensing device was developed consisting of a miniaturized three electrode system and two integrated colorimetric paper-based microfluidic components. Devices can tested easily and quickly with a smartphone camera and therefor can be used on site. The colorimetric detection mechanism uses aptamer functionalized polystyrene with gold and silver nanoparticles (PS-AgNPs and Ps-AuNPs). The Ps-AuNPs-based system allows qualitative detection (LOD 5 ppm) and stability over seven days. For the Ps-AgNPs-based system, the detection limit is 0.5 ppm with a linear range from 0.5 to 20 ppm and stability over 30 days. The electrochemical component presents a linear range from 0.01 to 1 ppm with a LOD of 0.01 ppm and performance stability over seven days. The diverse mechanisms offers a dual detection platform which minimizes false results including in real samples. In river water samples, the colorimetric system showed recoveries up to 105.61% and the electrochemical showed 91.12%. This system is also highly selective against other strong metals such as As2+, Cu2+, and others and resulted in no false positive or negative results.

Mentor(s):

Ana Ulloa Gomez, Purdue University

**Poster Presentation Abstract Number: 237** :: Innovative Technology/Entrepreneurship/Design

## Happy Hour

Author(s):

Meredith Lucero, College of Health & Human Sciences

Payton Hartman, College of Health & Human Sciences

Ava Torrance, College of Health & Human Sciences

Deforest Williamson, College of Health & Human Sciences

Abstract:

Happy Hour is a subscription-based live-streaming service that will provide real-time lines and wait times outside of each of the bars on Purdue University's campus. The concept of Happy Hour is intended to decrease the undesirable lines and wait times that customers endure at the bars while increasing overall customer satisfaction based on a time-efficient solution. Happy Hour is designed to maximize customer satisfaction for those who choose to spend their social hours at the bars on campus. The long wait times and lines outside of these establishments create barriers to the needs of the customers is met. Through this service, we hope to a) increase the social desire and satisfaction for customers in a more efficient time frame, b) maximize the time spent inside each establishment and, c) Decrease the time spent waiting in line and overall feeling of customer time being wasted. This app could include add-on features such as placeholders in lines, a week-by-week view of what specials and events are happening at each establishment, and the expected cover charge based on these events. Happy Hour could potentially encourage a more seamless social atmosphere for students and other guests of these establishments and local bars could see a potential occupancy and revenue gain.

Mentor(s):

Sandra Sydnor, Purdue University

**Poster Presentation Abstract Number: 238** :: Innovative Technology/Entrepreneurship/Design

## Biomedical Unmanned Aerial Vehicle for Narcan Delivery

Author(s):

Drew Lundin, College of Engineering, Honors College

Nathan Arnold, College of Engineering

Alex Hanna, College of Engineering

Amir Issa, College of Engineering

Stanley So, College of Engineering

Rohan Rajesh, College of Engineering

Shrijan Swaminathan, College of Engineering

Abstract:

Opioid overdose is a growing public health crisis in Indiana with a 50% increase in opioid overdose deaths from 2019 to 2020. Fortunately, Narcan is an easily administered drug that can reverse an overdose. However, oxygen deprivation from an overdose can cause brain damage within 6 minutes and some rural Indiana counties have an emergency medical service (EMS) response time of 17 minutes. This project seeks to design an Unmanned Aerial Vehicle (UAV) that autonomously delivers Narcan and instructs bystanders to administer the treatment, supplementing current EMS capabilities.

We derived vehicle flight performance requirements modeling current EMS infrastructure and the impact of cooperatively deployed UAVs. Then using physics simulations, we iterated vehicle configurations and compared components to best meet the requirements. The design process also included an evaluation of various path-planning methods, considering speeds and necessary hardware for each. The proposed UAV would increase the EMS coverage area of Indiana. The vehicle would navigate to a victim using a Vector Field Histogram algorithm identifying obstacles with a depth camera and could be controlled by a human operator through a 4G-enabled companion computer for added reliability. A bystander could access the Narcan from the payload dispenser, and follow video and audio instructions played by the vehicle. With the ability to rapidly reach far distances, autonomously land, and provide lifesaving drugs and instructions to bystanders, a fleet of Narcan delivery UAVs would provide EMS responses to areas where ambulances cannot reach in time, improving the medical outcomes of overdose victims.

Mentor(s):

James Goppert, Purdue University, School of Aeronautics and Astronautics

Nan Kong, Purdue University, School of Biomedical Engineering

**Poster Presentation Abstract Number: 239** :: Social Sciences/Humanities/Education

## Purdue Induction Mentoring: Supporting Newly Qualified Teachers During Their First Two Years

Author(s):

Micaela Menchaca, College of Health & Human Sciences

Abstract:

The importance of induction mentoring has been emphasized in studies and teacher education since its conceptualization in the 1980s. Yet, many first-year teachers are challenged to continue the development of pedagogical content knowledge (PCK) initiated in academic programs, of teacher resilience, of a sense of community in their district and with local stakeholders. Our research aims to address these challenges and can be broken down into two main goals: 1) identify common needs in Purdue's induction mentoring program and 2) implement changes in Purdue's induction and mentoring program based on those needs. To determine areas of challenge and need, we will conduct focus group interviews to document pre-service teacher narratives prior to induction and through their first two years of in-service teaching. Transcription of interviews collected across the two years will be entered into a coding program to detect common mentoring needs. Based on the previous literature, we anticipate finding themes established in past studies including issues with teacher burnout, a lack of belonging, and gaps in knowledge about disciplinary action, coping resources, and PCK integration. We anticipate making changes to the induction mentoring program informed by current needs will yield positive results in improved PCK development, increased feelings of community/belonging amongst new teachers, and an increase in teacher retention rates.

Mentor(s):

Signe Kastberg, Purdue University

Stephanie Oudghiri, Purdue University

**Poster Presentation Abstract Number: 240** :: Physical Sciences

## Characterizing Differential Reflectivity Calibration Dependence on Environmental Temperature using the X-band Teaching and Research Radar (XTRRA)


Author(s):

Emma Miller, College of Science, College of Science



Abstract:

Calibration scans are important for the maintenance of data and the quality of the information that radars output. In this study we looked for a temperature dependency in a full years' worth of differential reflectivity (ZDR) calibration scan data collected by the X-band Teaching and Research Radar (XTRRA) located near the Purdue campus in 2021. To process the data, a Python script was written to be used by the students in Radar Meteorology (EAPS 523) as part of their Course-based Undergraduate Research Experience (CURE). The ZDR mean values were then compared to the temperature data from the FAA Automated Surface Observing System (ASOS) station located at the Purdue Airport in West Lafayette (KLAF). A potential relationship was found when temperature changes occurred over a short period of time. ZDR mean changed inversely to temperature, a quick rise in environmental temperature corresponded to a decrease in ZDR mean relative 0 dB, and vice versa. A weak positive correlation of 0.487 was found for ZDR means over the full range of data, -0.2 dB through 0.8 dB. The XTRRA is housed in a radome and has temperature regulation via the internal air conditioning systems in Wang Hall. We speculate that we don't see a stronger relationship because the KLAF ASOS station experiences more solar radiation and is therefore warmer than the cooled radar, as well as the fact XTRRA and the station are situated 3.6 km apart.



Mentor(s):

Robin Tanamachi, Purdue University

**Poster Presentation Abstract Number: 241** :: Innovative Technology/Entrepreneurship/Design

## Sustainable Air Conditioning by Combining Membrane Air Dehumidification and Dew Point Evaporative Cooling


Author(s):

Maisha Mumtaz, College of Engineering



Abstract:

In the United States, approximately 46% of total building energy consumption is attributed to heating, ventilation, and air conditioning systems (HVAC), and 21% of electricity consumption in the commercial and residential sectors is due to space cooling. With the added issue of global warming, cooling and dehumidification loads are expected to further increase in the future. Current practices involve the use of a vapor compression cycle to cool and dehumidify air through condensation dehumidification using refrigerants which can be environmentally hazardous. This process is associated with large energy penalties relating to phase change of moisture, thus necessitating the exploration of alternative technologies. Combining membrane-based dehumidification with dewpoint evaporative cooling avoids the energy-intensive process of moisture condensation while efficiently cooling the air without the use of harmful refrigerants. This paper presents a thermodynamic model of an integrated system consisting of the dual membrane module dehumidifier combined with a dew point evaporative cooler. A parametric study is performed for different ambient conditions to investigate the system performance. Results show a system coefficient of performance (COP) value ranging from 2.2 to as high as 12.8 with a median value of 3.1. The system also displays potential for having its own self-sustaining water supply for cooling at outdoor humidity ratios above 0.015 kg water/ kg dry air. The modeling results show the technology to be promising and display potential scalability in the future to be used as commercial HVAC equipment.



Mentor(s):

David Warsinger, Purdue University

James Braun, Purdue University

**Poster Presentation Abstract Number: 242** :: Innovative Technology/Entrepreneurship/Design

**Implementation and Verification of an Embedded Multiprocessor with Shared L2 Memory**


Author(s):

Robert Murphy, College of Engineering, Honors College

Pranav Jagada, College of Engineering

Jimmy Jin, College of Engineering



Abstract:

A multiprocessor system can produce faster program execution at similar energy consumption levels as a uniprocessor by allowing multiple instructions to be executed simultaneously. A major obstacle in such a system is maintaining clean and cooperative operation between the different processors. Otherwise, data can be corrupted, given the multiple on-chip locations for data in the distributed cache hierarchy within a multiprocessor. To achieve the outlined benefits, a dual core processor will be created for the SoCET team's microprocessor. Split L1 caches, along with a unified, shared L2 cache will be implemented; this will provide higher execution throughput and limit accesses through the bandwidth-limited off-chip memory. To tackle the main challenge posed by a multiprocessor design, a MESI cache coherence protocol will be implemented to prevent data corruption. In addition, synchronization for parallel programs will be supported in the hardware architecture to ensure programmability. Completeness and correctness of the system will be verified using an industry standard method - Universal Verification Methodology (UVM). It is expected that adding a dual-core processor to the existing microprocessing unit will greatly improve performance by decreasing program execution time. Upon completion, the dual core system will be benchmarked against the uniprocessor implementation through computer simulation and hardware testing in a lab.



Mentor(s):

Mark Johnson, Purdue University

Cole Nelson, Purdue University

**Poster Presentation Abstract Number: 243** :: Physical Sciences

## On Using Radar Reflectivity to Assess the Impact of Changing Temperature on Rainfall

Author(s):

Ryan Navarre, College of Science

Abstract:

Earth's climate has been rapidly changing on account of anthropogenic processes, which may impact short term weather events such as rain. This study attempts to discover a relationship between radar reflectivity as a proxy for rainfall and the local surface temperature by making use of GridRad, an archive of gridded radar data from across the contiguous United States. Five locations, each with a unique climate, across the contiguous United States were chosen based on the location of an Automated Surface Observing Station (ASOS) and its proximity to a WSR-88D weather radar, while also attempting to reduce urban heat island effects as much as possible. The radar reflectivity at this location from the summers of 2008 through 2016 (April 1 through August 31) was compared with the associated surface temperature for every rain event observed by the ASOS station. Among all five sites, no significant correlation between rainfall and surface temperature was found. However, when a time series of temperature and rainfall were plotted, each location exhibited different trends in both radar reflectivity and surface temperature. This suggests the relationship has a climatological and/or geographical dependence if any at all. All locations showed clear positive or negative trends in reflectivity over time. However, this may be an artifact of the limited window of time and the temporal resolution that was studied. Further investigation with higher temporal resolution for a longer period of time is required to assess these trends to a higher degree of accuracy and should also include non-rain events.

Mentor(s):

Robin Tanamachi, Purdue University

**Poster Presentation Abstract Number: 244** :: Innovative Technology/Entrepreneurship/Design

## Tree Positioning and Localization


Author(s):

Elbek Nazarov, College of Engineering

Akshat Verma, College of Engineering



Abstract:

In forestry, it is incredibly difficult to know exactly where each tree is when creating an inventory of a plantation. Our research is trying to find a method in which we can determine the precise location of a tree for use in inventory analysis. Currently, we are experimenting with Ultra-Wideband (UWB) technology as a method for determining the location of a tree in GPS compromised areas. A surveyor could hold a UWB device and get real time data on where their location is relative to the plantation. Our ultimate goal is to map any local tree plantation using our UWB positioning method to global coordinates, in order to have an accurate understanding of where each tree lies within a global system. In this case, anyone in forestry that needs an accurate map of their tree plantation for inventory analysis, can replicate our method within their own local system, and transfer that mapping to a global one.



Mentor(s):

Guofan Shao, Purdue University

**Poster Presentation Abstract Number: 245** :: Physical Sciences

**SoCET Analog/Mixed Signal Project: 915Mhz Wireless reciever**

Author(s):

Long Nguyen, College of Engineering

Abstract:

Wireless communication is the building block of the modern world as the idea of transmitting information with an electromagnetic wave can be conducted with radio transceivers for sending and receiving messages. We are utilizing the 915 MHz unlicensed frequency band for our wireless receivers. As the project is still in its infancy, further calculation as well as simulation are still in progress and we can't wait to share our result.

Mentor(s):

Sarang Pramod, Purdue University

**Poster Presentation Abstract Number: 246** :: Innovative Technology/Entrepreneurship/Design

# Flight Hardware Manufacturing for FEMTA Suborbital Spaceflight Experiment


Author(s):

Tyler Nord, College of Engineering

Vebjorn Moskvil, College of Engineering

Abhirama Rachabattuni, College of Engineering

Ata Toraman, College of Engineering



Abstract:

The FEMTA (Film Evaporation MEMS (Micro-Electro-Mechanical Systems)Tunable Array) Suborbital Spaceflight Test is an experiment whose goal is to test the FEMTA thruster in a 0g environment. The FEMTA experiment comprises two sub-experiments, the propellant management system, and the thrust measurement. The experiment will launch aboard Blue Origin's New Shepard rocket in the Summer of 2023. The propellant management system will verify that vaporization of hydrofluoric ether is able to deliver a continuous flow of deionized water to a collection chamber representing the FEMTA thruster. Running in parallel, the thrust measurement experiment will characterize FEMTA thruster performance in 0g by measuring its continuous thrust. This experiment uses a second copy of the propellant tank used in the propellant management system and a FEMTA thruster instead of the collection chamber, operating the propellant tank and thruster as they would on-board a satellite.

The project is in the final manufacturing stage and production is currently focused on the optimization and construction of the flight hardware, including the propellant management system, the thrust stand experiment, and the avionics assembly. Results from component testing are analyzed and used to inform necessary design changes. From there, these components are manufactured from aluminum and corrosion resistant Delrin plastic at the Bechtel Innovation Design Center and the Purdue Aerospace Sciences Lab. The manufacturing objective for this semester is to manufacture all the flight hardware with help from the testing and development team, while minimizing weight and maximizing manufacturability.



Mentor(s):

Katherine Fowee Gasaway, AAE

Steven Pugia, AAE

Jesus Meza Galvan, AAE

**Poster Presentation Abstract Number: 247** :: Innovative Technology/Entrepreneurship/Design

**The Future of Unmanned Systems - Purdue Aerial Robotics Team (PART)**

Author(s):

Matthieu Opdyke, College of Engineering, Honors College

Eric O'Keefe, College of Engineering

Diego Montes, College of Engineering, Honors College

Hadi Ahmed, College of Engineering

Corey Auerbach, College of Engineering

Joao Paulo Ymayo, College of Engineering

Andrew Swanback, College of Engineering, College of Engineering

Evan Kamm, College of Engineering

Leonard Jung, College of Engineering

Jake Mohler, School of Management

Abstract:

PART is developing a two-vehicle system to compete in the Association of Unmanned Vehicle Systems International (AUVSI) Student Unmanned Aerial Systems (SUSA) competition. PART's Uninhabited Aerial System (UAS) air-drops an Uninhabited Ground Vehicle (UGV), both of which will complete a series of tasks demonstrating their ability to operate and navigate autonomously while performing remote sensing missions representative of real-world problems. While PART's tactical goal is to place top five in the competition, PART's strategic goal is to execute a comprehensive approach to interdisciplinary design, prototyping, and systems engineering by incorporating industry best-practices to mature students into principled industry leaders for their post-undergraduate careers.

Maturing UAS's ability to function within the National Airspace System (NAS) is a top priority for NASA and the FAA. Additionally, the US Department of Defense (DoD) and its international partners are seeking autonomous solutions to reduce the warfighters direct exposer to danger. PART is fostering an ecosystem to mature undergraduate students for academic, industry, and government engineering and business management positions that help NASA, the FAA, and the DoD close the existing capability gaps in UAS maturity. Specifically, PART addresses five Aeronautics Research Mission Directorate (ARMD) Strategic Thrust objectives: (1) Safe, Efficient Growth in Global Operations, (2) Ultra-Efficient Subsonic Transports, (3) Safe, Quiet, and Affordable Vertical Life Air Vehicles, (4) In-Time System Wide Safety Assurance, and (5) Assured Autonomy for Aviation Transformation. Through the development of their next-generation UAS, PART has achieved an integrated design that carves a path to meet and exceed these objectives

Mentor(s):

Shreyas Sundaram, Purdue University

**Poster Presentation Abstract Number: 248** :: Social Sciences/Humanities/Education

**Purdue Galleries: The Stories Objects Tell**

Author(s):

Kayla-Marie Otero, College of Liberal Arts

Abstract:

The objective of this project was to introduce students to anthropology and its role in museums by studying some of the 5600 objects in Purdue Galleries' permanent collection. There was a focus on cultural anthropology and ethnographic pieces. Research began by studying donor files. From there, the origin, uses, sociopolitical history, and cultural significance of the objects were uncovered through research in books and websites. The objects selected included images taken by Charles Pansirna of Chicago's Lithuanian community, Native American baskets, Native American ivory jewelry, a pendant depicting the Navajo story of the Whirling Logs, an Ashanti akua'ba, a prayer wheel from Afghanistan, an Ethiopian diptych, a kamanggabi replica from Papua New Guinea, a lithograph titled "Transformation" by Özlem (Özgür) Silverstein, and a lithograph titled "Hombre y Pescado y el Pozo" by Francísco Toledo. Little information was available about certain groups, like the Arambak of Papua New Guinea. Other pieces had plenty of information regarding the makers but little about the objects. Further investigation may be conducted regarding the history and contemporary significance of their heritage. This would involve primary sources, which may be difficult to obtain for many of the pieces.

Mentor(s):

Lana Newhart-Kellen, Purdue University

Erika Kvam, Purdue University

**Poster Presentation Abstract Number: 249** :: Mathematical/Computation Sciences

**Cyber Forensics Investigation of Web3 Wallets**

Author(s):

Akif Ozer, College of Science

Abstract:

Blockchain-based technologies such as cryptocurrencies (e.g., Bitcoin, Ethereum) and Non-fungible token (NFTs) are gaining huge popularity in recent years and will counting to be with all the technology advances constantly happening.  Online payment with digital assets (i.e., cryptocurrencies) is growing; therefore, they are popular mean to be used in dark web as anonymous payment. This popularity is also increasing the criminal activities involving cryptocurrencies and NFTs. Therefore, blockchain-based technologies are creating new challenges for the law enforcement. Cryptocurrencies and NFTs are stored in Web3 technology called wallets. However, Web3 wallets are not studied thoroughly from a digital forensic perspective. Current popular tools used in digital forensics such as Axiom and Autopsy, do not automatically extract mobile cryptocurrency application artifacts.

This research aims at looking into mobile Web3 cryptocurrency wallets applications as a subjected to cyber forensic study, to investigate what can be recovered, and to highlight privacy and security concerns related to the investigated applications.

Mentor(s):

Umit Karabiyik, Purdue University

**Poster Presentation Abstract Number: 250** :: Life Sciences

## Niche partitioning between American bullfrogs and green frogs

Author(s):

Lucas Papai, College of Science, College of Science

Abstract:

The competitive exclusion principle posits that no two species can occupy the exact same niche and coexist in the same area at the same time. While this hypothesis makes intuitive sense, a quick observation of natural communities reveals they are full of species that are superficially very similar. An example of this is the North American bullfrog (Lithobates catesbeianus) and the green frog (L. clamitans). Both belong to the same ecological guild, being of similar size and eating the same prey, making an apparent exception to the competitive exclusion principle Investigation into this quandary in similar situations with rodents has demonstrated that there is character displacement for body size when rodents of the same guild occur together. In this study, we aim to test whether body size can be used as a measure of character displacement, and thus niche partitioning, for bullfrogs and green frogs. Using a measure of relative abundances for the snout-vent length for both frogs, a correlative approach will test the hypothesis that the populations in communities with both species have differentiated their body size.

Mentor(s):

Catherine Searle, Purdue University

**Poster Presentation Abstract Number: 251** :: Physical Sciences

## Using Affordable Acoustic Recording Units to Understand the Acoustic Community and Its Relationship to Noise from Low Flying Airplan Engines


Author(s):

Conner Partaker, College of Science, College of Science, Honors College

Josephine Haydock, College of Science, School of Management, Honors College

Larkin Nickle, Polytechnic Institute, Honors College

Lily Peck, College of Science, College of Liberal Arts, Honors College

Annabelle Pitt, College of Science, Honors College

Palak Prashant, College of Science, Honors College

Nicholas Ryan, College of Science, Honors College



Abstract:

The noise generated by low flying airplane engines has vastly changed natural soundscapes in environments in communities across the country. In particular, smaller regional airports with training programs host a larger proportion of low flying aircrafts with shorter flights. One field of study is soundscape ecology that uses non-invasive acoustic sensors to measure biodiversity and its relationship with noise. Noise is a known stressor that impacts wildlife, but little is known about low flying aircraft engine noise and its impact on wildlife. In a small midtown community, we conducted a pilot study to see how the frequency of low flying aircraft might impact the acoustic community. To do this, we deployed affordable and portable acoustic recording units (Audio Moths) at seven locations across three transects that extend from the Purdue University Airport runway to forested habitats at one mile and three miles from the airport in West Lafayette for four weeks in October 2022. We compiled a noise map of the region collecting dBA points along the transects and generated airplane acoustic signatures. Then, we analyzed the audio files to determine if there was change in the acoustic community relative to airplane frequency.  This pilot project will be used for the development of AI-based tools that can automatically detect airplane acoustic signatures. We aim to share our findings with small regional airports about how low flying airplane noise patterns in forested habitats might affect the acoustic community.



Mentor(s):

Kristen Bellisario, Purdue University

**Poster Presentation Abstract Number: 252** :: Life Sciences

## Development of an Impactor to Collect Pathogenic Bioaerosols


Author(s):

Nicholas Pecoraro, College of Health & Human Sciences, Honors College

Anthony Bovenschen, College of Health & Human Sciences



Abstract:

Airborne biological particles (called bioaerosols) are found in various environments such as healthcare, agricultural, and biomedical facilities. Some bioaerosols are pathogenic and can cause diseases. Airborne SARS-CoV-2 causing COVID-19 and Legionella Pneumophila (L. Pneumophila) causing Legionnaires disease are examples of pathogenic bioaerosols. They can be aerosolized from the soil, water, animal, or human, suspended in the air for a long time, and inhaled. To prevent or minimize exposure to pathogenic bioaerosols, a rapid detection method is required. The current detection method involves collecting bioaerosols before being observed and analyzed. However, this method is generally time-consuming and expensive. To overcome the limitations, we developed an impactor to combine it with an antigen test kit which is a more rapid and inexpensive method. We determined the cut-off diameter of the impactor (d50) in various conditions using the simulation model. Specifically, the optimal number of jets and airflow rate to reach the target d50. The d50 value is important because it will allow control over the size of the aerosols captured. The target d50 was set to 0.5 µm which means the impactor can collect bioaerosols larger than 0.5 µm and is enough to collect a single cell of Legionella Pneumophila (1 µm). After finding the optimal parameters, we fabricated the impactor and evaluated the collection efficiency. We will combine the developed impactor with the previously mentioned analysis methods in the future.



Mentor(s):

Jae Park, Purdue University

Li Liao

**Poster Presentation Abstract Number: 253** :: Physical Sciences

## Quantum Integrated Pholtonics


Author(s):

Stanislav Pelipad, College of Engineering



Abstract:

Silicon photonic integrated circuits (PICs) can enable low cost, small size, and high complexity solutions for many applications such as telecommunications, sensing, and quantum. An indispensable component in PICs are phase shifters – allowing one to control the relative phase of the light in an on-chip waveguide. For silicon PICs, phase shifters typically use the thermo-optic effect by which the refractive index modulation (and therefore phase modulation) is related to the temperature of the waveguide. In this work, we consider different thermo-optic heater architectures for silicon PICs and compare their thermal tuning efficiency using the finite-element heat transport solver Lumerical HEAT. Our target application is for arrays of thermally-tunable microring resonators, where the resonance frequencies of each microring can be controlled by an in-ring thermo-optic phase shifter.” Once this design specification is meet, my findings will be sent to the senior VIP team to help with their IC design.



Mentor(s):

Lucas Cohen, Purdue University

**Poster Presentation Abstract Number: 254** :: Physical Sciences

# Beyond 5G


Author(s):

Thwandall Philemon, College of Engineering

Daanish Suhail, College of Science

Zijie Mai, College of Engineering

Ryan Sui, College of Engineering

Elbek Nazarov, College of Engineering

Vanessa Farrell, College of Engineering



Abstract:

The purpose of our team is to understand and implement basic ideas of upcoming 5G-6G technologies. In order to do this, the team split into four subteams investigating USRP, error correction codes, 5G simulation, as well as producing a general survey of emerging 5G-6G technologies.

Error correcting code is code implemented when correcting faulty signals during the receiving or sending process. As network speed increases, data is more subject to noise. In this project, we will explore different code options to address errors that will occur during signal communications.

The USRP device is very useful in designing, and deploying wireless systems with custom signal processing based on the usage context and the user preferences. The team is working with a USRP to be able to program it for communication purposes. Thus the sub team that is working on the USRP will learn how to use the USRP API and GNU radio to be able to learn and effectively program the USRP for digital communications.

For the survey report of development of the 5G-6G, we investigated four emerging technologies. Massive MIMO, full duplex antenna, and mm-Wave are the main areas we will be focusing on. The ultimate goal is to explore the current development and latest research of 5G communication technology.

In order to understand some of these technologies, we are trying to use the 5G simulator NYUSIM. The main goal is to figure out each parameter in the NYUSIM and how each one contributes to the figures that it generates.



Mentor(s):

Chih-Chun Wang, Purdue University

James Krogmeier, Purdue University

Sameer Mathad, Purdue University

**Poster Presentation Abstract Number: 255** :: Innovative Technology/Entrepreneurship/Design

# Fundamental mechanism and performance of triboelectric nanogenerators


Author(s):

Saichandana Pothireddy, College of Engineering, Honors College

Meghan Gron, College of Engineering, Honors College

Blake Iftiger, College of Engineering

Conor McCarthy, College of Engineering

Mihika Saxena, College of Engineering

Hongyi Shen, College of Engineering

Sriranga Kaluvakala, College of Engineering

Adit Shah, College of Engineering



Abstract:

Triboelectric nanogenerator (TENG) is an emerging technology that provides environmentally friendly and sustainable alternatives to current electronics and sensor technology. TENGs are small-scale devices that produce electrical energy by converting ambient mechanical energy that would otherwise be unutilized. Additionally, these devices are self-powered and have a small form factor, which makes them suitable for various applications, such as the development of smart wearable sensors. This technology relies on triboelectrification, a type of contact electrification that is driven from friction. Contact electrification is the process of two different materials becoming electrically charged after contact, and these charges are redistributed within the TENG device by electrostatic induction to produce an electrical output [1]. TENGs require some form of contact to convert mechanical energy into an electrical output. There are various contact modes, and each can influence the performance and energy output of a TENG device. The four fundamental contact modes are vertical contact separation, lateral sliding, single-electrode, and freestanding triboelectric layer [2]. The performance of TENGs also relies on the device architecture. The architecture of the device primarily concerns the number of dielectric layers included in the device. Three possible device architectures are the binary electrification layer TENG (BEL-TENG), the ternary electrification layer TENG (TEL-TENG) [3], and the opposite-charge-enhanced transistor-type triboelectric nanogenerator (OCT-TENG) [4]. Optimizing these two aspects of TENGs during the design process can improve their overall performance. TENGs are worth investigating, as they have the scope to revolutionize current approaches to creating eco-friendly and self-powered sensors and wearable devices.



Mentor(s):

Nachiket Vatkar, Purdue University

**Poster Presentation Abstract Number: 256** :: Life Sciences

## Implementing a non-invasive model of PTOA in skeletally mature mice

Author(s):

Graham Ragland, College of Engineering

Abstract:

Post-Traumatic osteoarthritis (PTOA) is a degenerative joint disease that develops after cartilage-damaging injury, most commonly in the knee. In humans, more than 50% of anterior cruciate ligament ruptures (ACLR) lead to the disease 10 to 20 years after injury. Due to long disease onset and difficulty with early diagnosis in human patients, murine models have been established as necessary for investigation of PTOA. Surgical and chemical methods of performing ACLR have been studied, including destabilization of the medial meniscus (DMM) and ACL transaction (ACLT). We are implementing a non-invasive method of ACL injury that was previously characterized by Christiansen et al. using a single load of tibial compression. Compression causes a transient anterior subluxation of the tibia relative to the femur, rupturing the ACL. This method was designed to replicate a common mechanism of joint injury and has been shown to initiate the onset and progression of PTOA in murine models. Previously, this model has been used to study 10-week-old mice, but we have implemented it for both 10-week-old and 16-week-old mice. The model can be applied to various studies that require a functional model of PTOA development, including pain and behavioral studies, gut-joint axis studies, and characterization of pathogenesis associated with the disease. The long-term goal of experimentation is to understand disease development and treatment targets to combat PTOA and its impacts.

Mentor(s):

Deva Chan, Purdue University

**Poster Presentation Abstract Number: 257** :: Social Sciences/Humanities/Education

## Banned Books

Author(s):

Kendall Raley, College of Education

Ashley Buening, College of Education

Emerson Ladig, College of Education

Mark DeLeon, College of Education

Abstract:

The purpose of this mini-research literacy project is to encourage students to think critically and make informed decisions whether public schools and public libraries should ban books. The theoretical framework for this project is inquiry within critical literacy. “Critical literacy is culturally responsive pedagogy” (Norris, Lucas, & Prudhoe, 2012). It sparks discourse between students and teachers, allowing them to connect on a personal level with texts. Moreover, it forces students to actively engage and dive deeper into the meaning of the texts. Our group chose the book Front Desk by Kelly Yang from the list of challenged and banned books. We conducted research on the book itself. We researched about the author, the content of the book, who banned the book, and when, and why it was banned.  Through collaborative discussions in a small group, we made informative decisions and decided that this books should not be banned. Some students shared this project with their mentor teachers in the classroom of the assigned school. Through this project, we hope to educate others that the ideas cannot be suppressed, and that this book must be a part the classroom. Books are a gateway to exposing students to real-world problems that exist. Additionally, they also encourage students to think critically. The following additional resources were explored: The Office of Intellectual Freedom of the American Library Association, the Banned Books website, articles by Gay (2002) and Norris, Lucas, and Prudhoe (2012), and the US Constitution.

Mentor(s):

Inna Abramova, Purdue University

**Poster Presentation Abstract Number: 258** ::

**Virtual Poster #317**

**Poster Presentation Abstract Number: 259** :: Social Sciences/Humanities/Education

## The impact of cultural congruity and ethnic identity on the mental health of Latinx students

Author(s):

Britney Ramos, College of Health & Human Sciences

Abstract:

Understanding how cultural congruity, defined as how one feels their culture is valued in an institution, and ethnic identity, the feeling of belonging to an ethnic group, impact Latinx students is essential in furthering an approach to the mental health needs of those populations. Research suggests cultural congruity in a university is important as minorities endure different challenges than their college peers. The goal of this study was to see the distinct effects of cultural congruity and ethnic identity on Latinx students' mental health. This study also explored the impact of these experiences in a PWI in turn are influenced by engagement in cultural contacts, which may help improve the mental health of students directly and may moderate the negative risks of low cultural congruity. The study therefore explored self-reported same-group ethnic friendships, and gender, as moderators of the predictors of Latinx student mental health. As hypothesized, multiple regressions showed that high cultural congruity was associated with, lower levels of depressive symptoms. However, there was no relationship between ethnic identity and depressive symptoms. Moderation effects of involvement in cultural activities, numbers of ethnic friends, and gender were explored. Implications of findings for enhancing adjustment and mental health of Latinx students at PWIs are discussed.

Mentor(s):

David Rollock, Purdue Psychological Sciences

**Poster Presentation Abstract Number: 260** :: Innovative Technology/Entrepreneurship/Design

# Distribution Power Grid Visualization Tool Tailored for Operator Use


Author(s):

Erik Raume, College of Engineering

Vedha Srigiri, College of Engineering

Lucas Manalo, College of Engineering

Anna Rosha, College of Engineering

Hyunseok (Chris) Hong, College of Engineering



Abstract:

The demand for effective electric grid visualization software has grown to surpass the options available to power system operators (e.g., field workers, local distribution control center personnel, utilities, etc.). There is a breadth of information that operators must process in short periods, such as voltage, current, and power values to assess the grid's current status. Power system operators are responsible for analyzing grid conditions and the distribution of electricity over large areas, meaning an efficient visualization tool is vital to their daily tasks. A properly designed system will allow controllers to examine grid characteristics in minimal time and obtain the necessary information to make rapid decisions. To address this need, our team is pursuing the development of a GUI (Graphic User Interface), which plots simple and adaptive designs so operators can make decisions in the field. This GUI will allow the operator to interact with grid components in a network-style layout and zoom into specific portions of the diagram. They can then access pertinent information needed to maintain the operation of the electrical grid, and notify supervisors of damage if necessary. The visualization software is currently targeted toward electrical systems of a few thousand components but could be extended to applications for larger systems. With these features, the visualization software will effectively allow operators to observe and maintain grid stability with live communication from the field to the office for repair.



Mentor(s):

Dionysios Aliprantis, Purdue University

Loraine Navarro, Purdue University

**Poster Presentation Abstract Number: 261** :: Life Sciences

## PRMT5-mediated Protein Modification in Adipocytes

Author(s):

Madilyn Reid, College of Science, Honors College

Abstract:

Adipose tissue is the main regulator of energy within our bodies and comes in two different types. White adipose tissue (WAT) is primarily for the storage of energy and fat that we have consumed while brown adipose tissue (BAT) is responsible for converting the extra energy we consume into heat. Protein arginine methyltransferase 5 (PRMT5) has known oncogenic properties for its role that it plays in the cell cycle and is suspected to have metabolic properties as well. In previous studies, PRMT5 has been shown to play a role in lipogenesis in WAT but its effects in BAT are still unknown. Our study aims to assess the effects of PRMT5 on lipogenesis in brown adipocytes in vitro. To do this, we will treat a BAT cell line with the PRMT5 inhibitor BLL3.3 and assess the differentiation and lipogenic protein expression level.

Mentor(s):

Shihuan Kuang, Purdue University

**Poster Presentation Abstract Number: 262** :: Innovative Technology/Entrepreneurship/Design

## Image Processing for NASA Solar Cruiser Performance Analysis


Author(s):

Becca Reinecke, College of Engineering

Katherine Kneeland, College of Engineering

Usman Chaudhary, College of Engineering

Andy Le, College of Science

Vishnu Pillai, College of Engineering

Benjamin Roeder, College of Engineering

Elliot Wong, College of Engineering

William Whitsitt, College of Engineering



Abstract:

NASA's upcoming experimental vehicle and heliophysics mission, Solar Cruiser, will harness photon pressure from the sun to propel a gossamer solar sail. The spacecraft will be equipped with a single, fixed-position context camera to confirm sail deployment, evaluate sail performance, assess spacecraft integrity, and capture high-quality images for public engagement. With a predominant focus on novel image processing research, software is being developed to analyze the sail during flight. Research will involve using image-processing methods to analyze performance and structural integrity of a sail quadrant.The topography of the sail is a major determinant for efficiency and in-flight behavior. External libraries and open source software, such as Edge Detection and K-Means clustering algorithms, can be implemented to build upon the existing framework and graphical user interface of the project. Edge detection software will allow for better analysis of the sail's performance, while the K-Means clustering algorithms will help to process and partition components of the taken image for future renders. Topographical analysis will use numerous photogrammetry algorithms to measure the shape of the sail in three dimensional space, while edge detection software will be developed to outline the sail and measure its billow and determine extraneous objects in frame. The advanced image processing techniques listed will allow for realistic, three dimensional renders to be fabricated from at least a single image taken of the sailcraft. The research methods mentioned will allow for more in-depth analysis on the sail and will continue to improve until the date of launch.



Mentor(s):

Katherine Fowee Gasaway, Purdue University

Alina Alexeenko, Purdue University

Anthony Cofer, Purdue University

**Poster Presentation Abstract Number: 263** :: Innovative Technology/Entrepreneurship/Design

# Replicating Optical Space Environment for NASA Solar Cruiser Context Camera


Author(s):

Becca Reinecke, College of Engineering

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Ashwin Limaye, College of Engineering

Samuel Smith, College of Engineering

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Sophie Witters, College of Engineering



Abstract:

NASA’s Solar Cruiser mission will rely upon solar sail technology to propel itself in an orbit around the sun. Solar Cruiser is a science mission aimed at gathering data about the poles of the Sun. Solar Sails are a developing method of low cost propulsion for lightweight spacecraft, most recently tested by lightsail 1 and lightsail 2. Purdue has partnered with NASA to test a context camera system to monitor the deployment and analyze the performance of the sail. A simulated optical environment, including a sun simulating light source, a model solar sail, and a space-like low reflectivity backdrop, is required to test the camera image quality and settings. The light source has a comparable color temperature to the sun, outputs 65,000 lumens, and is mounted on a tripod base chosen for its capability to adjust the light incidence angle. The base of the tripod was modified to improve its stability. The model solar sail is a 1:10 scale model of one quarter of the sail assembled from fire blankets. The backdrop is a series of melamine panels painted with Musou Black. Musou Black was chosen for its balance of high absorption and durability. The combination of the light and the backdrop allows for the photos taken by the camera system of the solar sail model to be accurate to the images it will take when in use on the mission, allowing further tests to determine ideal camera settings based on incidence angle.



Mentor(s):

Katherine Fowee Gasaway, Aeronautical and Astronautical Engineering

Andrew Binder, Aeronautical and Astronautical Engineering

Anthony Cofer, Aeronautical and Astronautical Engineering

**Poster Presentation Abstract Number: 264** :: Innovative Technology/Entrepreneurship/Design

## Video Analytics for Understanding Animal Behavior

Author(s):

Elizabeth Riegle, College of Engineering

Nicholas Powers, College of Science

Kayla Comer, College of Engineering

Jiwoo Kim, College of Engineering

Krishna Bendishankara, College of Engineering

Shaan Chanchani, College of Engineering

Megan Parsons, College of Engineering, College of Engineering

Lydia Stinnett, College of Engineering

Abstract:

Our project aims to estimate animal abundance in Senegal in order to monitor chimpanzees' hunting activity. The project utilizes motion-triggered camera traps to automatically capture videos of animals. However, large amounts of video data can be difficult to process by human perception. Therefore, we are creating an interactive visualization tool that automatically extracts statistics for display.

The visualization sub-team has created a python tool using Plotly and Dash to display preview, basic information, and preliminary statistics from two sites in Senegal – Assirik and Fongoli. Our app allows users to select between two sites and shows latitude and longitude when hovering over a point. After clicking on a camera trap location, a preview photo of the location and animal frequency at the site appears.

The statistics sub-team has implemented an off-the-shelf optical character recognition tool to extract temperature values from our captured footage. We are able to use a Python script to process thousands of images and store the results as a NumPy array for further exploration. Given its vectorized implementation, the NumPy file format is suitable for efficient computing and data analysis. We aim to visualize this data and identify any notable narratives.

Our results demonstrate that the visualization software tool creates a useful framework for showing animals and their frequency.

Mentor(s):

Amy Reibman, Purdue University

**Poster Presentation Abstract Number: 265** :: Social Sciences/Humanities/Education

## Fair Resource Allocation to Reduce Inequities in Criminal Justice and Healthcare

Author(s):

Alexia Rodrigues, College of Science
Alex Liu, College of Science

Abstract:

Together, we are working to identify discrepancies in the criminal justice system that put substance users at an unfair advantage for possible treatment and success in the future. This is done by modeling regressions involving the arrest-rates, developing charts to show the patterns of past arrests, and tracking the resources available for substance users. By doing this, we provide models to the local sheriff office that forecasts incoming inmates which allows the office to prepare accordingly. On the flip side, we are working to create a prediction model that exemplifies the risk of relapse for substance users. Ultimately, our goal is to use these models to determine the best course of action, given the limited resources available.

Mentor(s):

Pengyi Shi, Purdue University

**Poster Presentation Abstract Number: 266** :: Life Sciences

## The Role of Methylation in Regulating the Cellular Stress Response of Hsp31


Author(s):

James Rooney, College of Pharmacy

Jacob Lindsey, College of Pharmacy



Abstract:

The purpose of this study was to understand the role of methylation in regulating the cellular stress response of Hsp31 in Saccharomyces cerevisiae yeast cells. Hsp31 is an ortholog of the DJ-1 gene in humans, whose dysregulation is involved in cancer progression and Parkinson’s disease. Hsp31 is known to be methylated by the N-terminal methyltransferase, Tae1. Mutation of the N-terminal sequence affects Hsp31 methylation status, which may play a role in the protective activity of Hsp31 against cellular stress.

To investigate Hsp31 function we utilized yeast strains with gene deletions leading to deficiency in methylglyoxal (MGO) detoxification or oxidative stress tolerance. Glo1 is a gene in yeast involved in catalyzing the detoxification of MGO, which is a byproduct of glycolysis. Yap1 is a gene in yeast that is activated by hydrogen peroxide (H2O2) and required for oxidative stress tolerance. We established that the glo1Δ and yap1Δ yeast deletion strains are sensitive to cellular stress induced by MGO and oxidative agents, respectively. Hsp31 N-terminal mutant strains with differing methylation states can be expressed in the glo1Δ and yap1Δ genetic backgrounds, to determine if methylation increases or decreases the protective activity of Hsp31 under cellular stress. Hsp31 overexpression successfully rescues MGO toxicity in the glo1Δ strain. The effects of Hsp31 overexpression in other mutants are under investigation with the goal of establishing if methylation plays a role in Hsp31 response to cellular stress.



Mentor(s):

Tony Hazbun, Purdue University

**Poster Presentation Abstract Number: 267** :: Mathematical/Computation Sciences

## Engineering challenges in re-implementations of the YOLO family models in TensorFlow


Author(s):

Ibrahim Saeed, College of Science

Pongpatapee Peerapatanapokin, College of Engineering

Matuesz Romaniuk, College of Engineering



Abstract:

The field of Deep Learning and Deep Learning frameworks have made significant strides in the past few years. The performance of recent models far exceeds what we had just a few years ago and the improvements made to frameworks such as TensorFlow and Pytorch have allowed developers and researchers to make these strides more easily and efficiently. The TensorFlow Model Garden team aims to provide high-quality implementations of Deep Learning models in the TensorFlow framework by creating an open-source reimplementation of Deep Learning models that have come out in recent years. This will help allow other engineers to reuse or extend models from the Model Garden. YOLO or You Only Look Once is an Object Detection model that revolutionized our approach to Object Detection and has spawned various variations and improvements over the years. We refer to these variations of YOLO as the “YOLO Family”. Here, we document the engineering challenges faced when reproducing the YOLOX and YOLOv7 models in TensorFlow. These challenges include initial research and analysis, portability of custom operations between frameworks, and re-approaching component integration in a differently structured codebase. By documenting these challenges, we can aid engineers in re-implementing, modifying or extending the models to their specific need. This will make it easier in the future to decide which tools should be used in a specific reimplementation.



Mentor(s):

James Davis, Purdue University

**Poster Presentation Abstract Number: 268** :: Innovative Technology/Entrepreneurship/Design

# Screen Printing for Scalable TENG Sensor Manufacturing


Author(s):

Mihika Saxena, College of Engineering

Conor McCarthy, College of Engineering

Saichandana Pothireddy, College of Engineering

Hongyi Shen, College of Engineering

Meghan Gron, College of Engineering

Blake Iftiger, College of Engineering

Adit Shah, College of Engineering



Abstract:

Triboelectric nanogenerator (TENG) sensors are based on the principle of electrification driven by friction. TENG sensors are being considered a viable option for health monitoring devices because they are self-powered and offer biocompatibility. With everything getting digitalized, manufacturing of TENG sensors on a large scale requires an efficient and environment-friendly method. One such method is screen printing. Screen printing is a contact printing process which allows printing of electrical components, minimizing e-waste by promoting usage of biodegradable and recyclable solutions. A basic screen printer structure consists of a plane platform on which the substrate can be placed, a photosensitive screen with desired pattern, a squeegee for ink application, belt drive for back-and-forth movement of squeegee, and linear actuators for the up and down motion of screen. Photo emulsion method is used to create the desired pattern on the screen. This process involves coating the screen with emulsion, placing the sheet with pattern on the dried screen and exposing it to UV rays (curing). This method of producing sensors involves placing the substrate material below the screen and applying the ink of selected properties on the surface using a squeegee. The substrate sheet is then allowed to dry, creating an array of sensors simultaneously. Screen printing can give up to 100 µm of layer thickness even with a throughput as low as 2-3 m^2/s. Various factors that affect the ink on the substrate during the process of screen printing are viscosity, density, surface tension, curing characteristics of the ink etc. Being one of the cheapest, simplest and most flexible printing technologies, screen printing is a favorable method to print electronics on a large scale.



Mentor(s):

Nachiket Vatkar, Purdue University

**Poster Presentation Abstract Number: 269** :: Innovative Technology/Entrepreneurship/Design

## A Dynamic Cognitive Workload Allocation Method for Human Robot Interaction

Author(s):

Revanth Krishna Senthilkumaran, College of Engineering, Honors College

Abstract:

A method to dynamically allocate and measure visual perceptual and cognitive workload in the area of Human Robot Interaction to help understand the state of people with the help of a workload allocation algorithm, an affective prediction algorithm and a user study is being researched. A user study involving two participants to perform a task at a given time was conducted and data from biosensors and behavioral sensors were collected and analyzed. Husformer, which is an end-to-end multi-modal framework that uses cross-modal transformers to help recognize human state was used to help with this process. An algorithm was developed to evaluate performance metrics for workload allocation. Hence, based on each participant's cognitive load, the workload allocation algorithm allocates the task at hand as calculated to the participants dynamically. This study was an extension of a previous phase of a user study that was used to test and find correlations between cognitive workload allocation of an individual participant as the number of camera views in a GUI increased or the velocity of objects moving on the screen increased. We validated the effectiveness and productivity of the proposed affective workload allocation through the user experiment.

Mentor(s):

Byung-Cheol Min, Purdue University

**Poster Presentation Abstract Number: 270** :: Life Sciences

## Biocompatibility Validation of 3D-Printed Islet-on-a-Chip Microfluidic Device

Author(s):

Joshua Sexton, College of Engineering, Honors College

Abstract:

Characterization of β-cells is critical in the research of Type 1 Diabetes (T1D) due to their role in its pathophysiology and the potential for beta-cell replacement therapy to cure the disease. However, current microfluidic platforms for analyzing beta-cells are either costly or do not support beta-cell encapsulation, a potential protocol for beta-cell replacement therapy. Therefore, a physiologically relevant and cost-effective platform for beta-cell analysis is needed. Currently, an Islet-on-a-Chip microfluidic device is being developed that meets these needs by utilizing economical 3D-printing fabrication techniques and a design compatible with encapsulated beta-cells. As a potential platform for evaluating beta-cells' function, it is critical that the device could maintain their viability. To validate the biocompatibility of the device, a standard cytotoxicity test was performed on extracts of the 3D-printed resins at different time points using an AlamarBlue metabolic assay to analyze the effect of the material extracts upon cell viability. Results from this analysis indicated that the material extracts did not have an effect on the viability of cells. To further the validation, mouse islets were perfused with media while inside the device and were analyzed at different time points using fluorescent markers for apoptosis and hypoxia to assess β-cell health. This analysis indicated that the device was able to maintain the islets without negatively affecting their viability. Thus, the proposed Islet-on-a-Chip device has the potential to advance T1D research by providing a cost effective, encapsulation compatible alternative to current beta-cell characterization methods.

Mentor(s):

Emma Vanderlaan, Purdue University

Adrian Buganza Tepole, Purdue University

**Poster Presentation Abstract Number: 271** :: Physical Sciences

## Utilizing HYSPLIT to model atmospheric aerosol paths

Author(s):

Audrey Shirley, College of Science

Abstract:

The Hybrid Single-Particle Lagrangian Integrated Trajectory model (HYSPLIT) by the National Oceanic and Atmospheric Administration (NOAA) is an atmospheric transport and dispersion model. It uses a hybrid of Lagrangian (a moving reference frame) and Eulerian (a fixed frame of reference) approaches to model the movement of air on our planet. The model has been widely used throughout the research community to study long-range atmospheric aerosol transport, air quality, climate change and impact of volcanic eruptions. This study will be on the scientific principles on which the model is based, and the study will demonstrate its capability through an example involving a wildfire. Wildfires in the Western United States have become more frequent and intense in the last decade. Studies have projected these fires to get worse in the future due to climate change. This study will demonstrate the applicability of HYSPLIT by using it to study the extent of the impact of the 2021 Antelope Fire in California.

Mentor(s):

Gouri Prabhakar, Purdue University, Assistant Professor of Practice, EAPS Department, College of Science

**Poster Presentation Abstract Number: 272** :: Innovative Technology/Entrepreneurship/Design

## Matlab Vehicle Control


Author(s):

Nathan Skripac, College of Engineering

Charan Senthil Kumar, College of Engineering

Yuvraj Dahiya, College of Engineering

Rachel White, College of Engineering

Nicholas Rasmusson, School of Management



Abstract:

Autonomous vehicles are quickly becoming more and more common in the world we live in today. Having a safe control/navigation system is crucial to the car and its passenger’s safety. For our project we are evaluating code in MATLAB that contributes to the steering of an autonomous vehicle. We are looking at how the car performs under set conditions, and how certain alterations effect the car’s performance. This analysis will allow a progression of the code to become more efficient and accurate.



Mentor(s):

Shreya Ghosh, Purdue University

**Poster Presentation Abstract Number: 273** :: Social Sciences/Humanities/Education

## Lake Michigan Shoreline Landowner Survey


Author(s):

Colby Smock, College of Agriculture



Abstract:

My research has involved developing a survey to understand perspectives of homeowners along the Indiana Lake Michigan Shoreline based off the rapidly changing conditions they have observed in their recent history. The Indiana Lake Michigan Shoreline has undergone extreme stress due to water level fluctuations over the past ten years. From near record lows in 2013 to record highs in 2020 the rapidly changing water levels have caused severe erosion of beaches and foredune area. This has put the communities along this shoreline in a dire spot as they risk losing their beaches completely and most importantly homes along the lakeshore. The survey I am working on will help these communities understand how to move forward with planning and decision making with their shoreline management. Based on a comprehensive review of community plans and ordinances, many of these communities have little to no plan for how to move forward with addressing the management of their shoreline. Our survey is designed to help them understand what it is that their community wants and needs. The underlying questions we are trying to answer in this survey are how did we get here, in terms of both natural and anthropogenic forces, and how do we move forward? Our research hypothesizes that a lack of education, planning, urgency of response needed, and worries about funding will be driving forces behind a lot of the decision-making taking place along the Indiana Lake Michigan Shoreline.



Mentor(s):

Aaron Thompson, Purdue University

**Poster Presentation Abstract Number: 274** ::

**Withdrew**

**Poster Presentation Abstract Number: 275** :: Mathematical/Computation Sciences

## Autonomous Vehicle Simulation (VIP AMP)

Author(s):

Shashank Sridhar, College of Engineering

Amritanshu Ranjan, College of Engineering

Pranav Kolady, College of Engineering

Aaditya Pai, College of Engineering

Sanjeev Kummarapurugu, College of Engineering

Harsh Ajwani, College of Engineering

Abstract:

This project aims to simulate an autonomous vehicle that can learn the course of a path and avoid static obstacles using machine learning (ML) techniques. The end product will be able to safely navigate through several tracks with unique paths and obstacles. There are three components to the project: the ML model, simulation, and obstacle-avoidance algorithms. The ML model uses deep learning, specifically convolutional neural networks (CNNs), to learn the path of the course by controlling the steering angle. The CNN contains 2D convolutional, fully-connected, and dropout layers, with each layer using the Exponential Linear Unit (ELU) activation function. The fully-connected layers define a steering angle. The simulation will be set up using Udacity's self-driving car simulator and include real-world sensor module simulation to gather data to improve the algorithms. Radar and LiDAR sensor data will be used to train the vehicle to detect and identify surroundings to improve navigation. Simulating sensor data collection will be performed with MATLAB and Simulink. The vehicle will use object detection algorithms to maneuver around obstacles that will impede its path. The end goal of this product serves as research on how to train cars to navigate through paths and obstacles using deep learning.

Mentor(s):

Shreya Ghosh, Purdue University

Richard Ajagu, Purdue University

**Poster Presentation Abstract Number: 276** :: Social Sciences/Humanities/Education

## Does a military member or veteran with PTSD having a service dog affect their spouses' sleep?

Author(s):

Sophie Stahl, College of Science, Honors College

Abstract:

An increasing number of studies examine the effect of service dogs for military members or veterans with posttraumatic stress disorder (PTSD); however, no research has explored sleep outcomes for the spouses. This study analyzed associations between service dog placement for veteran with PTSD and their spouses' sleep.

The research included 88 spouses of veterans with PTSD: 48 in the treatment group (usual care + service dog) and 40 in the control group (usual care alone). Participants completed standardized survey assessments, including questions about their sleep quality, at baseline (0 months) and follow up (3 months). Mean, standard deviation, percent change, and effect sizes were calculated for each measure at each time point.

Compared to the control group, spouses of veterans in the treatment group had better mean sleep scores at baseline and follow up. Spouses in the control group had a larger change over time in sleep disturbances compared to the treatment group (-4.12% vs. -3.67%); still a higher mean score than the treatment group in the follow up (50.77 vs. 49.05). Spouses in the treatment group had a larger decrease in poor sleep quality compared to the control (-16.55% vs. 0.39%).

Results indicate that spouses of veterans with PTSD with a service dog may have better sleep relative to a control group. This may show that the impact of service dogs may extend beyond veterans with PTSD to influence the sleep of their spouses. Further exploration through objective measures of sleep, would allow for better understanding of these associations.

Mentor(s):

Leanne Nieforth, University of Arizona

**Poster Presentation Abstract Number: 277** :: Innovative Technology/Entrepreneurship/Design

## Machine learning to assist deployment of FRNDs at an emergency scene

Author(s):

Hasan Sultan, College of Engineering

Aakanksha Shripal, College of Engineering

Manas Paranjape, College of Science

Disha Maheshwari, College of Engineering

Miyu Hino, College of Engineering

Kalyan Salkar, College of Engineering

Minrui lu, College of Engineering

Abstract:

30 seconds is all it takes for a small flame to grow into a structure-enveloping, life-threatening blaze. Modern house fires burn at lung-scorching temperatures of 1400°F. They release black asphyxiating smoke, in addition to the typical byproducts of combustion. Every passing second increases the chances that a fire claims a life, including those of first responders, and destroys property. The vision behind this project - First Responder Network Drones (FRNDs) - is to improve victim outcomes, optimize emergency response time, and reduce safety risks to first responders. The key to FRND's success, is their ability to listen to conversations between 911 callers and the respective dispatchers to autonomously determine which missions potentially require FRNDs support. With the assistance of our proprietary algorithm, FRNDs can be dispatched before a first responder is dispatched by the 911 operator; therefore, shaving precious seconds off the emergency response time. Once at the scene, FRNDs can transmit visuals to the first responders, allowing them to proactively assess the scene while simultaneously preparing them for the challenges associated with that mission. This paper focuses on the collaboration of machine learning, noise reduction algorithms, and speaker differentiation techniques to create a binary classification model that instructs FRNDs to deploy for emergency missions before a 911 dispatcher can make that decision.

Mentor(s):

Charles D'Onofrio, Purdue University

**Poster Presentation Abstract Number: 278** :: Social Sciences/Humanities/Education

**Does the type of device or method of attachment impact data loss with wearable biosensors for people on the autism spectrum?**


Author(s):

Julia Suter, College of Health & Human Sciences, Honors College

Anna Strong, College of Health & Human Sciences



Abstract:

Title. Does the type of device or method of attachment impact data loss with wearable biosensors for people on the autism spectrum?

Background. Wearable sensors have the potential to measure outcomes and experiences of clinical populations in community settings. Evidence shows that people on the autism spectrum experience emotional distress and anxiety when in contact with specific unpleasant stimuli, which impacts data loss (Kyriacou et al., 2021). The goal of this review was to investigate how different types of wearable sensors and attachment methods impact data loss when collecting signals with wearable sensors.

Method. Studies were included if they: (1) were published since 2015; (2) had participants with Autism Spectrum Disorder; (3) used wearable sensors to collect data. Data extraction variables included type and attachment for biosensors and data loss. Of the 148 articles, 116 articles were included in the final analysis because they reported the presence or absence of data loss (51 = no loss; 65 = some data loss).

Results. A binomial logistic regression was performed to analyze whether sensor type or attachment predicated any type of data loss. Sensors with adhesive reduced data loss compared to the other types (OR = .15, 95% CI [.03, .82]). No types of sensors significantly predicted data loss.

Implications. In studies using a variety of wearable sensors, data loss was frequently reported. Adhesive attachment decreased issues with loss compared to other methods. In order to better understand factors that influence tolerability, researchers need to report more information about the demographics of the participants and the process of signal acquisition.



Mentor(s):

Carolyn McCormick, Purdue University

**Poster Presentation Abstract Number: 279** :: Social Sciences/Humanities/Education

## Does the type of device or method of attachment impact data loss with wearable biosensors for people on the autism spectrum?


Author(s):

Julia Suter, College of Health & Human Sciences, Honors College

Anna Strong, College of Health & Human Sciences



Abstract:

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Implications. In studies using a variety of wearable sensors, data loss was frequently reported. Adhesive attachment decreased issues with loss compared to other methods. In order to better understand factors that influence tolerability, researchers need to report more information about the demographics of the participants and the process of signal acquisition.



Mentor(s):

Carolyn McCormick, Purdue University

**Poster Presentation Abstract Number: 280** :: Physical Sciences

## Alternative Applications of Enzymes Using Mini-humidifiers

Author(s):

Erik Sveen, College of Science

Abstract:

Matrix deposition is essential for mass spectrometry imaging analysis of complex carbohydrates, such as N-linked glycans, which are important biomarkers for several diseases. Critical factors in using matrix deposition are both the price and the efficiency of the instrument. The HTX TM-SprayerTM is the benchmark instrument which is incredibly efficient, but not very accessible due to pricing. It has been demonstrated that mini-humidifiers can be used for matrix deposition with crystals less than 10 μm in diameter and provide similar sensitivity to commercial instruments. Herein, we utilized a mini-humidifier to replicate the function of a commercial matrix sprayer for application of an enzyme onto a biological sample for analysis of complex carbohydrates. We evaluated the consistency of the mini-humidifier to uniformly deposit low volumes of enzyme onto the sample. The mini humidifiers tested were able to dispense consistent spray at 10 μL per minute when left to spray for at least 2 minutes. Overall, we developed an alternative method for application of enzymes onto biological samples for studying complex carbohydrates using mass spectrometry imaging.

Mentor(s):

Miranda Weigand, Purdue University

**Poster Presentation Abstract Number: 281** :: Innovative Technology/Entrepreneurship/Design

## Early Explorations of Greenery Fabrication for Urban Environmental Sustainability


Author(s):

Emily Testin, College of Engineering

Maverick Broviak, College of Engineering



Abstract:

Greenery on buildings offers many benefits to building occupants and the building itself, such as providing healthy spaces for the occupants, reducing energy consumption, moderating temperatures, and decorating for aesthetics. However, planting on buildings has a high time, high human work cost and is challenging due to many environmental constraints. The purpose of this project is to develop a fabrication and robotic solution that enable planting seeds in various locations to promote urban environmental sustainability. In this ongoing project, we choose cat grass as our plant of interest because it is quick to grow and maintain. Then, we design and develop a planting prototype that deposits the soil, plants the seeds, and waters the cat grass in controllable ways. The prototype has a custom control over the dispensing of soil, seeds, and water, to allow for optimization and customization of soil and seed arrangement, soil height, and seed depth. The prototype can receive input for user-defined planting design and patterns comprised from the soil and seeds. As a concept-of-proof, we demonstrate the novel fabrication solution with several example tests where our machine can successfully plant. We plan to improve our machine to support planting in areas such as walls and ceilings by making the planting machine mobile by either mounting it on a cart or attaching it to a drone with additional degree-of-freedoms. Further, we plan to develop an accompanying design tool for users to design and control the planting layout, which communicates with the machine to execute the planting.



Mentor(s):

Liang He, Purdue University

**Poster Presentation Abstract Number: 282** :: Innovative Technology/Entrepreneurship/Design

## Early Explorations of Greenery Fabrication for Urban Environmental Sustainability

Author(s):

Emily Testin, College of Engineering

Maverick Broviak, College of Engineering, School of Management

Abstract:

Greenery on buildings offers many benefits to building occupants and the building itself, such as providing healthy spaces for the occupants, reducing energy consumption, moderating temperatures, and decorating for aesthetics. However, planting on buildings has a high time, high human work cost and is challenging due to many environmental constraints. The purpose of this project is to develop a fabrication and robotic solution that enable planting seeds in various locations to promote urban environmental sustainability. In this ongoing project, we choose cat grass as our plant of interest because it is quick to grow and maintain. Then, we design and develop a planting prototype that deposits the soil, plants the seeds, and waters the cat grass in controllable ways. The prototype has a custom control over the dispensing of soil, seeds, and water, to allow for optimization and customization of soil and seed arrangement, soil height, and seed depth. The prototype can receive input for user-defined planting design and patterns comprised from the soil and seeds. As a concept-of-proof, we demonstrate the novel fabrication solution with several example tests where our machine can successfully plant. We plan to improve our machine to support planting in areas such as walls and ceilings by making the planting machine mobile by either mounting it on a cart or attaching it to a drone with additional degree-of-freedoms. Further, we plan to develop an accompanying design tool for users to design and control the planting layout, which communicates with the machine to execute the planting.

Mentor(s):

Liang He, Purdue University

**Poster Presentation Abstract Number: 283** :: Fine Arts

## Intelligent Autonomous Scenery: Route Planning with Object Detection in Theatrical Environments

Author(s):

Mason Trenaman Jr., College of Liberal Arts

Shep Dick, College of Engineering

Evan Holland, Polytechnic Institute

Jack Filpi, College of Liberal Arts

Abstract:

The IZZY Project is an incorporation of advanced technology into a theatrical setting for the purpose of moving scenery along a specified path while maintaining a safe environment for people. There are three parts to this system: line following, obstacle detection, and position feedback. Line following is accomplished using inductive sensors that detect aircraft cable, a type of metal wire commonly used in theatrical environments. Obstacle detection is accomplished by a mounted sensor connected to the onboard computer. Relative positioning data is pulled from the sensor motor drivers. Absolute positioning data is gathered from a time-of-flight based RF tracking system. Our testing focused on collecting data about these systems in terms of how responsive they were to dynamic conditions commonly found in theatrical environments. Different sensor types, configurations, and mounts were tested to get the most reliable detection of the aircraft cable, obstacles, and position in the space. The most reliable sensor configurations, as seen from the results of our tests, were 2 flush inductive sensors at a 30-degree angle from the ground and a 2D Lidar sensor which uses an infrared beam on a rotating disk to detect distances to surrounding objects. Tests were also performed to document system sensitivities and accuracy before incorporating the positioning deck into IZZY hardware.

Mentor(s):

Richard Dionne, Purdue University

**Poster Presentation Abstract Number: 284** :: Life Sciences

# Effects of Adding Oregano Essential Oil to the Water of Grow-Finish Pigs on Heat Stress Response


Author(s):

Isabel Turner, College of Agriculture, Honors College



Abstract:

One hundred and ninety-two grow-finish pigs were used in a 28-day experiment to determine if adding oregano essential oil to the water would mediate the detrimental effects of heat stress. Pigs were blocked by sex and BW and randomly allotted to a 2x2 factorial design of water treatment (oregano essential oil vs. control) and environment (heat stress vs. thermoneutral). There were 8 pens/treatment with 6 pigs/pen (4 barrows and 2 gilts/pen). Pigs were given 15 days to acclimate to pens and water treatment under thermoneutral conditions, and then half of the pigs were subjected to a 3-day diurnal heat stress (12 hours at 33.3℃ and 12 hours at 26.7℃). On day 22 of the experiment (3-days post heat stress), one barrow from each pen was euthanized and jejunal mucosa was collected, flash frozen in liquid nitrogen, and stored at -80oC for subsequent analysis. Frozen tissue samples were ground, and RNA was isolated using TRIzol. The RNA samples were DNase treated and then reverse transcribed. Expression of CDKN1A, GPX1, SOD1, SLC2A2, and MUC2 were determined by qPCR using SYBR green. Pigs subjected to heat stress had reduced ADG (P < 0.003) and Gain: Feed (P < 0.008) during the 3-day heat stress compared to pigs reared under thermoneutral conditions. No differences were observed in CDKN1A, GPX1, SOD1, SLC2A2, and MUC2 expression in the jejunum (P > 0.10). This suggests that neither heat stress nor oregano essential oil influenced gene expression in the jejunum.



Mentor(s):

John Radcliffe, Purdue University

Brian Richert, Purdue University

**Poster Presentation Abstract Number: 285** :: Innovative Technology/Entrepreneurship/Design

## Avionics Development of the FEMTA Suborbital Team


Author(s):

Jacob Valdez, College of Engineering, Honors College

Aubrey Gatewood, College of Engineering

Max Lantz, College of Engineering

Pruthvi Patel, College of Engineering



Abstract:

FEMTA (Film Evaporation Micro-electromechanical Tunable Array) is a micropropulsion system designed to control the attitude of a small satellite using ultrapure deionized water propellant. The FEMTA Suborbital Flight Experiment is a research effort to conduct 0G environmental testing on the FEMTA system. It consists of two experiments: a propellant management system and a thruster experiment. The former showcases a vapor-driven pump for propellant delivery into that thruster. As ambient pressure decreases, fluid vaporization applies pressure to a flexible diaphragm that induces propellant flow. Sensors along the flow path characterize this flow to verify the vapor-driven pump's ability to reliably supply propellant. The thruster experiment gathers data on the propulsion characteristics of a FEMTA microthruster.

The avionics subteam is tasked with developing a system to aid in testing and controlling the propellant management and thruster systems and processing data from the sensors onboard the hardware, particularly during 0G operations. The culmination of avionics work has led to the development of an Arduino-driven system, which leverages an Adafruit Feather M0 Adalogger and pressure, temperature, and acceleration sensors to determine its mission phase and to control the system. The result of this refactored system meets the objective of verifying and validating the electronics components: testing sensors in near-suborbital conditions, simulating the New Shepard flight on the Adalogger, and determining transitions between flight phases using sensor data.



Mentor(s):

Katherine Fowee Gasaway, AAE

Steven Pugia, AAE

Jesus Meza Galvan, AAE

**Poster Presentation Abstract Number: 286** :: Social Sciences/Humanities/Education

## Learning Russian through Poem Translation

Author(s):

Marissa Van Sickle, College of Liberal Arts, Honors College

Abstract:

In this project, I aim to explore the process of Russian poem translation as a student with an intermediate to advanced grasp of Russian. This project will analyze how the translation methods provide additional learning experiences and a greater understanding of Russian words and rhythms than might otherwise be possible. I will focus on translating six classical short poems by Marina Tsvetaeva and Anna Akhmatova, two Russian poets who are known for their approaches to word rhythm and connotations – one matching natural language rhythms and the other using words in unusual ways. I will experiment with matching rhyming schemes and poetic meter between the translations and the original. This process will facilitate greater familiarity with natural meter and rhyme in Russian words, as well as a better understanding of the connotations of certain phrases and the best ways to match English words to Russian experiences. The project will also provide a model of how language learners can approach translation as a learning experience while still maintaining the integrity of the original text.

Mentor(s):

Olga Lyanda-Geller, Purdue University

**Poster Presentation Abstract Number: 287** :: Life Sciences

## Electrophysiological Analysis of CRISPR-edited human-induced pluripotent stem cell-derived cortical spheroids carrying an SCN2A epilepsy variant

Author(s):

Muhan Wang, College of Pharmacy

Conrad Otterbacher, College of Science

Trang Nguyen

Abstract:

Epilepsy is a condition characterized by abnormal neuron firings that leads to seizures. Recent studies have suggested that mutations in the SCN2A gene are the genetic causes of certain types of epilepsies, including benign familial infantile seizures and early infantile epileptic encephalopathy. Many children often experience SCN2A-associated seizures in early infancy. This condition severely impairs their quality of life and can lead to critical neuronal damage or even death. The SCN2A gene encodes for the voltage-gated sodium channel Nav1.2, a protein involved in generating and continuing action potentials in the brain. The L1342P genetic variant is identified as a recurrent mutation of SCN2A and is the target of our study. Understanding the characteristics of the mutation will aid in the understanding and treatment of epilepsies associated with this SCN2A mutation. However, few studies have focused on characterizing the mutation in human samples. In our project, we use human induced pluripotent stem cells (hiPSCs) to generate cortical spheroids to better represent the epilepsy-associated mutation.

Cortical spheroids are three-dimensional cell aggregates made up of neurons that model complex features of the human brain. Electrophysiology is essential in understanding the electrical activity and the dysfunction of neurons. One of the techniques used is patch-clamp. This strategy records the electrical activity of a single neuron from the generated cortical spheroids. The patch clamp technique also directly measures each neuron's membrane potential and current flow. In this project, we will employ patch clamp to assess the neuronal electrical activity of L1342P-variant cortical spheroids derived from CRISPR/Cas9 edited hiPSCs. We hypothesized that the neurons carrying the mutation would have increased neuronal activities, reminiscent of the increased electrical activity described in patients. Our approach involves comparing the number of action potentials fired by each neuron with increasing current and measuring the maximum number of action potentials fired by each neuron.

In this poster, we describe our preliminary data, which suggests that the L1342P mutation led to hyperexcitability in the neurons compared to the control group without the mutation. These findings point to the use of the cortical spheroid model as a tool to mimic hyperexcitability phenotypes seen in patients and as a potential platform to one day screen for potential anti-epileptic therapeutics targeting Nav1.2.

Mentor(s):

Maria Olivero, Purdue University

**Poster Presentation Abstract Number: 288** :: Life Sciences

**Application of a qPCR Protocol for Drinking Water**

Author(s):

Ruth Wei, College of Science

Abstract:

Abstract redacted.

Mentor(s):

Caitlin Proctor, Purdue University

Liam Johnson, Purdue University

**Poster Presentation Abstract Number: 289** :: Life Sciences

## In Vitro Modeling of the Enthesis for Tendon to Bone Healing

Author(s):

Tyler Williams, College of Engineering, Honors College

Andrew Ferrer, College of Engineering

Abstract:

Approximately 450,000 Rotator Cuff repairs occur annually, and the rate of retears postoperatively is up to 94%. A major cause of retears is the generation of fibrovascular scar tissue during the healing process after tendon-to-bone repair. This new scar tissue bypasses the regeneration of an important component of the tendon to bone interface, the enthesis. The compositional and mechanical gradients present within the enthesis are crucial for load bearing and natural joint movement. An in vitro setup that utilizes a specialized electrospun biomimetic scaffold compressed onto porcine bone segments mimics this defined tissue region. In these tissue-engineered scaffolds, the highly aligned nature of tendon is mimicked using layers of aligned fibers. The structural gradient present in the enthesis is modeled by collecting layers of non-aligned electrospun fibers and placing them on top of the aligned layers. A previous pilot study demonstrated the feasibility of a setup that included a stainless-steel bridge secured by screws that compressed the scaffold onto the bone; however, contamination risk due to setup difficulty and incomplete media perfusion throughout the scaffold limited feasibility. A new proposed model using a nylon mesh bridge secured by orthodontic rubber bands will reduce contamination risk while also allowing for sufficient compression of the scaffold onto the bone like that of suture repair. Additionally, the setup ensures effective perfusion of cell media from the top of the scaffold to the layer closest to the bone.

Mentor(s):

Dianne Little, Purdue University

**Poster Presentation Abstract Number: 290** :: Life Sciences

## Visual and saccade-related activity in pyramidal neurons of the zebrafish optic tectum


Author(s):

Sydney Williams, College of Science



Abstract:

In zebrafish, there is an area in the brain called the optic tectum is the largest visual brain area and. This visual area has a role in initiatesing specific visual behaviors based on what is seen. The optic tectum receives input from torus longitudinalis (TL), a second-order visual area in fish. is connected tothe optic tectum.While there are neurons in the TL is known to contain neurons that respond is to visual stimulation as well asand neurons whose activity is correlated with fast eye movements (saccades)., But how information from TL is integrated in tectum is still fairly unknown. The goal of this study is to determine if tectal pyramidal neurons (PyrNs), which receive direct synaptic input from TL, exhibit saccade-correlated patterns of activity. To do so we will employ in vivo confocal imaging to monitor calcium dynamics in PyrNs while simultaneously tracking eye movements. Data obtained from these experiments will allow us to distinguish between two models of how saccade-related information is processed in tectum. In the first, visual and saccadic signals are integrated, resulting in PyrNs that are both visually responsive and active during saccades. In the second model, visual and saccadic signals remain segregated, resulting in distinct, non-overlapping populations of visually responsive PyrNs and saccade-correlated PyrNs. Initial recordings confirmed our ability to monitor PyrN calcium dynamics during both spontaneous eye movements and saccades evoked by drifting gratings. In preliminary tests we found that visually responsive PyrNs far outnumber saccade-correlated PyrNs, suggesting that visual and saccadic signals remain mostly segregated in tectum.  Experiments are currently underway to determine if PyrNs active during saccades are also visually responsive.



Mentor(s):

Estuardo Robles, Purdue University

**Poster Presentation Abstract Number: 291** :: Physical Sciences

## Classification of Super-Symmetrical and Standard Model proton-proton collisions using Deep Neural Networks

Author(s):

Anastasia Wong, College of Science

Giovanni De Geronimo, College of Engineering

Delany Koi, College of Science

Aryan Shahu, College of Science

Yashashwini Singh, College of Science

Abstract:

The Standard Model of Particle Physics has been serving us well for years, correctly predicting and describing much of our fundamental physics. However, it wrongly predicts the mass of the Higgs Boson to be significantly greater than its observed mass. There are many different potential extensions of the Standard Model that could explain this, one of which proposes the existence of supersymmetric counterparts to all elementary particles. Our research discusses the standard and supersymmetric models, and how we are using simulated data and deep neural networks to verify the existence of these particles.

Mentor(s):

Abraham Koshy, Purdue University

**Poster Presentation Abstract Number: 292** :: Mathematical/Computation Sciences

## Onnx Bug Study

Author(s):

Joseph Woo, College of Science

Arav Tewari, College of Engineering

Saad Sharief, College of Science

Abstract:

Deep Learning (DL) applications are usually developed using DL frameworks such as TensorFlow and PyTorch. Each framework has its own internal representation of DL models, but they are not inherently compatible with other frameworks. This is an issue because teams or organizations who wish to collaborate and created models with different frameworks will have a difficult time working together as their models will be incompatible with each other. To address this problem, intermediate representations such as ONNX are developed to enable intercompatability between models developed within different frameworks. ONNX acts as a common representation that can be used to transfer models between frameworks or runtimes. Though ONNX is the leading tool in DL interoperability, there has been little research into issues within ONNX or its surrounding infrastructure (model converters). We will be performing a failure analysis on ONNX conversion tools, and ask the following questions: What are the types, frequencies, and causes of issues in ONNX converters? We plan to study closed GitHub issues in the tensorflox-onnx, PyTorch, and ONNX repositories. From these issues, we first create a taxonomy of defects present in ONNX conversion tools. Then we categorize these closed issues into this taxonomy and study their frequencies and root causes. This study will provde an understanding of the underlying issues in conversion tools, which can then be used for further testing of these tools and additionally the improvement of the tools and ONNX itself.

Mentor(s):

James Davis, Purdue University

**Poster Presentation Abstract Number: 293** :: Life Sciences

## Characterization of an Amino Acid Substitution in the VP4 Structural Protein of Enterovirus D68


Author(s):

Kayla Wrobleski, College of Science



Abstract:

Enterovirus D68 (EV-D68) is a single stranded positive-sense RNA virus first isolated in 1962. EV-D68 is a respiratory virus in the Picornaviridae family implicated in recent biennial outbreaks of Acute Flaccid Myelitis (AFM) in young children. AFM causes a flaccid paralysis like polio and can lead to permanent muscle weakness. Currently, there is no specific treatment for AFM. EV-D68 is a pseudo-T=3 icosahedral virus with 60 copies each of four structural proteins. VP1, VP2, and VP3 make up the virus capsid, while VP4 resides on the internal capsid surface. The structural proteins of EV-D68 are determinants of capsid meta-stability, viral breathing, and viral entry and serve as immunogens for the human antibody response. Most work focuses on VP1, however, VP4 is the most conserved structural protein among enteroviruses. Despite this, not much is known about how VP4 influences EV-D68 infection. We hypothesize that a highly conserved enterovirus VP4 residue, lysine 42 (K42), influences the capability of EV-D68 to cause infection. Ongoing mutagenesis experiments of K42 are currently underway to analyze the effect of amino acid substitutions on virus particle dynamics. The results of these mutagenesis experiments will be examined as part of continuing research on viral entry and inhibition of EV-D68. Small molecule inhibitors have been shown to decrease particle dynamics. Characterization of the K42 residue will further illustrate how VP4 is important for viral entry which can lead to more targeted treatments for EV-D68 infection.



Mentor(s):

Richard Kuhn, Purdue University

**Poster Presentation Abstract Number: 294** :: Physical Sciences

## Geospatial Analysis of the Martian Surface for Colonization


Author(s):

Kunal Zalani, College of Science, Honors College



Abstract:

The goal of this research project is to help determine the effect that certain factors will have on the colonization of Mars and how that affects the locations of these colonies. From preliminary research, it seems that there aren't maps of the Martian surface that both consider multiple factors and are easy to decipher for non-experts. Furthermore, while there is research to determine landing zones, there doesn't seem to be a map of potential hotspots for colonization. It should be noted that to consider every possible variable and to analyze the entire surface of Mars goes far beyond the scope of any singular project. It will take a collection of smaller projects to determine an overall answer. Therefore, the question posed in this project will be as follows: How do the geological and meteorological conditions on Mars affect the location, energy sources, and materials used to build future colonies? It should be noted that this is a work in progress and the main goals will be to 1. create a simplified map of a region of Mars that overlays datasets and shows hotspots that are suitable for colonization using the parameters described and 2. develop a simple procedure that can be used to crowdsource data analysis in an effort to expedite the process of surveying the entire Martian surface.



Mentor(s):

Katie Jarriel, Purdue University

**Poster Presentation Abstract Number: 295** :: Innovative Technology/Entrepreneurship/Design

## Artificial Intelligence

Author(s):

Wenjia Zhang, College of Science, College of Science

Abstract:

Artificial intelligence has been a raising topic and is the center of several global conversations. The use of Artificial intelligence has caused issues for both the government and people who are working in the industries for its highly efficient and programmed features (Chatterjee & Sreenivasulu, 2019). Artificial intelligence also needs “less salary” compared with humans (Elmousalami, 2020). Thus, whether we should continuously develop AI has been asked. In the research, “Will Artificial Intelligence Replace the Human Echocardiographer”, Sengupta (2018) illustrated shortcomings and less capable abilities. Jelena used machine learning and evolutionary computing to discuss the ability of AI in various databases(Jelena, 2021). Jarrahi mentioned that there are also lots of moral issues and legalization problems related to AI. Societies are not ready to brace AI as a part of our life. This poster will explore the history of the development of AI and the current debates on this issue.

Mentor(s):

Qian Wang, Purdue University

**Poster Presentation Abstract Number: 296** :: Social Sciences/Humanities/Education

## The Effects Attending University has on Gaining a Successful Career

Author(s):

Lejia Zhou, College of Liberal Arts

Abstract:

Throughout the past few years, the population engaged in the job market doubled according to a research finding. More and more people are trying to find ways to gain success in their careers, which will provide material support for people to live better. Some of them choose to enter the job market earlier, while others consider college as a necessary pathway to career success.

The poster is based on research about the four academic articles, as well as other additional materials. By analyzing data included in these articles, it discusses the role college plays prior to career entrance. At the same time, with evidence gathered from previous research, the poster explains whether university is necessary for achieving a successful career.

The result shows that universities provide students with opportunities, ability, and knowledge, thus getting them prepared for their future job. More importantly, those who graduated from the university not only have a higher possibility of getting a well-paid job and being promoted, but also it is found that they even build their own businesses easier. Additionally, the poster argues that despite the differences between countries and regions, universities in general have paved the ground for a successful career to some extent.

Conclusively, the overall poster includes an analysis of the advantages provided to job participators from three main aspects—application, promotion, and entrepreneurship. It claims that entering university is necessary in order to gain a successful career.

Mentor(s):

Qian Wang, Purdue University

**Poster Presentation Abstract Number: 297** :: Innovative Technology/Entrepreneurship/Design

## Film Evaporation MEMS Tunable Array (FEMTA) Microthruster Suborbital In-Flight Thrust Characterization System

Author(s):

Xingmei Zhu, College of Engineering

Yuto Tanaka, College of Engineering

Abstract:

Film Evaporation MEMS Tunable Array (FEMTA) is a micro-propulsion system using ultrapure deionized water as the propellant and provides thrust on the micro-newton level by releasing gaseous water. This technique is favored in satellite attitude adjustments due to its lightweight, and control of thrust on small orders of magnitude. The goal of this project is to generate a load-gauging system to measure the output of a FEMTA thruster under vacuum and microgravity.

The method used to measure thrust uses three main components. A D'Arsonval voltage meter, a photo-interrupter, and a Feather Arduino. The D'Arsonval meter will deflect a needle in proportion to the trust applied by FEMTA. The needle will move a flag placed inside the photo-interrupter. The photo-interrupter detects the position of the flag which is read by the Arduino. The Arduino will apply a voltage to the D'Arsonval meter to compensate for the force applied to the flag by FEMTA. The voltage applied will be calibrated to the known thrust value.

This system could be used for future projects in need to test different types of thrusters in vacuum and microgravity. This system will be used in flight during a Suborbital rocket launch to test the performance of FEMTA. In the future, the system however relies heavily on the Feather Arduino for it has an analog direct current voltage output, and if the values of the analog DCV output are incorrect it will severely affect the system, so it could be replaced by other alternatives.

Mentor(s):

Kate Gasaway, Purdue University

Steven Pugia, Purdue University

# RESEARCH TALKS

## SESSION 1: 9:30AM-10:00AM

### ROOM: STEW 214A

9:30 Children's Picture Books for Socio-emotional Learning in the Context of Literacy, Diversity, and Equity
**400** *Yimei Xiong*
Mentors: Christy Powell, Helen Bentley, Wonki Lee

9:45 Are there associations between attentional disengagement, joint attention, and language abilities in toddlers and young children with autism spectrum disorder?
**401** *Selah Schieber*
Mentors: Brandon Keehn

### ROOM: STEW 214B

9:30 Quantifying Mechanobiology of Synoviocytes Under Cyclic Stretch
**402** *Maya Alborn*
Mentors: Deva Chan, Aritra Chatterjee, Clarisse Zigan

9:45 Pre-Silicon Verification of Digital IP Library Using Universal Verification Methodology
**403** *Fan Jing Hoon, Pranav Srisankar, Maxwell Michalec, Duncan Van*
Mentors: Sarang Pramod

### ROOM: STEW 214C

9:30 Chromatin Remodeling Complexes in Androgen Deprivation Induced Neuroendocrine Prostate Cancer
**404** *Sam King*
Mentors: Emily Dykhuizen, Surbhi Sood, Sandra Ordonez

9:45 A Gaussian Process Model for Spatio-Temporal Ozone Distribution in California
**405** *Jerry Gu*
Mentors: Guang Lin

## SESSION 2: 10:00AM-11:00AM

### ROOM: STEW 214A

10:00 Utilization of Spatial Analysis to Investigate IU Health Arnett's High Patient Fall Rate
**406** *Colleen Cole*
Mentors: Katie Jarriel

10:15 Home-based leg heat therapy to improve walking performance in elderly individuals
**407** *Sidharth Reddy*
Mentors: Ro Bohyun, Bruno Rose

10:30 Digitalizing Delphi: Educating Audiences Through Virtual Reconstruction
**408** *Kate Koury*
Mentors: Katie Jarriel, George Takahashi, Arne Flaten

10:45 3D Printed highly Sensitive Pressure Sensors
**409** *Mitesh Mylvaganan*
Mentors: Sunghwan Lee

## ROOM: STEW 214B

10:00 Real-Time Operating System Implementation on Control of RoboMaster Competition Robot
**410** *YuXi Liu*
Mentors: Abolfazl Hashemi, Zijian He

10:15 Internet of Things and Digital Twinning with TENG devices
**411** *Conor McCarthy, Meghan Gron, Saichandana Pothireddy, Blake Ifitger, Mihika Saxena*
Mentors: Nachiket Vatkar

10:30 Implication of Modified Total Oxidizable Precursor (TOP) Assay for detecting Per- and Polyfluoroalkyl substances (PFAS) in complex media
**412** *Leyan Peng*
Mentors: Youn Jeong Choi, Caroline Alukkal

10:45 Proximal Femur Trabecular Orientation in Hindlimb Unloaded Murine Models
**413** *Anisha Rath*
Mentors: Deva Chan, Elizabeth Blaber, Zachary Davis

## ROOM: STEW 214C

10:00 Microfinancing and Entrepreneurship in Cocoa Refinement in Côte d'Ivoire
**414** *Erin Soro*
Mentors: Colin Sullivan

10:15 Changed to Poster #196
**415**

10:30 Generation of IFC compliant models of bridge infrastructure assets using lab generated OBJ data
**416** *Sankhya Gowda*
Mentors: Jiansong Zhang

10:45 Adaptable Human Detection
**417** *Robert Sego, Tiffany Yu, Xilai Dai, Diya Prasanth, Anisha Chawla, Kaden Merrill, Alex Weber, Natasha Gundapaneni, Patrick Li*
Mentors: Carla Zoltowski, Edward Delp

## ROOM: STEW 214D

10:00 Linguistic Changes in Russian in Turbulent Times
**418** *Renee Forfa*
Mentors: Olga Lyanda-Geller

10:15 Laughter and Madness: The Comic Horror of Evil Dead II
**419** *David Gowan*
Mentors: Elena Coda

10:30 English-Russian Philosophical Glossary for Aleksei Losev
**420** *Michael Linge*
Mentors: Olga Lyanda-Geller

10:45 Quantification and comparison of bacterial communities of healthy and BRD-affected dairy cattle
**421** *Noelmi Ulloa*
Mentors: Timothy Johnson, Eunice Centeno

# SESSION 3: 11:00AM-12:00PM

## ROOM: STEW 214A

11:00 Mechanisms of Alcohol-Facilitated Laboratory Aggression among High-Risk Couples
**422** *Emily Khoo*
Mentors: Daniel W. Oesterle, Christopher Eckhardt

11:15 Understanding the Menstrual Health Needs of People Experiencing Homelessness during the COVID-19 Pandemic in Lafayette, Indiana
**423** *Emma Schnolis, Jaclyn Frank, Emily Otten, Anukriti Arora*
Mentors: Andrea DeMaria, Rebecca Martinez, Natalia Rodriquez, Risa Cromer

11:30 Racial and Ethnic Disparities in Service Referral and Use Among High-Risk Children Diagnosed with Autism Spectrum Disorder
**424** *Aaliyah Saunders, Victoria Bozinovski*
Mentors: Brandon Keehn

11:45 The Role of BIPOC Parents in Diversifying Children's Literature
**425** *Kayla Neal*
Mentors: Christy Wessel-Powell

## ROOM: STEW 214B

11:00 Purdue SoCET: Design Flow
**426** *Wilbur Chen, Tam Le, Joseph Eisenburg, Yiyun Wang*
Mentors: Raghuraman Kottaiyur, Mark Johnson

11:15 SWARMS: Multi-Agent Control Simulation Platform
**427** *Amikosh Dube, Michael Lock, Anam Nasim, Sullivan Cisco, Sohan Pramanik, Reed Baker, Annie Mitten*
Mentors: Shreyas Sundaram, Tong Yao

11:30 Static CMOS Implementation of Polymorphic Logic
**428** *Malcolm McClymont, Jacob Chappell*
Mentors: Mark Johnson, Joerg Appenzeller, Boyuan Chen

11:45 Pursuing the development of antifouling implantable biosensors and novel bioadhesives
**429** *Carl Russell III*
Mentors: Hyowon Lee, JongCheon Lim, Angel Enriquez

## ROOM: STEW 214C

11:00 Characterizing Graphing Literacy in Undergraduate Biology Major and Non-Major Students
**430** *Kal Holder*
Mentors: Nouran Amin, Stephanie Gardner

11:15 “Sometimes I feel uglier than ever”: Influences on Internal and External Body Image
**431** *Alexandra Hughes, Maia Lynch, Emily Otten*
Mentors: Andrea DeMaria

11:30 Tumor-associated antigen surface density in mechanisms of CAR T cell activation threshold-setting
**432** *Kenneth Rodriguez-Lopez*
Mentors: Shalini Low-Nam, Kevin Scrudders

11:45 Synthesis of Signaling Hormones Streptomyces rochi butenolides (SRBs)
**433** *Gracie Sanders*
Mentors: Elizabeth Parkinson, Haylie Hennigan

## ROOM: STEW 214D

11:00 Farmer Perspectives on Diversified Agriculture
**434** *Isabel Jensen*
Mentors: Emily Usher

11:15 Anti-Pathogenic Activity of Concentrated Dairy Ingredients on Porcine Rotavirus
**435** *Chenhai Li*
Mentors: Arun K Bhunia, Rishi Drolia, Dongqi Liu

11:30 DWORF's Impact on hIPSC-Cardiomyocytes
**436** *Alexandra Ware*
Mentors: Jake Megna, Scott Macdonnell

11:45 Designing and Developing a Camera System for Automated Tree Measurement
**437** *Robert Stewart, Aidan Crowley*
Mentors: Guofan Shao

# SESSION 4: 1:15PM-2:00PM

## ROOM: STEW 214A

1:15 Elementary Students' Conceptions of Programming on A Sorting Task
**438** *Sirou Wang*
Mentors: Laura Bofferding

1:30 Future of self-driving car: a blessing or a curse?
**439** *Amanda Huang*
Mentors: Qian Wang

1:45 Associations of Motor Skills with Inhibitory Control and Creativity in Preadolescent Children
**440** *Qiwei Zhu, Mark Naguib*
Mentors: Shih-Chun Kao, Laura Claxton

## ROOM: STEW 214B

1:15 Earth Remote Sensing with Signals of Opportunity
**441** *Andrew Brandt, Isaac Gelman, Tanish Sanghavi, Eli Bohlander*
Mentors: James Garrison, Leo Li

1:30 Human Olfactory Response to Volatile Organic Compound Emissions from Household and Personal Care Products
**442** *Zachary Limaye*
Mentors: Nusrat Jung, Brandon Boor, Jordan Cross

1:45 Social Justice and Equity as Operating Range: Enriching Success Pathways for Underrepresented Minority Students
**443** *Mackenzie Richards*
Mentors: Barrett Caldwell

## ROOM: STEW 214C

1:15 Feasibility and Anticipated Acceptability of Community Health Worker-facilitated HPV Self-sampling for Cervical Cancer Screening in Lake County, Indiana
**444** *Alyssa Arreola, Sathveka Sembian*
Mentors: Natalia Rodriguez, Tiwaladeoluwa Adekunle, Layla Claure, Lara Balian

1:30 Tourism Insights: ESG in Lodging and Hospitality
**445** *Emily Cassanmagnago*
Mentors: Jonathan Day

1:45 The Current Conscription System in the Republic of Korea and Its Explicit and Implicit Problems: It is Time to Adjust
**446** *MinJae Choi*
Mentors: Qian Wang

# SESSION 5: 2:00PM-3:00PM

## ROOM: STEW 214A

2:00 Examining the Correlation of Brownfield and Superfund Sites with Health Outcomes in Indiana at the Census Tract Level
**447** *Sharon Kulali*
Mentors: Ellen Wells

2:15 Openness in Social Judgments of Diverse Others
**448** *Emily Fields*
Mentors: Sang Woo, Louis Hickman, Cavan Bonner

2:30 Alignment Among U.S. States' Early Mathematics Learning Guidelines: An Expanded Review
**449** *Abigail Callis*
Mentors: David Purpura, Erica Zippert

2:45 Math Aversion and Math Anxiety: The Psychology Behind Why Math is Unpopular
**450** *Arija Simonaitis*
Mentors: Sean Lane, Mairead Willis

## ROOM: STEW 214B

2:00 Environmental Testing and Computational Modeling for NASA Solar Cruiser Sail Context Camera
**451** *Tasveen Chopra, Trent Fatur, Isha Shamim, William Davis, Justin Lin, Joao Pedro Bacchi, Ian Veak, Rhea Pahuja, Emma Fisk*
Mentors: Katherine Fowee Gasaway, Alina Alexeenko, Andrew Binder, Anthony Cofer

2:15 Experimental Evaluation of changes in HVAC Filter Performance During Rapid Aerosol Loading
**452** *Elliot Cram, Laura Ajala*
Mentors: Chunxu Huang, Brandon Boor, Nusrat Jung

2:30 Child Automated Speech-to-Text Team - General Overview
**453** *Adrien Dubois, Aakanksha Shripal, Aarini Panzade, Aarohi Panzade, Anish Bhowmik, Brian Ha, Jasper Koliba, Rosemary Ajish*
Mentors: David Purpura, Avery Closser

2:45 Characterization of Particulates in Indoor Environments for Infants
**454** *Brian Magnuson*
Mentors: Brandon Boor, Satya Patra, Jordan Cross

## ROOM: STEW 214C

2:00 Peroxide-Initiated Hydrophosphination of gem-Difluoroalkenes.
**455** *Ryan Lee*
Mentors: Andrew Intelli, Ryan Altman

2:15 Laboratory screening of sorghum lines for incompatibility, a post-attachment resistance mechanism to the parasitic weed *Striga hermonthica*
**456** *Cameron Matthews*
Mentors: Patrick Rich, Gebisa Ejeta, Adedayo Adeyanju, Nathan Bowser

2:30 Structural and Functional Characterization of Phospholipase C β3
**457** *Kennedy Outlaw*
Mentors: Angeline Lyon, Isaac Fisher

2:45 Determining the binding between PLC epsilon and RhoA using the nanoluciferase assay
**458** *Siddhi Shetty*
Mentors: Angeline Lyon, Ketaki Mahurkar

# SESSION 6: 3:00PM-3:45PM

## ROOM: STEW 214A

3:00 Understanding Young People's Child Maltreatment Disclosure Experiences: A Qualitative Content Analysis of Family Violence Discussions on Social Media
**459** *Anneliese Williams, Amelia Williams*
Mentors: Laura Schwab-Reese

3:15 Lane Detection
**460** *Pume Tuchinda, Daniyaal Rasheed, Justin Chan, Mingyu Kim, William Stevens*
Mentors: Edward Delp, Carla Zoltowski

3:30 Currency Detection using Image Processing Techniques
**461** *Sohee Kim, Anvit Sinha, Katherine Sandys, Joseph Lin, Daniel Choi, Kavin Sathishkumar, Leng Lohanakakul*
Mentors: Edward Delp, Carla Zoltowski

## ROOM: STEW 214B

3:00 Optimization of Ultrasonic Welding Parameters for Carbon Fiber Reinforced Thermoplastic Composite Plies
**462** *Harry Lee*
Mentors: Garam Kim, Eduardo Barocio

3:15 Immersible Sensor Development
**463** *Yubo Song, Chih-Yao Chan*
Mentors: Eui Won Bae, Iyll-Joon Doh

## ROOM: STEW 214C

3:00 Understanding the Freezing Properties of Lunar Particle Suspension Droplets
**464** *Mariana Aguilar, Katie Meves, Valeria Garcia*
Mentors: Alexandria Johnson

3:15 Macroscopic Resistance Measurement Of Vanadium Dioxide During Metal Insulator Phase Transition
**465** *Amit Rohan Rajapurohita*
Mentors: Erica Carlson

3:30 Graph Neural Network Triggers for Tau3Mu Events at the HL-LHC
**466** *Benjamin Simon*
Mentors: Miaoyuan Liu, Pan Li, Jan-Frederik Schulte, Siqi Miao

# RESEARCH TALKS

**Talk Presentation Abstract Number: 400** :: Social Sciences/Humanities/Education

**Children’s Picture Books for Socio-emotional Learning in the Context of Literacy, Diversity, and Equity**


Author(s):

Yimei Xiong, College of Education



Abstract:

It has been widely accepted that children’s socio-emotional growth and literacy development are inextricably interconnected. Especially for those students who have emotional and behavioral difficulties, learning to recognize and understand their emotions are crucial for academic success. Considering the improvement of socio-emotional learning (SEL) on children’s development, educators develop and select SEL teaching materials that are best suited to their school and situation in the context of literacy education. The overlapping area between SEL and literacy creates a highly effective learning environment while developing healthy identities from which students benefit from self-acceptance and self-awareness. However, diversity and equity have not received enough attention in this context. Hence, in the current study, researchers aim to promote SEL under literacy instruction in K-5 classrooms with diversity, inclusion, and equity lens. We examined self-awareness and self-acceptance concepts in children’s picture books, which are for students from diverse backgrounds, as well as analyzed 27 children’s picture books published between 2017-2021, and qualitatively coded the themes and keywords of the books. These 27 books were considered to have a theme of self-awareness and self-acceptance. Using a critical multicultural analysis framework, our research team analyzed specific features of the books including race, ethnicity, gender, and agency relationship of the protagonist(s). The culture and tradition, power structure, emotional resilience, and interpersonal relationship conveyed in the combination of writing and illustrations help students recognize their identity and solve the challenges they face.



Mentor(s):

Christy Powell, Purdue University

Wonki Lee, Purdue University

**Talk Presentation Abstract Number: 401** :: Social Sciences/Humanities/Education

**Are there associations between attentional disengagement, joint attention, and language abilities in toddlers and young children with autism spectrum disorder?**

Author(s):

Selah Schieber, College of Health & Human Sciences, Honors College

Abstract:

Impairments in joint or shared attention are present in toddlers and young children with autism spectrum disorder (ASD). Early joint attention abilities, in children with and without ASD, are vital for language development, and deficits in joint attention have been linked to later language and communication delays in ASD. Recent research suggests that infants and toddlers later diagnosed with ASD may display impaired non-social attentional disengagement, or the ability to shift attention from one location to another. However, it is unclear whether early disengagement difficulties are associated with joint attention and language abilities in toddlers with ASD. Thus, the objective of this study was to investigate the relationship between attentional disengagement, joint attention, and language abilities in young children referred for an ASD evaluation. Participants included a total of 155 children, 87 with ASD and 68 non-ASD children (14-48 months). Joint attention was assessed using items from the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2). Receptive and expressive language abilities were measured using the Mullen Scales of Early Learning (MSEL). Finally, disengagement was measured using a gap-overlap eye-tracking paradigm. As expected, there is a significant association between joint attention skills and language abilities across all children. Contrary to our hypothesis, there was not a significant correlation between joint attention skills and measures of attentional disengagement. However, poorer receptive language abilities were associated and greater difficulties disengaging attention. Results from the present study replicate existing findings related to joint attention and language development and suggest that ‘sticky attention’ may be associated with receptive language abilities.

Mentor(s):

Brandon Keehn, Purdue University

**Talk Presentation Abstract Number: 402** :: Life Sciences

# Quantifying Mechanobiology of Synoviocytes Under Cyclic Stretch

Author(s):

Maya Alborn, College of Engineering

Abstract:

Osteoarthritis is a debilitating disease that affects millions of Americans. This ailment can cause low molecular weight hyaluronan, as opposed to high molecular weight in healthy joints. Hyaluronan is a macromolecule that provides lubrication and can modulate wound healing. Synoviocytes produce components such as hyaluronan in the fluid in the synovial joint. Lack of loading or excessive loading can alter cellular responses, affect morphology, and change the synthesis and break down of hyaluronan. To stretch synoviocytes we created an ABS 3D printed holder for the FlexCell 6-well plate where the synoviocytes will be seeded on. We also fabricated cylindrical Delrin posts to stretch the membrane in the wells by indentation. We used the ElectroForce 5500 to actuate the posts such as to subject the membranes under different magnitudes of strains 5%, 10%, and 20%. The experimental setup was validated through strain quantification measurements to ensure the membrane was stretched at specific strains like what was given as input. Post-stretching, we will quantify the changes in cell viability by live/dead staining and changes in cell morphology by fluorescence and brightfield microscopy and compare the results with unstretched controls. In future studies, we plan to analyze hyaluronan production between different strain groups. We believe these studies will provide understanding of the mechanobiological responses of synoviocytes under stretch which may be important in paving therapeutic strategies to prevent or delay the progression of osteoarthritis.

Key Words: Osteoarthritis, synoviocytes, cell stretch, strain quantification, cell viability

Mentor(s):

Deva Chan, Weldon School of Biomedical Engineering

Clarisse Zigan, Weldon School of Biomedical Engineering

**Talk Presentation Abstract Number: 403** :: Innovative Technology/Entrepreneurship/Design

## Pre-Silicon Verification of Digital IP Library Using Universal Verification Methodology


Author(s):

Fan Jing Hoon, College of Engineering

Pranav Srisankar, College of Engineering

Maxwell Michalec, College of Engineering

Duncan Van, College of Engineering



Abstract:

Modern system-on-chips (SoCs), designed using a hardware description language, often reuse some functional blocks that are common among multiple iterations of the chip's design. The System-on-Chip Extension Technologies (SoCET) team has developed a digital library of commonly used functional blocks that can be implemented in future RISC-V SoCs. To ensure the blocks function according to their specifications, thorough verification is needed. This research project's focus is to bring up testbenches using SystemVerilog's Universal Verification Methodology (UVM) to verify the modules. UVM is the industry standard for verifying the register transfer level descriptions of digital designs and adopts object-oriented programming methods, allowing verification engineers to extend its library of classes, reuse code, and abstract away from the component being tested. The project team has been bringing up UVM test benches for the first-in-first-out buffer, stack, counter, and shift register modules in the digital library. By fully verifying the library of modules, the SoCET team will be able to easily include them in future designs, resulting in higher-quality SoC development.



Mentor(s):

Sarang Pramod, Purdue University

**Talk Presentation Abstract Number: 404** :: Life Sciences

**Chromatin Remodeling Complexes in Androgen Deprivation Induced Neuroendocrine Prostate Cancer**

Author(s):

Sam King, College of Pharmacy, Honors College

Abstract:

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 such factor is BAF, a multiunit ATP-dependent chromatin remodeler. The purpose of my project is to understand the role of BAF170, a subunit in the BAF complex, in androgen deprivation-induced neuroendocrine 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 in vivo androgen deprivation, these cell lines are grown in steroid-deprived cell culture media. This drives LnCaP cells to develop a neuronal morphology, as well as differential expression of neuronal-related genes. Experimental results of assays measuring morphology and gene expression using cell lines with modified BAF170 expression indicate that BAF170 affects this differentiation process. Several compounds have also been screened to target BAF170 to develop better tools to understand chromatin remodeling biology. These agents could also be used in-vivo in the future, which is promising as neuroendocrine prostate cancer has the lowest patient survival rate compared to any other subset of prostate cancer.

Mentor(s):

Emily Dykhuizen, MCMP

Sandra Ordonez, MCMP

**Talk Presentation Abstract Number: 405** :: Mathematical/Computation Sciences

## A Gaussian Process Model for Spatio-Temporal Ozone Distribution in California

Author(s):

Jerry Gu, Temporary

Abstract:

Ozone at ground level is considered by the Environmental Protection Agency as a criteria air pollutant due to its ability to cause respiratory issues when breathed in. Thus, it is vital for researchers to be able to determine the concentrations of ground level ozone at certain places and certain times. The University Corporation for Atmospheric Research (UCAR) uses satellites to collect ozone data at specific locations during specific time intervals. Because it is unfeasible to measure the exact ozone levels everywhere at any time, it would be valuable to be able to predict spatio-temporal distributions of ozone concentration. We propose using the Gaussian Regression process, with the Matérn covariance function, to create a model that can predict the ozone concentration at a specific place and time. We chose to create an ozone model for California, due to its large population and abundance of urban areas, where people are most affected by ozone. California also harbors many pollution creating industries that make it one of the states with the worst air quality in the U.S. Based on the data provided by UCAR, we used our model to generate a spatio-temporal map of ozone concentration across California. We demonstrated that the Gaussian Regression method using the Matérn kernel can reliably predict the spatio-temporal dependence structure from a large set of data.

Mentor(s):

Guang Lin, Purdue University

**Talk Presentation Abstract Number: 406** :: Life Sciences

## Utilization of Spatial Analysis to Investigate IU Health Arnett's High Patient Fall Rate

Author(s):

Colleen Cole, College of Health & Human Sciences, Honors College

Abstract:

At IU Health Arnett Hospital in Lafayette, IN, patient falls happen more frequently than at other hospitals in the surrounding area, a problematic trend that has been ongoing since before the pandemic and has not seen any improvement. This is a cause of great concern because each time a patient falls, hospital staff must come to their assistance and then follow a thorough reporting protocol, which reduces the number of staff members available to help with other concurrent situations occurring elsewhere. That is not to mention the risk of serious injury and possibly even death to the patient from the fall itself. IU Health Arnett has acknowledged that this issue needs to be addressed, however it is hard to find solutions considering a clear cause has not yet been established. Many factors exist that could contribute to the hospital's high frequency of patient falls, but only a select few have been taken into consideration thus far. Therefore, the purpose of this research is to utilize spatial analysis to investigate a potential relationship between patient falls per floor and nursing staff population.

Mentor(s):

Katie Jarriel, Purdue University

**Talk Presentation Abstract Number: 407** :: Life Sciences

## Home-based leg heat therapy to improve walking performance in elderly individuals

Author(s):

Sidharth Reddy, College of Health & Human Sciences

Abstract:

The purpose of this study is to assess how much home-based leg heat therapy can improve the walking efficiency of the elderly.With time, people naturally lose strength.These losses cause them to walk less efficiently. Furthermore, for this study, two elderly patients start this process each month. Their walking efficiency and their senses will be measured by tests. For their first test, their cognitive function will be evaluated on the MSEE exam. Following that, the patient will have a thermal sensation test where they must differentiate between hot/thermoneutral stimuli. After passing that test, the patients will move onto the physical tests. They will complete a 6-minute walk test where they will try to walk as far as they can in 6 minutes. After, the patient will then take part in a calf strength test measured by an Isokinetic Dynamometer. They will perform three submaximal positions for each plantar flexion till they reach the patient’s max. The last is the chair stand test where they stand up and sit down on a chair as quickly as possible for 5 minutes. Once completed, the patient will return after 12 weeks to see how much their results from the physical test changed after undergoing heat based-leg therapy. After, it's all said and done. It is expected for the patient to experience some improvement in their walking ability. From there, we can draw the conclusion that heat-based leg therapy is an effective utility in improving the walking efficiency in the elderly.

Mentor(s):

Ro Bohyun, Purdue University

**Talk Presentation Abstract Number: 408** :: Social Sciences/Humanities/Education

## Digitalizing Delphi: Educating Audiences Through Virtual Reconstruction

Author(s):

Kate Koury, Polytechnic Institute, College of Liberal Arts, Honors College

Abstract:

Implementing a 3D model into a virtual space allows the general public to engage critically with archaeological processes. There are many unseen decisions that go into reconstructing an ancient temple. Analysis of available materials and techniques, predictions of how objects were used, decisions of what sources to reference, puzzle piecing broken remains together, and even educated guesses used to fill gaps in information often go unobserved by the public. This work will educate users about those choices by allowing the side-by-side comparison of conflicting theories on the reconstruction of the Tholos at Delphi, which is an ideal site because of its unique shape, history, and presence of missing information. Data used in the reconstruction includes images taken on site, original archeological renderings and measurements, and existing theories of the temple's construction. The final virtual model will allow for side-by-side comparison of these differences. Furthermore, previous 3D representations are generally made for professional audiences and are rarely interactive.This model is also designed to elevate the current archeological process from static representations into a format as dynamic as the process of reconstruction itself. The next step for this project is to fully integrate and experiment with how users engage with the model in an interactive application. Using modern technology to explore ancient artifacts creates new and exciting processes that show looking back to history can be just as powerful as envisioning the future.

Mentor(s):

Katie Jarriel, John Martinson Honors College

Arne Flaten, Rueful School of Art and Design

**Talk Presentation Abstract Number: 409** :: Physical Sciences

## 3D Printed highly Sensitive Pressure Sensors


Author(s):

Mitesh Mylvaganan, Polytechnic Institute



Abstract:

Our research is focused on highly sensitive pressure sensors using hybrid structure of 3D printed substrate and conducting polymer. The sensors work by changing the resistance in the sensor when the surface is deformed. When a pressure is applied, the contact area between the sensing element surface and electrode is increased leading to a higher current going through the sensor which can be measured and translated into a pressure reading. The previous methods of fabricating pressure sensors currently include slow or expensive methods like injection molding or photolithography. If we could 3D print them, it would allow for the sensors to be made in much higher quantities and for much cheaper. We are flushing out the usage of 3D printers in this process to achieve optimal. Elegoo Mars 3 will be used for 3D print with a high resolution of up to 35 µm. Our research also focuses on the shape of the pressure sensor because different shapes can have more sensitive reactions to low pressures. We are testing new shapes which produce sensitive response to low pressure (< 10 kPa). To analyze the effect of the surface area on the sensor characteristics, the density of spikes on the dome shaped 3D printed substrate was varied (no spike, low-density spikes, high-density spikes). Our results confirm that a high density of spikes on the dome produced more pronounced readings when low pressures were applied to it. We hope to produce a fully functioning sensor that can be manufactured quickly and inexpensively.



Mentor(s):

Sunghwan Lee, Purdue University

**Talk Presentation Abstract Number: 410** :: Innovative Technology/Entrepreneurship/Design

**Real-Time Operating System Implementation on Control of RoboMaster Competition Robot**


Author(s):

YuXi Liu, College of Engineering



Abstract:

The challenge of controlling a competition robot arises when it needs to simultaneously deal with the sensor's feedback, compute and solve for kinematic equations, and change behavior models based on user input. These requirements increase the complexity of the control system and "bare-metal programming" is not sufficient to solve this issue. Therefore, a Real-Time Operating System is implemented to prioritize tasks and creates threads for multitasking.

FreeRTOS is the Real-Time Operating System that has been implemented on the STM32 control board to control the robot. This Mecanum-wheel robot with a 2DOF gimbal that launches projectiles is able to compute the inverse kinematic of the chassis, maintain the

gimbal stabilization through the feedback from the motor's encoder and an IMU, and switch between various behavior models in almost real-time with negligible delay. Since a pilot will manually control this robot to fight against other robots in this competition, lower delay

crucially improves the responsiveness of the robot and hence its performance. This Real-Time Operating System control framework can be used in other competition robots or embedded system devices with certain complexities and require multitasking.



Mentor(s):

Abolfazl Hashemi, Purdue University

**Talk Presentation Abstract Number: 411** :: Innovative Technology/Entrepreneurship/Design

## Internet of Things and Digital Twinning with TENG devices


Author(s):

Conor McCarthy, College of Engineering

Meghan Gron, College of Engineering, Honors College

Saichandana Pothireddy, College of Engineering, Honors College

Blake Ifitger, College of Engineering

Mihika Saxena, College of Engineering



Abstract:

Digital Twinning is the virtual representation of the real world. Digital Twinning was first developed by NASA in 2010 as a product of Industry 4.0. The development of Digital Twinning has since created opportunities for industries to simulate, monitor, and test their systems and processes. Simply put, the real world will send data and signals to the virtual world. In return, the virtual world will return information and processes to the real world. The advantage of it is its ability to utilize the advantages of both the physical and virtual while minimizing each's constraints. These include reduction in machine down time and increased safety during training for employees. One of the prevailing uses for Digital Twinning is for Product Lifecycle Management (PLM). The traditionally heavy resource requirement is alleviated by Digital Twinning allowing companies to better understand and manage their products. This is made possible by "Internet of Things" (IoT). IoT is the communication of physical objects with sensors to an online space. The best at-home example of the power of IoT is the smart home appliances seen in homes. Using traditional and disruptive technologies IoT aims to improve all aspects of industry. Triboelectric Nanogenerators (TENGs) are considered to be perfect for the requirements of IoT devices. TENGs have a high recognition accuracy and can generate their own signals without the need for external power. These sensors can lend themselves to Digital Twinning as they can act as the signal giver to the virtual engine.



Mentor(s):

Nachiket Vatkar, Purdue University

**Talk Presentation Abstract Number: 412** :: Physical Sciences

# Implication of Modified Total Oxidizable Precursor (TOP) Assay for detecting Per- and Polyfluoroalkyl substances (PFAS) in complex media


Author(s):

Leyan Peng, College of Engineering



Abstract:

Per- and Polyfluoroalkyl substances (PFAS) are a group of man-made chemicals having stable fluorinated alkyl chains that make them highly persistent and cause negative health impacts in humans and environment. PFAS includes more than 4,700 chemicals consisting of fluorinated carbon tail with different functional head groups, of which only less than hundred compounds are directly quantifiable due to the instrumental and reference standards constraints. Some “precursor PFAS” can biologically and abiotically transform to more stable terminal products. TOP assays has been used in this context to accelerate the conversion of precursor to terminal PFAS, mainly Perfluoroalkyl acids (PFAAs), using thermal and chemical oxidation. Converted PFAAs can be easily measured using LC-MS/MS techniques so to indirectly detect PFAS precursors. However, the TOP assay was developed initially for clean matrices such as groundwater, and interferences of hydroxy radical reaction by the environmental matrices, especially that with high organic carbon was known issue. Therefore, here we propose a modified version of the TOP assay to better facilitate PFAS analysis in complex samples including leachate, wastewater and biosolids samples for this study. Samples were oxidized with hydrogen peroxide followed by TOP assay reagents. We observed significant increase in the PFAS detection as well as fewer interferences with our modified method. Hence, we conclude that this optimized method will improve the PFAS quantitation methods in various environmental samples.



Mentor(s):

Youn Jeong Choi, Purdue University

**Talk Presentation Abstract Number: 413** :: Life Sciences

# Proximal Femur Trabecular Orientation in Hindlimb Unloaded Murine Models

Author(s):

Anisha Rath, College of Engineering

Abstract:

During spaceflight, bone morphology is severely affected by microgravity, often causing astronauts to have decreased bone formation and increased bone resorption. This typically results in a decrease in bone mass, causing bone fragility. One approach used to simulate the effects of microgravity is hindlimb unloading, which suspends an animal from its tail to remove the weight bearing on the hindlimbs. The objective of this study is to determine if hindlimb unloading, diet, and radiation leads to any trabecular orientation and microarchitecture changes in mouse models. To do so, we scanned murine proximal femurs using micro-computed tomography, an imaging tool creating high-resolution 3D images made of 2D transaxial projections of the murine specimen. This allowed us to gathering data about bone microarchitecture to observe the effects of microgravity in mice proximal femurs. Segmentation was conducted to differentiate between cortical and trabecular bone. Using these files, regions of interest (ROI) in the trabecular proximal femur of murine models were identified, specifically the femoral head, femoral neck, and peak of the greater trochanter. These ROIs were used in data analysis to create a 3D input anatomical axis that determined the orientation of each individual trabeculae. We used multivariate ANOVA analyses to examine if any significant differences were found from this. By observing these differences, we can see if orientation and other microarchitecture changes in the murine proximal femur can be detected. With this knowledge, further research  to determine whether an intervention is effective at preserving trabecular morphology and orientation in the face of disruptions.

Keywords: Trabecular, Orientation, Hindlimb Unloading, microgravity

Mentor(s):

Deva Chan, Purdue University Weldon School of Biomedical Engineering

Zachary Davis, Purdue University Weldon School of Biomedical Engineering

**Talk Presentation Abstract Number: 414** :: Social Sciences/Humanities/Education

## Microfinancing and Entrepreneurship in Cocoa Refinement in Côte d'Ivoire

Author(s):

Erin Soro, School of Management

Abstract:

Economic growth and entrepreneurship in developing countries is often limited by access to credit markets (Levine, 1993). In the case of Côte d'Ivoire, credit constraints may be limiting producers to exporting raw cocoa beans, rather than competing in later and more lucrative stages of refinement. Currently, Côte d'Ivoire produces 45% of the cocoa in the world, but only receives only 7% of the global revenue of cocoa. This pattern is repeated throughout the developing world: in Mali with gold and bauxite in Guinea, both countries rely more on exporting rawer versions of the minerals over refining them further. This project aims to evaluate the potential of microfinancing to break this pattern. Using a combination of case studies and data from randomized controlled trials in microfinance, I plan to i) measure the effect of microfinance on the development of raw product refinement processes, ii) identify the constraints limiting investment in refinement in developing countries, and iii) evaluate the potential of microfinance to encourage entrepreneurship in the case of cocoa refinement in Côte d'Ivoire.

Mentor(s):

Colin Sullivan, Purdue University

**Talk Presentation Abstract Number: 415** ::

**Poster #196**

**Talk Presentation Abstract Number: 416** :: Mathematical/Computation Sciences

## Generation of IFC compliant models of bridge infrastructure assets using lab generated OBJ data


Author(s):

Sankhya Gowda, College of Science



Abstract:

With the development of the IFC 4.3 candidate, a considerable boost has been given to the digitization of infrastructures in open formats. Moreover, the 4.3 schema has only recently extended domains to “horizontal resources” like bridges and railways as it sets the pathway for interoperability amongst different infrastructures under buildingSMART. This research project attempts to show a combination of BIM and IFC modeling procedures in a bridge infrastructure scenario. It attempts to find existing utilities and algorithms that can help create a robust algorithm which uses a data-driven approach to match different parts of a bridge automatically from an OBJ file. The input data for the IFC modeling procedure is obtained from the processing of OBJ files that extract the standard dimensions of an asset like a bridge. It then examines the modeling of the input data and uses a transformational conversion process that exploits 3D object recognition to preserve the geometric and semantic information of the infrastructure in IFC format.



Mentor(s):

Jiansong Zhang, Purdue University

**Talk Presentation Abstract Number: 417** :: Mathematical/Computation Sciences

## Adaptable Human Detection


Author(s):

Robert Sego, College of Engineering

Tiffany Yu, College of Engineering

Xilai Dai, College of Engineering

Diya Prasanth, College of Science, College of Science

Anisha Chawla, College of Engineering

Kaden Merrill, College of Engineering

Alex Weber, College of Engineering

Natasha Gundapaneni, College of Engineering

Patrick Li, College of Engineering



Abstract:

Pedestrian detection models are often inaccurate for datasets other than the one they were trained on; they generalize poorly due to their specialized structure that often relies on constructs such as anchor settings. Additionally, their source datasets are uniform and often do not contain images of crowds or diverse enough scenarios. Intention estimation, crowd counting, and subject identification are all related problems that require the detection of humans. The purpose of this project is to create a broader human detection model capable of finding people in a variety of contexts. The end model must detect people in unusual poses, obscured partially by the scenery, distorted by fast movement, or surrounded by a crowd. To meet these constraints, we implemented YOLO, a general object detection neural network, and trained it on the WIDER 2019 Pedestrians dataset.

By using a more general architecture and a web-scraped, varied dataset, we seek to create a more robust detector that is effective on a wider range of datasets than contemporary models for pedestrian detection, such as F2Dnet, EGCL, and Pedestron. Our final analysis will compare the trained YOLO detector against these pedestrian detectors on street view, surveillance, and crowd images. The resulting model will be an effective research tool for various tasks and can inform future designs for pedestrian detectors.



Mentor(s):

Carla Zoltowski, Purdue University

**Talk Presentation Abstract Number: 418** :: Social Sciences/Humanities/Education

## Linguistic Changes in Russian in Turbulent Times

Author(s):

Renee Forfa, College of Liberal Arts, Polytechnic Institute

Abstract:

Vocabulary changes are a natural and constant driving force in every language. These changes are accelerated and become more frequent during times of conflict and hardship. On February 24, 2022, Russian troops invaded Ukraine. Over the course of the resulting Russo-Ukrainian war, new words have emerged from Russian and Ukrainian sources alike to reflect the escalating conflict. These newly coined words are spontaneously emerging in response to current events. Examples include language experiments and wordplay, e.g. мобилизАКция (a portmanteau of the words mobilization and action) and могилизация (mokillization). In addition to lexical changes, there are also changes observed on the morphological and syntactical levels. My research examines the emergence and application of changes to the Russian lexicon in modern news sources.

Mentor(s):

Olga Lyanda-Geller, Purdue University

**Talk Presentation Abstract Number: 419** :: Fine Arts

## Laughter and Madness: The Comic Horror of Evil Dead II

Author(s):

David Gowan, College of Engineering, College of Liberal Arts

Abstract:

In 1981, the low-budget horror film The Evil Dead became a box office success, launching the career of director Sam Raimi. Still banned in certain countries, the film is infamous for its gruesome, gory, blood-soaked imagery. With its 1987 sequel, Evil Dead II, Raimi took the series in a different direction, producing a horror comedy that expanded upon some of the darkly comic elements of the first film. This paper seeks to explore how humor is utilized in Evil Dead II by interrogating the film's interplay between slapstick comedy and supernatural horror. Selected scenes from throughout the film are dissected and analyzed through the lens of different theories and philosophies of comedy—including incongruity theory, Henri Bergson's ideas on comedy, and Plato's philosophy of comedy. In addition, the similarities and differences between the film and its predecessor are discussed in order to contextualize Evil Dead II's horror elements.

What we find with Evil Dead II is that throughout the film, laughter is intertwined with madness and evil. The demonic spirits which torture the protagonist, Ash, do so in juvenile, Chaplinesque ways, for amusement—both theirs and ours. Only when Ash is pushed to the limit and has a psychotic break does he begin to fully appreciate his circumstances—that he is the butt of some cosmic joke—and join in laughing. In this regard, the comedy of Evil Dead II builds another dimension to the film's horror, enhancing the story, rather than undermining it.

Mentor(s):

Elena Coda, Purdue University

**Talk Presentation Abstract Number: 420** :: Social Sciences/Humanities/Education

**English-Russian Philosophical Glossary for Aleksei Losev**

Author(s):

Michael Linge, College of Health & Human Sciences, College of Liberal Arts

Abstract:

This project aims to create a functional English-Russian philosophical glossary. In general, Russian has its own unique lexicon of philosophical terms that differ from English, and this is even more so the case with philosopher Aleksei Losev. This glossary will facilitate readers into the world of both Russian philosophy and Aleksei Losev’s specific system. The work used is Aleksei Losev’s Dialectic of Myth (Russian Edition 1930, English translation Vladimir Marchenko 2003). By reading and studying the work in both English and Russian side by side, I compiled a list of key philosophical terms from the book that will most assist the readers in understanding Losev’s philosophical system. One example would be the term “myth” as used both in Losev’s system and apart from it. Not only does this glossary offer a list of terms, but it provides a full explanation of them as they function in Losev’s work and outside of it. We estimate the finished glossary will include upward of 30-40 bilingual entries. Despite the challenges brought by studying both Russian and philosophy, we aim to demonstrate that it is possible and rewarding.

Mentor(s):

Olga Lyanda-Geller, Purdue University

**Talk Presentation Abstract Number: 421** :: Life Sciences

## Quantification and comparison of bacterial communities of healthy and BRD-affected dairy cattle

Author(s):

Noelmi Ulloa, College of Agriculture

Abstract:

Despite advances in animal husbandry and animal welfare, bovine respiratory disease (BRD) remains a significant problem for dairy producers. The costs associated with respiratory diseases include prevention, treatment, and lost productivity; therefore, outbreaks of BRD can cause devastating economic outcomes for dairy owners. Due to the interactions between hosts responses, microbial agents, and environmental factors, early detection is crucial for a prompt response to decrease mortality risk. Bovine respiratory infections are caused mainly by four bacteria, Mannheimia haemolytica, Pasteurella multocida, Histophilus somni and Mycoplasma bovis. Therefore, this study aims to quantify and compare the abundance of these pathogens from nasal swabs taken from healthy and BRD-affected dairy cattle to determine a threshold bacterial abundance that can be used as a parameter to identify BRD using the easy to collect nasal swab sample. We have already used quantitative PCR to determine the abundance of the four pathogens from about 100 BRD affected and 100 apparently healthy animals. We hope that this data can be used to develop a rapid diagnostic test to determine the health status of dairy cattle

Mentor(s):

Timothy Johnson, Purdue University

**Talk Presentation Abstract Number: 422** :: Social Sciences/Humanities/Education

## Mechanisms of Alcohol-Facilitated Laboratory Aggression among High-Risk Couples

Author(s):

Emily Khoo, College of Health & Human Sciences

Abstract:

Intimate partner violence (IPV) is a pervasive concern for those within romantic relationships and is related to a multitude of negative physical and mental health consequences. Numerous individual-difference risk factors for IPV have been established, including problematic drinking, negative affect, impulsivity, and relationship dynamics; however, the underlying mechanisms of how these risk factors lead to IPV is unclear. One promising finding from a recent study suggests that the indirect effect of alcohol use on IPV may be mediated through investment model processes (i.e., relationship satisfaction and commitment). However, understanding how these specific mediators proximally relate to IPV at the event level and in tandem with other established risk factors is critical. Therefore, the current study aimed to examine problematic drinking, relationship satisfaction, relationship commitment, negative affect, and negative urgency as intervening mechanisms of laboratory-based aggression among a high-risk couple. Participants included 149 individuals (49% women; $n = 73$) within romantic relationships where one partner reported past-month heavy episodic drinking and past-year IPV perpetration. None of the predictor variables tested within the mediational model including, problematic drinking (ß = -145.32), relationship satisfaction (ß = 622.94), relationship commitment (ß = -1963.94), negative affect (ß = -197.38), or negative urgency (ß = -1499.33), had a significant effect on laboratory-based aggression. Additionally, age ($p = 0.96$) and length ($p = 0.79$) of their current romantic relationship also had no effect on laboratory-based aggression. Findings from the present study will be discussed in relation to improving the measurement of distal constructs at the event-level.

Mentor(s):

Daniel W. Oesterle, Purdue University

**Talk Presentation Abstract Number: 423** :: Life Sciences

## Understanding the Menstrual Health Needs of People Experiencing Homelessness during the COVID-19 Pandemic in Lafayette, Indiana

Author(s):

Emma Schnolis, College of Health & Human Sciences, Honors College

Jaclyn Frank, College of Health & Human Sciences

Emily Otten, College of Science

Anukriti Arora, College of Health & Human Sciences

Abstract:

BACKGROUND: Period poverty occurs in all countries with limited access to menstruation products and other necessary resources. This project gathered information from people experiencing homelessness and professionals serving this community to inform programming efforts to address menstrual management needs to help improve this group’s reproductive health.

OBJECTIVE: This study’s focus was to understand what people experiencing homelessness know, experience, and practice when menstruating. A secondary purpose was to identify ways the COVID-19 pandemic impacted menstruation management in this population and how service providers support their needs.

METHODS: In-depth interviews were conducted with 1) menstruators experiencing homelessness (n=12) and 2) community healthcare and social service providers (e.g., case managers, community health workers, nurses, n=12). Thematic analysis techniques were used for data analysis.

RESULTS: Menstruators experiencing homelessness navigated restrictive community resources with limited access to products, services, and spaces. While community workers offered some health education and connection to care, menstruators experienced complex interactions with providers and the healthcare system, exacerbated by social stigma, limited healthcare access, and underlying chronic health conditions. The COVID-19 pandemic further magnified healthcare access disparities for this group as public spaces closed, economic conditions deteriorated, and health outcomes were poor among those most socioeconomically disadvantaged.

CONCLUSIONS: Outcomes from this work will benefit marginalized groups by using the experiences of these menstruators to develop meaningful health and policy interventions. Findings will advance reproductive and public health research by illuminating the disparities people experiencing homelessness face when managing menstruation in Indiana and contribute to the national dialogue on the importance of addressing these barriers.

Mentor(s):

Andrea DeMaria, Purdue University, College of Public Health

Natalia Rodriquez, Purdue University, College of Public Health

Risa Cromer, Purdue University, College of Liberal Arts

**Talk Presentation Abstract Number: 424** :: Social Sciences/Humanities/Education

## Racial and Ethnic Disparities in Service Referral and Use Among High-Risk Children Diagnosed with Autism Spectrum Disorder


Author(s):

Aaliyah Saunders, College of Health & Human Sciences, College of Liberal Arts

Victoria Bozinovski



Abstract:

Background: Early identification of autism spectrum disorder (ASD) and subsequent entry into early intervention is associated with more optimal outcomes. However, prior research has shown that racial/ethnic disparities exist for ASD service utilization and access.

Objectives: To measure racial/ethnic disparities in service referral and use in children diagnosed with ASD.

Methods: Participants included 74 young children with ASD (Non-Hispanic White = 48, Any other race=26). Caregivers completed demographic and intervention surveys. The intervention survey focused on service recommendations and utilization, as well as barriers to service use. Services included applied behavior analysis, relationship-based developmental intervention, play therapy, developmental therapy, developmental preschool, and speech, occupational, physical, and feeding therapies.

Results: For provider service recommendations, the proportion of children recommended for intervention varied by race/ethnicity for play and developmental therapy. For both approaches, Non-Hispanic White families were less likely to be referred compared to families of any other race.

Conclusions: Contrary to prior research that has shown disparities in service referral and use, which may negatively impact people of color, our findings show that these disparities may not exist within our current system of care.



Mentor(s):

Brandon Keehn, Purdue University

**Talk Presentation Abstract Number: 425** :: Social Sciences/Humanities/Education

**The Role of BIPOC Parents in Diversifying Children's Literature**

Author(s):

Kayla Neal, College of Education

Abstract:

When obstacles threaten to hamper young children's educational growth, self-image, and aspirations, parents are key stakeholders to remove barriers. Parents have meaningful truths to share about reading materials that engage, inspire, and instruct their children best. Educational research has brought diverse representation in children's books into greater focus. For such books to have meaningful impact, a partnership is required that authors, teachers, administrators, and children can't fulfill alone: parents are essential informants. This study uses thematic analysis of interviews of five families with BIPOC elementary students to explore their experiences with authentic racial representation in children's literature. Findings promise to inform teacher education, expand criteria for selecting books, and insist working with families can help students thrive.

Mentor(s):

Christy Wessel-Powell, Purdue University

**Talk Presentation Abstract Number: 426** :: Mathematical/Computation Sciences

## Purdue SoCET: Design Flow


Author(s):

Wilbur Chen, College of Engineering

Tam Le, College of Engineering

Joseph Eisenburg, College of Engineering College of Engineering

Yiyun Wang, College of Engineering



Abstract:

The System on Chip Extensions Technology (SoCET) team designs and works on the AFTx06 chip. This process involves designing chip components at a higher level with Hardware Description Languages (HDLs) and requires different design techniques to transform this higher-level design into a full physical layout – one with wires, metal, and other materials. Our Design Flow sub-team focuses on transforming the HDL code into a physical layout. In other words, this project aims to transform the specifications into a chip fabricated on silicon. This process involves three main steps: Synthesis, Floor Planning, and Place and Route. Synthesis translates the created Register Transfer Level (RTL) code to a gate-level netlist. The same process occurs for the testbench, which is a program designed to run simulations and tests on the code for a chip component. In other words, synthesis takes relatively higher-level hardware code and transforms it into lower-level code that can be more easily turned into a physical design. The second step is floor planning, which is placing logic blocks while also considering the design constraints. There are a wide variety of limiting factors of physical chip designs that must be considered, such as a chip component being so small that the design must consider the limited capabilities of the manufacturing tools. The final step that we need to implement is placing and routing, which physically places and wires the mapped netlist, preparing the chip for the physical design process.



Mentor(s):

Raghuraman Kottaiyur, Purdue University

**Talk Presentation Abstract Number: 427** :: Innovative Technology/Entrepreneurship/Design

## SWARMS: Multi-Agent Control Simulation Platform

Author(s):

Amikosh Dube

Michael Lock

Anam Nasim

Sullivan Cisco

Sohan Pramanik

Reed Baker

Annie Mitten

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. The current web platform is getting redesigned to become accessible and professional. We are developing various environments, such as natural forests and gamified levels, to evaluate drone algorithms. In addition, we are building PID controllers that stabilize drone maneuvers for users to test their algorithms quickly. We are also developing an obstacle avoidance algorithm to detect multiple obstacles and display 3D visualizations of the updated path. Our plans include creating a dense city environment and implementing intuitive checkpoint and object recognition systems to support disaster management and package delivery applications.

Mentor(s):

Shreyas Sundaram, Purdue University

**Talk Presentation Abstract Number: 428** :: Mathematical/Computation Sciences

## Static CMOS Implementation of Polymorphic Logic


Author(s):

Malcolm McClymont, College of Engineering

Jacob Chappell, College of Engineering



Abstract:

Integrated circuit (IC) reverse engineering presents a major risk for computer security and protection of intellectual property. Various methods can be employed to extract the schematic of a circuit. Polymorphic logic gates have been presented as an effective method of impeding reverse engineering but are often achieved using novel devices unavailable on a large scale. The purpose of this paper is to present the combination of static CMOS polymorphic logic gates and serial logic locking to implement a multi-function device. Polymorphic gates are created by wiring transistors such that the gate’s logic function can be changed by applying different power supply voltages.

This method was used to create a NAND/NOR gate and a XOR/BUF gate. To conceal which transistors of each gate correspond to which function, each logic gate is rotationally symmetrical. By connecting these gates and applying different power supply voltages to each individual gate, a device that can perform multiple functions can be created. The device proposed in this paper, which will be referred to as the polymorphic logic array, can perform various multi-bit operations. The 128-bit control signals that correspond to each function are used as keys. These keys are inserted into a register as a serial signal. By inserting a different key, the device’s function can change during runtime. This study describes the operation of the polymorphic logic array, its advantages and disadvantages compared to existing obfuscation methods, and its potential future uses.



Mentor(s):

Mark Johnson, Purdue University

Boyuan Chen, Purdue University

**Talk Presentation Abstract Number: 429** :: Innovative Technology/Entrepreneurship/Design

## Pursuing the development of antifouling implantable biosensors and novel bioadhesives

Author(s):

Carl Russell III, College of Engineering

Abstract:

Constant and reliable modes of patient monitoring are critical in modern healthcare. Implantable biosensors have the capability to track various clinically relevant biomarkers to allow clinicians to make informed, data-driven decisions. Biosensors typically feature a biorecognition element and a signal transducer. However, many implantable biochemical sensors have limited in vivo functionality regarding 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.). Sensor fouling and device drift are notorious issues for chronically implanted electronics including neurostimulators and biosensors. In this work, I seek to utilize the latest sensor characterization techniques to better evaluate the baseline performance of novel device designs. I use a sensor assembly procedure to construct and package a model biosensor and evaluate the electrochemical performance of the biosensor in vitro using cyclic voltammetry, electrochemical impedance spectroscopy, and chronoamperometry. This preliminary work will demonstrate whether the biosensor can maintain its functional properties after implementing novel sensor designs and applying simulated exposure testing using human serum protein analogs. When sensors like these are implanted, device migration needs to be minimized. I also discuss the development of novel bioadhesives to ensure the biosensor can maintain its functional properties while eliminating the concerns of sensor detachment. The novel bioadhesives and antifouling components of such sensors will optimize future surgical implantation procedures by eliminating the need for traumatic harmful invasive or complicated device anchoring while improving long-term monitoring accuracy.

Mentor(s):

Hyowon Lee, Laboratory of Implantable Microsystems Research, Purdue University

Angel Enriquez, Laboratory of Implantable Microsystems Research, Purdue University

**Talk Presentation Abstract Number: 430** :: Social Sciences/Humanities/Education

## Characterizing Graphing Literacy in Undergraduate Biology Major and Non-Major Students

Author(s):

Kal Holder, College of Science, College of Liberal Arts, Honors College

Abstract:

The ability to graphically display data to communicate and share knowledge is an expected quantitative skill of any student. However, this is oftentimes challenging for students. This study seeks to better understand how undergraduate biology major and non-major students enrolled in an introductory biology course at a 4 year masters granting institution create and evaluate graphs.

More specifically, this study seeks to determine the type of graph knowledge students apply when creating (graph type task) versus evaluating a graph (graph selection task). This information was collected from an assessment of student graphing ability through the program GraphSmarts, completed by 98 biology major students and 36 non-major students. These data then underwent qualitative analysis using inductive and deductive coding methods to describe and capture patterns in participant responses.

Although analysis is still ongoing, current results suggest that non-major students are less apt to utilize statistically grounded and trend based explanations in creation and evaluation of graphs. However, both major and non-major students did not utilize variable identity and quantity as an explanatory factor in their generation of graphs

These results suggest a perpetuated struggle with graphing literacy for both major and non-major students. The lack of variable identity and quantity explanations in graph creation and evaluation tasks demonstrates that students require further support in the understanding of why graphs are constructed in a particular manner and how to select the optimal graph type. Curriculum expansion must be made to better support students' graphing abilities for both major and non-major students.

Mentor(s):

Nouran Amin, Purdue University

**Talk Presentation Abstract Number: 431** :: Social Sciences/Humanities/Education

## "Sometimes I feel uglier than ever": Influences on Internal and External Body Image

Author(s):

Alexandra Hughes, College of Science

Maia Lynch, College of Health & Human Sciences

Emily Otten, College of Science

Abstract:

Background: Menstruation is a biological phenomenon experienced by many people around the world. Despite the commonality of this experience, little is known about the cultural, social, and familial factors affecting Italian women's body image during menstruation.

Objective: The purpose of this study was to understand how menarche and menstruation impact body image, pubic hair grooming, and genital hygiene behaviors. A secondary purpose was to explore the cultural and societal impacts specific to Italy.

Methods: Researchers conducted 28 in-depth, semi-structured interviews (May-June 2022) with English-speaking women aged 25 – 60 years living in or near Florence, Italy who have experienced menstruation or menopause. Interviews were audio-recorded and transcribed verbatim. HyperRESEARCH aided in data organization and analysis. Qualitative content and thematic analysis techniques were used to contextualize data and identify emerging themes.

Results: External and internal influences such as family members, friends, and psychological/physical changes left women with negative feelings surrounding themselves and their bodies during menstruation. A negative view of their genitals led to a change in hygiene and pubic hair removal practices.

Conclusions: Results indicated social and cultural factors in Italy have major influence on menstruation-related body image, GSI, and genital hygiene practices. Findings highlight the impacts menstruation has on overall health and well-being, including behaviors and feelings. Information from this study can provide insight on helpful ways to discuss feelings toward menstruation and healthy menstruation management among all people in Italy.

Mentor(s):

Andrea DeMaria, Purdue University

**Talk Presentation Abstract Number: 432** :: Life Sciences

## Tumor-associated antigen surface density in mechanisms of CAR T cell activation threshold-setting

Author(s):

Kenneth Rodriguez-Lopez, College of Science

Abstract:

Engineered T cells expressing chimeric antigen receptors (CARs) are tunable anti-tumor therapeutics that have proven to be successful in blood cancers by retargeting the killing potential of these adaptive immune cells. Unfortunately, the translation to eradicating solid tumors has largely failed due to severe toxicities from CAR T cell treatments. Defining the thresholds for CAR T cell activation will promote improved receptor design and more tolerable therapeutic regimens. Tumor evolution includes changes in expression of tumor-associated antigens (TAA) which may promote immune evasion. One such antigen, the folate receptor (FOLR1), is overexpressed in ovarian, breast, lung, pancreatic, and kidney cancers. The expression of this receptor spans 2 to 3 orders of magnitude in normal-to-disease surface densities, therefore, developing clonal populations that differ in expression level of FOLR1 is needed for studies to reflect different stages and TAA organization that are characteristic of in vivo systems. We culture these clonal populations in extracellular matrices (ECMs) to develop 3-dimensional cancer cultures (spheroids). TIRF microscopy is an optical technique that can be used to study phenomena in a very thin volume near the adherent surface, such the plasma membrane. This technique, in tandem with flow cytometry, is used to quantify the expression and distribution of FOLR1. Finally, the populations will be used in cell-cell killing assays to measure CAR T cell-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:FOLR1 binding events to T cell activation.

Mentor(s):

Shalini Low-Nam, Purdue University

**Talk Presentation Abstract Number: 433** :: Physical Sciences

## Synthesis of Signaling Hormones Streptomyces rochi butenolides (SRBs)

Author(s):

Gracie Sanders, College of Science, Honors College

Abstract:

Biofilms are present in approximately 80% of chronic illnesses and are therefore a strong target for therapeutic intervention. These bacterial clusters cannot be physically or chemically removed, which leads to treatment complications. Biofilms produce virulence factors, oftentimes in response to stimulation by LuxR-type receptors activated by acyl-homoserine lactones (AHLs). The virulence factors recruit more bacteria to join the biofilm and cause growth. This project is interested in the synthesis of Streptomyces rochi butenolides (SRBs), signaling hormones that have been hypothesized to inhibit virulence factor production in biofilm producing bacteria due to structural similarity to known Lux-R inhibitors. The SRBs, and Streptomyces angochromogenes butenolides (SABs), are structurally similar to known biofilm regulators such as the LuxR competitive inhibitors. SAB/SRB compounds will not aid in killing of biofilms. However, they will prevent virulence and inhibit growth. The synthetic route for the SRB side chains begins with monobenzylation of pentane-1,5-diol followed by an oxidation to afford 5-(benzyloxy)pentanal. This is subjected to a Grignard reaction with two different Grignard reagents corresponding to each SRB. These products are then oxidized, protected and hydrogenated. Lastly, an Appel reaction will afford both SRB1 and SRB2 side chains. Once an efficient route to accessing the SAB/SRB compounds is obtained, their activities against LuxR and biofilm formation can be tested in Pseudomonas bacteria. If SAB/SRB are found to have the desired inhibitory processes against LuxR, structural derivatives can be synthesized to further study antibiofilm activity.

Mentor(s):

Elizabeth Parkinson, Purdue University

**Talk Presentation Abstract Number: 434** :: Social Sciences/Humanities/Education

## Farmer Perspectives on Diversified Agriculture

Author(s):

Isabel Jensen, College of Agriculture

Abstract:

The Corn Belt region in the Midwest currently struggles financially, socially, and environmentally due to lack of agricultural diversification. The #DiverseCornBelt (#DCB) project focuses on increasing diversity in agriculture at the farm, landscape, and market level. This research focuses on Midwestern farmers' perspectives about diversified agriculture. This will enable the #DCB team to better understand what farmers think about this topic. The perspectives will be identified using Q methodology. Diversified and conventional farmers will rank 22 statements about diversified agriculture from most disagree to most agree. These statements were informed by peer reviewed literature, ag periodicals, and focus groups. An inverted factor analysis conducted on the farmers' ranked statements will identify common perspectives on diversified agriculture. To pilot these statements, we asked #DCB team members to rank statements as either diversified or conventional farmers and provide feedback on statement content. Three main perspectives were identified in this pilot activity, providing preliminary ideas of potential farmer perspectives. The next steps of this research are to introduce more statements promoting the current system and conduct this ranking activity with farmers to identify common perspectives.

Mentor(s):

Emily Usher, Purdue University

**Talk Presentation Abstract Number: 435** :: Life Sciences

## Anti-Pathogenic Activity of Concentrated Dairy Ingredients on Porcine Rotavirus


Author(s):

Chenhai Li, College of Agriculture



Abstract:

Rotavirus (RV) is an intestinal pathogen that can infect most young mammalian species. Porcine rotavirus (PoRV) is one of the major causes of neonatal diarrhea and mortality in swine and can cause huge property damage to animal industries. It is necessary to find non-toxic natural ingredient concentrates that can inhibit rotavirus infection. Therefore, this study was designed to test the efficacy of dairy concentrates and bovine plasma to inhibit PoRV infection in the porcine small intestinal epithelial cell (IPEC-J2) model. PoRV was cultured and quantified on Rhesus African green monkey kidney cells (MA-104) to yield a virus titer of 10^7 focus-forming units (FFU). Three proprietary dairy concentrate samples FXP, Bovine Plasma, and commercial lactoferrin (LF) were used to treat IPEC-J2 cells for 1 h before RV infection. The cytopathogenic effect (CPE), RV-mediated cytotoxicity via lactate dehydrogenase (LDH), and alkaline phosphatase (ALP) release assay were then analyzed after 24 h PoRV infection. FXP treatment had the most obvious inhibitory effect of PoRV infection and exhibited only 10% cytotoxicity, and significantly reduced CPE. The other two treatments also inhibited rotavirus in varying degrees. PoRV-infected cells without any treatment showed significant CPE and 25% cytotoxicity. This experiment showed the inhibitory effect of dairy products on PoRV and their potential utility as a feed supplement to control swine rotavirus infection.



Mentor(s):

Arun K Bhunia, Purdue University

Dongqi Liu, Purdue Univeristy

**Talk Presentation Abstract Number: 436** :: Life Sciences

## DWORF's Impact on hIPSC-Cardiomyocytes

Author(s):

Alexandra Ware, College of Science

Abstract:

Abstract redacted.

Mentor(s):

Jake Megna, Regeneron Pharmaceuticals

**Talk Presentation Abstract Number: 437** :: Innovative Technology/Entrepreneurship/Design

## Designing and Developing a Camera System for Automated Tree Measurement

Author(s):

Robert Stewart, College of Engineering

Aidan Crowley, College of Engineering

Abstract:

The tree sensing and positioning project through the Department of Forestry and Natural Resources aims to create a digital system to yield accurate measurements and location data for individual trees within a plantation. Our scope within this project is to design a proprietary camera system that can capture images of trees, generate distance and size measurements, and link that data with a GPS coordinate for each tree. While this project is still in the early phase of development, we do have goals that we hope to achieve by the end of the semester. We are working with another sub team to use GPS base stations and ultra-wideband signals in order to achieve very accurate position data for the camera unit. The camera system is being designed so that a user can manage and change the positioning of the lenses on the fly for better data collection. The lenses we sourced have digital focus control to ensure that the different subjects are properly seen, as data collection distance will vary while in use. The system is controlled by a Raspberry Pi which is responsible for camera focus and separation distance adjustment as well as geometric calculations made for tree size and position analysis. We hope to have a final prototype of the full camera system completed by the end of the semester so that only minor improvements need to be made to create the field-ready system.

Mentor(s):

Guofan Shao, Purdue University

**Talk Presentation Abstract Number: 438** :: Mathematical/Computation Sciences

## Elementary Students' Conceptions of Programming on A Sorting Task

Author(s):

Sirou Wang, College of Education

Abstract:

Understanding students’ conceptions of programming is important for building on their knowledge in meaningful ways. In this study, 27 first graders and 26 third graders sorted pictures of objects, before and after a programming intervention, based on whether the pictures definitely involve programming, sort-of involve programming, or do not involve programming. Results indicate that the percent of students labeling pictures as definitely involving programming increased for the majority of items and this change was significant for girls on three of the five items of interest (two programming games and a robot). Students’ changes aligned with programming applications they used and learned about during the intervention, suggesting helping students make direct connections to programming applications is important for their developing conceptions.

Mentor(s):

Laura Bofferding, Purdue University

**Talk Presentation Abstract Number: 439** :: Innovative Technology/Entrepreneurship/Design

**Future of self-driving car: a blessing or a curse?**

Author(s):

Amanda Huang, Polytechnic Institute

Abstract:

Self - driving car, also known as an autonomous vehicle (AV), is a ground vehicle that has the ability to sense the environment with little to no human involvement. It relies on cameras, sensors, radar, and artificial intelligence to execute software. The Society of Automotive Engineers (SAE) categorized it into 6 levels, from level 0 (fully manual) to level 5 (fully driving automation). The Institute of Electrical and Electronics Engineers (IEEE) predicts that 75% of cars on the roads in the world will be autonomous by 2040. Driverless cars would be the future of transportation, and skepticism toward the technology would be dispelled as people became more knowledgeable about it.

Paper examines the impact that AV has on traffic flow, the environment, and safety issues. Cited research is conducted by using a specific or imagined city as a model to examine. Other cited research calculated the effect by mathematical formulas. The result shows traffic flow would be reduced by 35% as the automatic vehicles could intelligently work together. Greenhouse gas emissions can be reduced depending on the scale of travel demand. It has the potential to reduce car crashes as 94% of car crashes are due to human error.

Though AV still has some downsides, looking long-term all the drawbacks will be solved as time passes and as technology improves. Humans should vision things further and understand new technology as it changes rapidly. Automobiles would be a blessing for the future.

Mentor(s):

Qian Wang, Purdue University

**Talk Presentation Abstract Number: 440** :: Life Sciences

## Associations of Motor Skills with Inhibitory Control and Creativity in Preadolescent Children


Author(s):

Qiwei Zhu, College of Pharmacy, College of Health & Human Sciences

Mark Naguib, College of Health & Human Sciences



Abstract:

Childhood motor skills have been shown to be positively associated with fundamental cognitive domains such as inhibitory control processes that resist perceptual conflicts and inhibit impulsive responses. However, whether the positive association of motor skills with cognition can be extended to creative thinking, a cognitive ability essential for generating creative solutions to modern problems in many real-life settings, has remained rarely explored. Thus, the purpose of this study was to test the hypothesis that motor skills would be positively associated with not only inhibitory control but also creativity in preadolescent children. Seventy-eight children (37 female), aged between 8 to 10 years old, and lived in the West Lafayette/Lafayette area were recruited to complete two lab visits on separate days. Participants completed the Movement Assessment Battery for Children Second Edition (MABC-2), modified Eriksen flanker task, and Alternate Uses Test (AUT) to measure motor skills, inhibitory control, and creativity, respectively. Results from bivariate correlations showed that higher levels of manual dexterity as well as static and dynamic balance were correlated with higher accuracy during the flanker task and more acceptable responses during AUT. Further, these associations remained statistically significant after controlling for confounding variables such as age and intelligence quotient. These findings support our hypothesis that individual differences in motor skills during childhood may play a role in inhibitory control and creativity performance.



Mentor(s):

Shih-Chun Kao, Purdue University

**Talk Presentation Abstract Number: 441** :: Innovative Technology/Entrepreneurship/Design

## Earth Remote Sensing with Signals of Opportunity

Author(s):

Andrew Brandt, College of Engineering

Isaac Gelman, College of Engineering

Tanish Sanghavi, College of Engineering

Eli Bohlander, College of Engineering

Abstract:

Signals of Opportunity (SoOp) is a bistatic method of remote sensing using existing signals. Satellites, especially transmitters in geostationary orbit (GEO) are promising sources of SoOp. The main goal of this project is to provide a new way of aggregating and visualizing these signals to find suitable candidates for SoOp research. Previously, a version of the program was created in Python to calculate and visualize radiated power of GEO satellites onto the surface of the earth based on the user input. In order to investigate SoOp on a large scale, a simpler way of extracting these parameters from the database is needed. To solve this problem, the researchers created an application building upon the previous Python program. The user first provides a database file from the International Telecommunications Union (ITU) containing satellite parameters such as location, gain pattern, power, etc. The program generates a list of satellites that meet the power threshold then generates power density maps based on selections from the list. Optimized searching methods and power calculation functions make the program efficient. A graphical user interface made with the Python package Tkinter allows for intuitive and efficient navigation of the database. This streamlines the searching process for available signal sources for use in SoOp research.

Mentor(s):

James Garrison, Purdue University

**Talk Presentation Abstract Number: 442** :: Physical Sciences

## Human Olfactory Response to Volatile Organic Compound Emissions from Household and Personal Care Products

Author(s):

Zachary Limaye, College of Engineering

Abstract:

Household and personal care products are potent sources of indoor air pollutants. These fragranced products fall under the classification of scented volatile chemical products (sVCPs). These sVCPs are known to emit volatile organic compounds (VOCs), a wide variety of chemicals, of which are known to lead to adverse health effects. However, the consequences on cognitive and emotional response is not thoroughly studied. This study aims to use a controlled environmental chamber to characterize VOC emission from sVCPs, while recording human response with odor assessment and biometric data.

In order to isolate VOCs emitted by sVCPs, this study developed an inert controlled environmental chamber. The VOCs emitted are measured in real-time (1 Hz) with a high-resolution proton transfer reaction time-of-flight mass spectrometer (PTR-TOF-MS). The PTR-TOF-MS samples air from the chamber and records the chemical composition. The chamber will utilize VOC-free air supplied by a zero-air-generator in order to isolate the VOCs from the sVCPs. Air-exchange-rate is kept constant while temperature and relative humidity are measured in real time. At constant intervals, the participants heart rate and blood-oxygen saturation are monitored concurrently with odor assessment. The PTR-TOF-MS data captures the complexity of the VOC emissions and provides important information in determining the relationship between sVCP emissions and olfaction response. The integration of the chamber and PTR-TOF-MS will provide novel discoveries regarding the relationship between indoor air quality and human physiological behavior.

Mentor(s):

Nusrat Jung, Purdue University Architectural Engineering

Jordan Cross, Purdue University Graduate School

**Talk Presentation Abstract Number: 443** :: Social Sciences/Humanities/Education

## Social Justice and Equity as Operating Range: Enriching Success Pathways for Underrepresented Minority Students

Author(s):

Mackenzie Richards, College of Engineering

Abstract:

The issue of racial equity, diversity, and inclusion (EDI) continues to dominate conversations within American colleges and universities and can be modeled as a response to multiple shocks to the social and organizational environment. At the enterprise level, the goal of EDI initiatives is to support and include underrepresented minorities (URM) by expanding organizational operating ranges and creating an environment of success. Individual students are faced with making decisions to increase the value of their own experience and reach success. The authors describe a project to help expand the range of "success pathways" for those individuals, especially URM undergraduate students. Insight into this experience comes from the authors being URM students themselves. Three success outcomes related to the value chain interpretation of success pathway experiences were identified: 1) becoming a competitive candidate for job positions and career success; 2) having a positive and supportive college experience; and 3) gaining research experience and preparation for graduate school. It is important to track programs and pathways across a variety of STEM majors, including each domain of success outcomes, so that students are more aware of the options available to help them. This allows students to expand their own "operating range" and self-definition of success. The authors presented how decision analysis associated with EDI pathways to increase the quality of URM student experience can help assess and improve resilience and robustness of these students to both the Institute of Industrial and Systems Engineers (IISE) Annual Conference and Purdue’s office for diversity and inclusion.

Mentor(s):

Barrett Caldwell, Purdue University

**Talk Presentation Abstract Number: 444** :: Social Sciences/Humanities/Education

## Feasibility and Anticipated Acceptability of Community Health Worker-facilitated HPV Self-sampling for Cervical Cancer Screening in Lake County, Indiana

Author(s):

Alyssa Arreola, College of Science

Sathveka Sembian, College of Engineering

Abstract:

Significant cervical cancer disparities exist between African American and Asian populations compared to White populations in Indiana. Specifically, Lake County, Indiana, which has the largest Hispanic population in the state, has one of the highest mortality rates for cervical cancer in the state, and disproportionally higher incidence rates of cervical cancer among Hispanics. Although there has been progress in reducing cervical cancer prevalence through screening and HPV vaccination, these implementations have not completely resolved disparities in minority communities. To increase screening uptake, the President's Cancer Panel recommends HPV self-sampling and engaging the help of community (CHWs). CHW-facilitated self-sampling has been recognized as an effective means of improving screening, however few studies explore CHWs' perspectives on the feasibility and acceptability of this intervention. To explore this idea further, in-depth, semi-structured qualitative interviews were conducted with 15 CHWs from Lake County and neighboring counties (St. Joseph, LaPorte, and Cook County in Illinois). A thematic analysis revealed CHWs' perspectives and their roles in the mitigation of multilevel barriers to screening within these minoritized communities. From CHWs' perspectives, a CHW-led approach to HPV self-sampling shows promises of improving screening rates and cervical cancer incidence. Privacy, time saved, and comfort were found to be facilitators for acceptability, with concerns of the novelty, trust in provider expertise, and lack of physical space emerging as barriers. Likewise, synergies with existing CHW work were identified as a facilitator for acceptability and time limitations as a barrier. We conclude by sharing six key considerations for implementation identified by CHWs.

Mentor(s):

Natalia Rodriguez, Purdue University

Layla Claure, Purdue University

Lara Balian, Purdue University

**Talk Presentation Abstract Number: 445** :: Social Sciences/Humanities/Education

**Tourism Insights: ESG in Lodging and Hospitality**

Author(s):

Emily Cassanmagnago, School of Management, School of Management

Abstract:

Our world is aiming to be a more sustainable place and in recent years, more and more companies are adopting reporting formats that address the ESG - Environmental, Social and Governance - to perform their activities. A guide was created to explain what ESG covers, why businesses are adopting it, and how it differs from other forms of reporting on corporate responsibility. The study highlights the importance of ESG reporting to stakeholders, including customers, in an age of uncertainty and low customer loyalty in the Lodging & Hospitality industry.

Mentor(s):

Jonathan Day, Purdue University

**Talk Presentation Abstract Number: 446** :: Social Sciences/Humanities/Education

## The Current Conscription System in the Republic of Korea and Its Explicit and Implicit Problems: It is Time to Adjust


Author(s):

MinJae Choi, School of Management



Abstract:

The Republic of Korea has adopted a conscription system since seven decades ago when the Korean War broke out. All male citizens in the Republic of Korea bear the responsibility to fulfill their duty of national defense for at least 18 months with a wage less than the minimum wage in the military. Moreover, among G20 countries that are currently adopting conscription systems (Brazil, Mexico, Russia, and Turkey), the conscription in the Republic of Korea is the longest and the only one that does not have any other alternative options and conscript most.

In this article, it is investigated and analyzed the treatment of conscripts in the Republic of Korea, the disadvantages of being conscripted for nearly two years-long, and the implicit and explicit problems of the current conscription system over two major controversial points: whether the Korean government should maintain the current conscription system or not and whether the Korean conscription system should be expanded to include women or not.

Synthesizing all the investigations and research done in this article, this article provides the reason why the Korean government should switch the military service system to the volunteer military system. As a result, this article suggests possible solutions and alternatives: a volunteer military system with basic military training for both male and female citizens.



Mentor(s):

Qian Wang, Purdue University

**Talk Presentation Abstract Number: 447** :: Social Sciences/Humanities/Education

## Examining the Correlation of Brownfield and Superfund Sites with Health Outcomes in Indiana at the Census Tract Level

Author(s):

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

Abstract:

Brownfield and Superfund sites contain harmful chemicals that can lead to high exposures for nearby residents, which may contribute to negative health outcomes. The goal of this analysis is to determine the correlation between health outcomes and the number of sites at the census tract level. Publicly-available data from the US Census and the US Centers for Disease Control and Prevention from 2010 and 2021 were used to identify locations of hazardous sites and health outcomes in Indiana. Health data was available for 1,253 census tracts with 2,251 brownfields and 2,264 Superfund sites. The mean number of brownfields per census tract was 2.0 (minimum: 0, maximum: 30); for superfund sites the mean was 2.0 (minimum: 0, maximum: 20). The mean number of adults over the age of 18 with cancers, excluding skin cancer, per census tract was 7.0 percent (minimum: 0.7, maximum: 11.3); with chronic kidney disease the mean was 3.2 percent (minimum: 1.1, maximum: 7.6); with chronic obstructive pulmonary disease the mean was 9.0 percent (minimum: 2.5, maximum: 19.5); with coronary heart disease the mean was 6.9 percent (minimum: 1.3, maximum: 14.7); with current asthma the mean was 10.4 percent (minimum: 7.8, maximum: 17.8); with diabetes the mean was 12.3 percent (minimum: 2.5, maximum: 30.4). Analysis is ongoing. It is hoped that this analysis will contribute to our understanding of social injustice and environmental contamination.

Mentor(s):

Ellen Wells, Purdue University

**Talk Presentation Abstract Number: 448** :: Social Sciences/Humanities/Education

## Openness in Social Judgments of Diverse Others

Author(s):

Emily Fields, College of Health & Human Sciences, School of Management

Abstract:

As technology advances and more interviews are conducted online, it is important to explore what characteristics interviewers rely on most when forming judgments of a candidate's hirability. Research by Torres and Gregory (2018) addressed the differences in ratings when hiring managers either read resumes or interviewed the candidates and found that during interviews, together with perceived competence, aesthetics (e.g., eye contact and professional appearance) factored into the final hiring decision. Our research (currently ongoing) is to investigate how (a) people evaluate (potential) job applicants with diverse demographic characteristics (e.g., gender, race) differently; (b) these evaluations differ depending on the way the applicant interview information is presented; and (c) interviewers'' personality characteristics (such as openness) affect the way they perceive these applicants with diverse characteristics.

Using an online study platform, we will recruit approximately 500 individuals to participate in the study. The participants must be White, at least 25 years of age, and have had experience with the interviewing and hiring process. We have developed video recordings of hypothetical interviews done by individuals varying on the following three dimensions: competence, gender, and race. Participants will be asked to review a series of interview transcripts/videos and rate each applicant's hirability and other characteristics. This study is experimental in nature; the hypothetical characteristics of the applicants and the job position will be systematically varied across participants, and each will be randomly assigned to one of the conditions. In addition, they will be asked to answer questions about their personality and demographic characteristics.

Mentor(s):

Sang Woo, Purdue University

Cavan Bonner, Purdue University

**Talk Presentation Abstract Number: 449** :: Social Sciences/Humanities/Education

## Alignment Among U.S. States' Early Mathematics Learning Guidelines: An Expanded Review


Author(s):

Abigail Callis, College of Health & Human Sciences



Abstract:

A systematic document review of early mathematics learning guidelines/standards for all 50 U.S. states and Washington D.C. was conducted identifying which broad mathematics domains and specific skills were emphasized, as well as the specificity and rigor of each standard across all 51 documents. We expanded upon a prior analysis of a limited set of specific numeracy skills in early learning guideline (ELG) documents to include additional numeracy skills considered theoretically and empirically important for early mathematics development. Results show that individual U.S. states included an extensive list of numeracy skills in their mathematics standards beyond what has been highlighted in past research. Similar math skills are emphasized across U.S. states' standards, yet vary greatly in the amount of specific guidance provided and the extent to which the skills are portrayed to develop.



Mentor(s):

David Purpura, Purdue University

**Talk Presentation Abstract Number: 450** :: Social Sciences/Humanities/Education

**Math Aversion and Math Anxiety: The Psychology Behind Why Math is Unpopular**

Author(s):

Arija Simonaitis, College of Science, College of Health & Human Sciences, Honors College

Abstract:

Mathematics is a critical subject taught in schools that has many applications later on in life. However, mathematics has occasionally been regarded as an “unpopular” subject: some children and adults alike attempt to avoid mathematics as much as possible. In some cases, this occurs as a result of “math aversion”, in which a person generally dislikes math and makes efforts to avoid it. In other cases, a severe avoidance of math could even be a result of “math anxiety”, which is a strong feeling of apprehension and sometimes even stress or fear surrounding the subject of math. This project evaluates current research on math aversion and math anxiety, assessing what underlying causes contribute to these negative feelings towards math, and how they can be approached. Additionally, this project discusses the future of math education with regards to research in math anxiety and math aversion.

Mentor(s):

Sean Lane, University of Missouri (previously Purdue)

**Talk Presentation Abstract Number: 451** :: Innovative Technology/Entrepreneurship/Design

**Environmental Testing and Computational Modeling for NASA Solar Cruiser Sail Context Camera**


Author(s):

Tasveen Chopra, College of Engineering

Trent Fatur, School of Management

Isha Shamim, College of Engineering

William Davis, College of Engineering

Justin Lin, College of Engineering

Joao Pedro Bacchi, School of Management

Ian Veak, College of Engineering

Rhea Pahuja, College of Science

Emma Fisk, College of Engineering

Siya Deshpande, College of Engineering



Abstract:

Solar sails are an alternative form of propulsion which, instead of firing traditional propellant, utilizes the radiation pressure produced by the reflection of a star's light off a large, thin, reflective sail. Purdue University students are developing a camera system that analyzes solar sail efficiency for the Nasa Solar Cruiser Mission. In order to ensure the camera can handle the different aspects of space environments, a variety of tests such as vibration, radiation, and thermal testing are run in order to validate that the hardware can withstand these conditions. Initial verification tests will use modeling software to replicate the conditions the camera would encounter during launch. The thermal simulation provided by the SolidWorks tool for a camera model will allow for detailed specification of heat sources, heat transfer, etc. to ensure the camera's survival once launched. In addition to modeling, two physical testing procedures will be implemented. The Lyostar freeze dryer will function as a thermal vacuum chamber (TVAC) to physically test the camera in space-like conditions, and a shaker table will conduct sine and random vibration testing to ensure the camera can withstand launch vibrations. The goal is to verify and validate that the camera can withstand the harsh environments of launch and orbit. by using a combination of software and physical equipment testing.



Mentor(s):

Katherine Fowee Gasaway, Aeronautical and Astronautical Engineering

Andrew Binder, Aeronautical and Astronautical Engineering

Anthony Cofer, Aeronautical and Astronautical Engineering

**Talk Presentation Abstract Number: 452** :: Physical Sciences

## Experimental Evaluation of changes in HVAC Filter Performance During Rapid Aerosol Loading


Author(s):

Elliot Cram, College of Engineering

Laura Ajala, College of Engineering



Abstract:

Indoor air quality (IAQ) becomes increasingly important as people spend a growing proportion of their time in indoor built environments. Poor air quality is associated with respiratory ailments and transmission of infections, including the COVID 19 virus. Thus, there is a need to further study the performance of heating, ventilation, and air conditioning (HVAC) systems in buildings. There is currently a gap in knowledge about the performance of Minimum Efficiency Reporting Value (MERV) class filters under artificial aerosol loading.

In this study, we use a full-scale air duct located in the Architectural Engineering Lab at Purdue University to simulate urban aerosol loading on MERV filters in an indoor built environment. We test the efficiency of MERV 8 and MERV 14 filters by projecting potassium chloride salt aerosol through the test rig. Experiments are conducted until a pressure drop of 1.5 inches of water column (in. WC) is achieved; the time to reach this pressure drop is an indication of filter performance.

The data show higher efficiency for MERV 14 filters than MERV 8 filters. MERV 14 filters take less than two hours to reach the final pressure drop of 1.5 in. WC compared to upwards of six hours for MERV 8 filters. This is a significant step in understanding the use

of these filters; MERV 14 filters trap more particles and should therefore be used in situations that demand higher efficiency air filtration compared to MERV 8 filters.



Mentor(s):

Chunxu Huang, Purdue University

Nusrat Jung, Purdue University

**Talk Presentation Abstract Number: 453** :: Innovative Technology/Entrepreneurship/Design

## Child Automated Speech-to-Text Team - General Overview

Author(s):

Adrien Dubois, College of Engineering

Aakanksha Shripal, College of Engineering

Aarini Panzade, College of Science

Aarohi Panzade, College of Science

Anish Bhowmik, College of Science

Brian Ha, College of Engineering

Jasper Koliba, College of Engineering

Rosemary Ajish, College of Science

Abstract:

Often, child psychologists utilize audio transcription to examine and improve speech and cognitive development. Most state-of-the-art models, however, are only trained on adult speech; while these models have reached an average precision of 90%, they perform very poorly on child speech. Researchers currently spend 5 minutes transcribing recordings of conversations by hand for every 1 minute of an audio file. With thousands of such files, this has been a time-consuming task for early child development researchers. The Child Automated Speech-to-Text (CAST) team is creating a machine learning automatic transcription tool, trained on child speech to match the high accuracy of competing state-of-the-art models. In this way, the CAST team has developed an innovative pipeline beginning with a Hidden Markov Model and a Deep Learning Model working in parallel, followed by a sentence correction algorithm and an N-Gram based probabilistic model to join the two outputs. Using around 50 hours of audio from conversations between a parent and their children, our current model has reached a training accuracy of 85%, and a testing accuracy of 15%. Therefore, to combat the issue of overfitting, the team has conducted multiple rounds of data augmentation, revamped its preprocessing pipeline and conducted hyper-parameter optimization.

Mentor(s):

David Purpura, Purdue University

**Talk Presentation Abstract Number: 454** :: Physical Sciences

## Characterization of Particulates in Indoor Environments for Infants


Author(s):

Brian Magnuson, College of Engineering



Abstract:

The key periods of infant motor development can be negatively and permanently affected by the exposure to, and ingestion of, harmful substances found in household dust. The physical and chemical characteristics of dust and other particulates found in indoor environments can be used to determine the specific infant ingestion rates and surface transfer behaviors. The experimental procedure is divided into four key processes, which are sample collection, sample packaging, characteristic analysis, and surface transfer analysis. A standardized vacuuming method will be used for collecting samples from infant-occupied urban and suburban homes around the U.S. Dust samples will be sieved for fibers and analyzed to determine characteristics such as mass, density, particulate size, and chemical composition. Following the sample collection, an environmental chamber will house surface transfer experiments, which will employ a robotic platform with the collected household dust samples to simulate the resuspension and surface transfer of dust in interactions between surfaces and objects. The finalized dust sample collection method has a performance efficiency of 95-97% and by using ISO test dust as a reference baseline, the characterization of dust samples is the most accurate when Isopropyl Alcohol is used as the dispersant with no sonification in the Mastersizer 3000 Particle Size Analyzer. Based on these results, this project expects to provide comprehensive data about the characterization of dust in indoor environments and identify the mechanistic behaviors of surface transfer for dust and other particulates, which will contribute towards the EPA Exposure Factors Handbook.



Mentor(s):

Brandon Boor, Purdue University

Jordan Cross, Purdue University

**Talk Presentation Abstract Number: 455** :: Physical Sciences

## Peroxide-Initiated Hydrophosphination of gem-Difluoroalkenes.

Author(s):

Ryan Lee, College of Pharmacy, Honors College

Abstract:

Installation of fluorine and fluorinated functional groups into drug-like scaffolds can alter the physicochemical, pharmacokinetic, and pharmacodynamic properties of the compound. However, current synthetic strategies cannot access a wide range of fluorinated substructures, which hinders the study of new fluorinated functional groups. One such substructure, the α,α-difluorophosphine oxide, represents an understudied functional group in medicinal chemistry. One convergent preparation of the α,α-difluorophosphine oxide would involve reaction of a gem-difluorinated alkene with a P–H bond, but many methods of gem-difluoroalkenes instead undergo a C–F substitution pathway that delivers monofluorinated products. Therefore, the development of fluorine-retentive methods remains a significant challenge. We herein report a peroxide-initiated hydrophosphination of gem-difluoroalkenes that produces a wide range of α,α-difluorophosphine oxides.

Mentor(s):

Andrew Intelli, Purdue University

**Talk Presentation Abstract Number: 456** :: Life Sciences

# Laboratory screening of sorghum lines for incompatibility, a post-attachment resistance mechanism to the parasitic weed Striga hermonthica


Author(s):

Cameron Matthews, College of Agriculture, College of Agriculture



Abstract:

Striga hermonthica is an obligate root parasitic weed in sorghum, reducing crop yield severely, especially in low-input agriculture common across sub-Saharan Africa. Host plant resistance is an essential component of Striga control. Only one resistance gene is known, LGS1, controlling strigolactone production. Sorghum lgs1 mutants have reduced Striga germination stimulant activity. After germinating in response to host-exuded strigolactones, Striga attaches to its roots. Another resistance mechanism called incompatibility occurs at the post-attachment stage. Striga on an incompatible host fails to form the functional xylem connection necessary to sustain continued growth. We screened 58 inbred sorghum lines of common pedigree, including some released as resistant varieties in Africa, by laboratory co-culture that allowed successive observations of parasitic attachments. Differences in Striga germination stimulant activity between lines were overcome by exogenous application of strigolactones. One parent was the donor of both lgs1 and incompatibility. The second parent was a high stimulant (LGS1) line with presumed susceptibility to Striga. Phenotyping included Striga germination stimulant activity, germination inhibition, haustorial initiation by the sorghum roots as well as the number of Striga attachments and whether these grew over the observation period. Although the second parent was LGS1, it did not contrast with the resistant parent sufficiently enough in terms of post-attachment success of Striga to distinguish the progeny lines for resistance at this stage. This co-culture method will be used to phenotype recombinant inbred lines derived from parents contrasting for incompatibility in efforts to identify the gene(s) underlying this Striga resistance trait.



Mentor(s):

Patrick Rich, Purdue University

Adedayo Adeyanju, Purdue University

Nathan Bowser, Purdue University

**Talk Presentation Abstract Number: 457** :: Life Sciences

## Structural and Functional Characterization of Phospholipase C β3

Author(s):

Kennedy Outlaw

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 to change cellular behavior. PLCβ is a downstream effector of G-protein coupled receptors (GPCRs) and is activated by the heterotrimeric G protein subunits Gαq and Gβγ. In small-angle X-ray scattering (SAXS) experiments, the solution structure of PLCβ has additional density unaccounted for in crystal structures suggesting that PLCβ exists in multiple conformations, an “open state” involving outward rotation of part of the protein and a “closed state”. We hypothesize the open state represents a low activity conformation. To test this, we used cryo-electron microscopy (cryo-EM) single particle analysis to determine the solution structure of full-length PLCβ3 to 4.1 Å resolution. PLCβ3 existed in a closed confirmation under these conditions. We also mutated residues in PLCβ3 at intramolecular interfaces to disrupt the contacts and measured changes in basal and Gβγ-stimulated activity. These mutations had minimal impact on basal activity but decreased stimulation by Gβγ. These results suggest PLCβ may adopt a different conformation when interacting with the membrane and Gβγ. We are currently working to determine the structure of PLCβ3 on a model membrane. In the future, will use Cryo-EM to investigate this proposed allosteric conformational change.

Mentor(s):

Angeline Lyon, Department of Chemistry, Department of Biology, Department of Medicinal Chemistry and Molecular Pharmacology

**Talk Presentation Abstract Number: 458** :: Life Sciences

**Determining the binding between PLC epsilon and RhoA using the nanoluciferase assay**


Author(s):

Siddhi Shetty, College of Science, Honors College



Abstract:

Phospholipase C epsilon (PLCe) enzymes hydrolyze phosphatidylinositol (PI) lipids to produce secondary messengers that increase intracellular calcium and activate protein kinase C. Since PLCe is central to a number of cell-signaling pathways, including proliferation and survival, its regulation is critical. One of the best characterized PLCe activators is the small GTPase RhoA, which binds directly to the catalytic core of the lipase to increase its activity. The goal of my research project is to optimize a fluoresence-based assay to monitor the interactions between RhoA and PLCe in live cells. In this assay, the enzyme luciferase is divided into two parts: the a small bit (SmBiT) and a large bit (LgBiT). These SmBiT was added to the N-terminus of PLCe and the LgBiT added to the N-terminus of RhoA. When RhoA and PLCe interact in the cell, the luciferase enzyme is reformed, and the fluorescent signal is restored. Through western blots and cell-based activity assays, I have established that the SmBiT and LgBiT tags do not alter the stability, expression, or activity of PLCe or RhoA in cells. I will use this assay to determine the regions of PLCe required for RhoA binding and activation in the cell, and expand my work to investigate other G proteins that regulate PLCe activity.



Mentor(s):

Angeline Lyon, Purdue University

**Talk Presentation Abstract Number: 459** :: Social Sciences/Humanities/Education

## Understanding Young People’s Child Maltreatment Disclosure Experiences: A Qualitative Content Analysis of Family Violence Discussions on Social Media


Author(s):

Anneliese Williams, College of Health & Human Sciences

Amelia Williams, College of Health & Human Sciences



Abstract:

Background: Disclosure of child maltreatment is critical for victims to receive the appropriate resources and support for healing. Young people often prefer to disclose to their peers, frequently on social media platforms. Little is known about how children and adolescents use these platforms to share and respond to disclosures of childhood maltreatment.

Objective: We sought to assess young people's use of social media, specifically the online peer-to-peer support platform TalkLife, for disclosure and response to the disclosure of child maltreatment.

Methods: We used an iterative, team-based qualitative content analysis of messages sent on the TalkLife platform between 2013 and 2020. From within posts categorized by TalkLife as "Family Issues Suspected," we used content analysis to identify 200 messages focused on child maltreatment and build a coding framework. We analyzed each message's characteristics using this coding framework to determine common themes within disclosures and their responses.

Results: Disclosers tended to post about abuse characteristics, responses to the abuse, and the instigating event to posting. Peer responses asked about the victim’s present situation or provided support through advice, emotional reassurance, or reactions to the abuse. Most commonly, peers advised the victim to report, individually message the user, change their own mindset about the abuse, or confront the perpetrator.

Conclusions: Understanding maltreatment disclosure on social media builds the foundation for research into identification and intervention algorithms on online platforms. Further, these findings can inform educational programming for youth to teach proper handling of disclosure. Together, these interventions may impact maltreated children’s lives significantly.



Mentor(s):

Laura Schwab-Reese, Purdue University

**Talk Presentation Abstract Number: 460** :: Mathematical/Computation Sciences

## Lane Detection


Author(s):

Pume Tuchinda, College of Engineering

Daniyaal Rasheed, College of Engineering

Justin Chan, College of Engineering

Mingyu Kim, College of Engineering

William Stevens, College of Science



Abstract:

With the prevalence of autonomous vehicles, the computer vision algorithms utilized for autonomous driving must be robust and accurate to assess road features through images captured in real time. In our previous work, we designed a neural network model according to the U-Net architecture trained on the BDD100k dataset, to give binary segmentations of the locations of lane lines in an image. With the success of last semester’s model, we wanted to branch out towards other vision tasks for autonomous driving like object detection, and also develop a proof of concept model for multi-task learning. This process includes developing a neural network to perform traffic object detection, as well as lane line and drivable area segmentation, within a single neural network with a shared backbone to allow feature sharing among the tasks. This will be achieved through modifying last semester's segmentation model and implementing an object detection model through utilizing the YOLO network with a Darknet-53 backbone. The modifications to the model will include implementing a path aggregation network decoder through the works done in Feature Pyramid Networks and Spatial Pyramid Pooling. The decoder is designed to aggregate backbone features at multiple resolutions, allowing the model to selectively merge shallow and deep information to increase the receptive field of the model and allow better predictions. These developments will allow a single neural network model to perform the three crucial vision tasks for autonomous driving and create a new proof-of-concept model for future work to be built upon.



Mentor(s):

Edward Delp, Purdue University

**Talk Presentation Abstract Number: 461** :: Innovative Technology/Entrepreneurship/Design

## Currency Detection using Image Processing Techniques

Author(s):

Sohee Kim, College of Science

Anvit Sinha, College of Science

Katherine Sandys, College of Engineering

Joseph Lin, College of Engineering

Daniel Choi, College of Engineering

Kavin Sathishkumar, College of Engineering

Leng Lohanakakul, College of Engineering

Abstract:

The purpose of this project is to build an app for users to be able to take pictures of Columbian or Thai paper bills and the app should be able to differentiate the two and extract key information about the bill. Currency can be differentiated by the writing or symbols present on the bill. The application has three parts: an android app for front-end UI (user interface), a back-end for image processing using Python script, and a server that interacts with both the back end and the app. To achieve our project goals, we will use several image processing techniques to preprocess the image, segment the image into meaningful regions, and extract and process features within these regions. The final product is an Android application that allows the user to take an image of a bill and display the country, denomination, and conversion to USD of the currency back to the user.

Mentor(s):

Edward Delp, Purdue University

**Talk Presentation Abstract Number: 462** :: Innovative Technology/Entrepreneurship/Design

## Optimization of Ultrasonic Welding Parameters for Carbon Fiber Reinforced Thermoplastic Composite Plies

Author(s):

Harry Lee, College of Engineering, Honors College

Abstract:

Ultrasonic spot welding is often used to fix thermoplastic composite plies before they are consolidated in a tool. However, improper ultrasonic welding parameters can cause thermal degradation, fiber breakage, warping, or incomplete welds. This research investigated the welding parameters, which were amplitude, energy, and pressure, with various numbers of carbon fiber reinforced polyether ketone ketone (PEKK) composite plies to determine the relationship between the welding parameter, number of plies, and the quality of welds. A thermal camera was used to measure the temperature development and distribution over time during the welding with different welding parameters. Thermal characteristics and thermal degradation of the composite material were investigated using differential scanning calorimeter (DSC) and thermogravimetric analysis (TGA). After the spot-welded plies were consolidated, the microstructure of the consolidated laminate was observed to identify any defect caused by improper welding parameters. Lastly, mode I interlaminar fracture toughness of the consolidated laminate that was spot-welded with a different parameter was investigated using a double cantilever beam (DCB) test.

Mentor(s):

Garam Kim, Purdue University

**Talk Presentation Abstract Number: 463** :: Innovative Technology/Entrepreneurship/Design

# Immersible Sensor Development

Author(s):

Yubo Song, College of Engineering, Honors College

Chih-Yao Chan, College of Engineering

Abstract:

Abstract redacted.

Mentor(s):

Eui Won Bae, Purdue University

**Talk Presentation Abstract Number: 464** :: Physical Sciences

## Understanding the Freezing Properties of Lunar Particle Suspension Droplets

Author(s):

Mariana Aguilar, College of Science, College of Science

Katie Meves, College of Science

Valeria Garcia, College of Science

Abstract:

The Earth's moon we see today is vastly different from what it was 3 billion years ago when it was likely home to a collisional atmosphere. At this time, the Moon experienced amounts of volcanism, which released tremendous volumes of gas from the subsurface – enough to create a considerable atmosphere of up to 1 kPa which is almost double the pressure on modern Mars. Observations of our solar system have taught us that all atmospheres are hosts to clouds and aerosols. Knowing when, where, and under what conditions cloud particles form is important for understanding the evolution of the lunar atmosphere, how it reacted to temperature gradients, and how it cycled volatiles. To study this, we investigated the water ice nucleation properties of three aerosols: JSC-1A lunar simulant, which has similar composition and properties to lunar sample #14163 returned by Apollo 14 Mission, Exolith LMS-1D Lunar Mare simulant, which simulates the ancient volcanic deposits on the Moon, and Arizona Test Dust (ATD), a common standard for Earth atmospheric studies. A Peltier thermoelectric cooler and droplet freezing array were used to isolate distilled water droplets with aerosols and were brought down to temperatures as low as -18º C (-0.4º F). The concentration of aerosol particles and the size of the droplets were varied across our experiments. We are currently studying the temperatures and times these droplets froze to help understand the conditions at which nucleation of water ice clouds occurs on the Moon as a first step towards understanding the lunar atmosphere.

Mentor(s):

Alexandria Johnson, Purdue University

**Talk Presentation Abstract Number: 465** :: Physical Sciences

## Macroscopic Resistance Measurement 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 temperature-driven Metal-Insulator phase transition. We use optical microscopy techniques to take videos of the surface of thin film VO2, simultaneously measuring resistance. We observed patches of metal and insulator form while undergoing MI phase transition and showed hysteretic effects. We model the observed resistance by converting each pixel of the recorded images into an insulating node(0) or a metallic node(1) 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(0s) or saturated metallic resistors(1s). The resistance values connecting the nodes with their four terminals were based on the temperature and resistance measurements taken during the saturation of each phase. I developed 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 late, 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 greyscale 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, Purdue University

**Talk Presentation Abstract Number: 466** :: Physical Sciences

## Graph Neural Network Triggers for Tau3Mu Events at the HL-LHC


Author(s):

Benjamin Simon, College of Science, College of Science



Abstract:

The purpose of this study was to construct and train a neural network model that can identify decays of a tau particle into three muons in a high pile-up environment based on event data obtained in the CMS detector of the Large Hadron Collider. This network would serve to select signal candidate events for readout and storage in the Level-1 trigger system during the run of the HL-LHC. Current standard model calculations indicate that this decay is nearly impossible with a branching ratio of ~10-55, but some models of BSM physics predict a much larger branching ratio of ~10-8. A large trigger acceptance for these events would allow for a precise branching ratio calculation and provide evidence for or against BSM physics. Two primary models were considered: a standard fully-connected network and a custom graph convolutional network. These networks were trained on roughly 80,000 signal events with pile-up and 500,000 events consisting only of simulated background noise from pile-up. The hyperparameters of these models were optimized using grid-search methods and Bayesian optimization. Their performances as classifiers were evaluated by determining their trigger acceptances at various trigger rates and comparing them to current CMS algorithms. The graph network achieved an acceptance rate of 0.9314 at a trigger rate of 30kHz. The graph neural network’s high performance makes it a strong candidate for use in the CMS trigger system.



Mentor(s):

Miaoyuan Liu, Purdue University

Jan-Frederik Schulte, Purdue University

Siqi Miao, Purdue University

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A for Aristocracy, Not Effort: An Examination of Meritocracy and Legacy Admissions
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Mentors: James Ogg, Aaron Ault

# VIRTUAL POSTERS

**Poster Presentation Abstract Number: 300**:: Mathematical/Computation Sciences

# 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. 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, Purdue University

**Poster Presentation Abstract Number: 301**:: Innovative Technology/Entrepreneurship/Design

## Women's Gym and Facilities

Author(s):

Chloe Bohlander, College of Health & Human Sciences

Yushan Zhou, College of Health & Human Sciences

Emmy Huber, College of Health & Human Sciences

Ruolin Zhao, College of Health & Human Sciences

Abstract:

Abstract redacted.

Mentor(s):

Sandra Sydnor, Purdue University

**Poster Presentation Abstract Number: 302**:: Mathematical/Computation Sciences

**NanoHUB: Growing Global Impact Data Analytics and Machine Learning**

Author(s):

Aneesh Chakravarthula Chakravarthula, College of Science, Honors College

Dain Kang

Dheeraj Kumar

Johnathan Kao

Ting-Han Chen

Zach Hunter

Abstract:

We are interested in understanding more about users of the NanoHub website through data analytics. We are observing key features like the pattern of their usage, the time of their usage, their location, and the utilities that they use. This data will be converted to Salesforce in order to better understand user data and make adjustments to the website accordingly.

Mentor(s):

Gerhard Klimeck, Purdue University

**Poster Presentation Abstract Number: 303**:: Innovative Technology/Entrepreneurship/Design

## Lane Detection Using Image Processing and Machine Learning

Author(s):

Evan Chen, College of Engineering

Paloma Arellano, College of Engineering

Myung Sun Park, College of Engineering

Hyoju Kang, College of Engineering

Laula Huang, College of Engineering

Shao Ning Huang, College of Engineering

Abstract:

Lane detection is one of the most important aspects of autonomous driving since it determines the lane where the car must drive in without manual manipulation. Our work aims to analyze and work with lane detection algorithms. After profoundly understanding how lane detection works, we will implement our knowledge of creating image processing and a machine-learning algorithm for lane detection. First, we look for existing lane detection algorithms for the image processing method online. After testing them with the same input video, we found the best algorithm for making the most precise lane detection. We analyzed the algorithm by testing the code under three conditions: rainy weather, curved road, and dark lighting. As a result of the analysis, we found out the code works best under dim lighting as the lanes are successfully identified. However, the code fails when it rains because the rain hinders the vision for detecting the road. For curved roads, the algorithm’s performance varies depending on where the camera is placed and the road's curvature. We can expand our understanding of the lane detection algorithm onto machine-learning by knowing the strengths and weaknesses of the code. In the future, we will fully implement machine-learning algorithms by using more image sets to feed and train the algorithms on areas in which the code is not working correctly to improve the usage of lane detection in autonomous driving.

Mentor(s):

Shreya Ghosh, Purdue University

**Poster Presentation Abstract Number: 304**:: Life Sciences

## Construction of kcnj13 Plasmid Construct Expressed Under Different Somite Promoters

Author(s):

Jiapei Chen, College of Science

Abstract:

Bioelectricity refers to the endogenous electrical signal regulated by the ion channels on the cell membrane. It participates in important biological processes such as wound healing, regeneration, and embryogenesis. In developmental biology, the fin patterning is determined by morphogen gradients and signaling molecules in the embryonic stage. In zebrafish, accumulating evidence has shown that bioelectricity-related mutations can alter fin development. kcnj13 is an inwardly rectifying potassium channel that regulates the K+ gradient. In-situ hybridization and transgenic phenocopy experiments show the ectopic and transient expression of kcnj13 in somite leads to adult fish fin elongation, indicating somite bioelectricity alternations could affect fin patterning. However, it remains unclear which ones contribute to which fin structure as the somite is composed of different compartments. To study the effect of kcnj13 in somite compartments, we need to generate transgenic zebrafish lines to observe the adult phenotype. My major work is to generate the Gateway constructs for transgenic fish lines.

Gateway cloning is a method of transferring desired DNA segments between plasmid vectors. In my work, different plasmid constructs are created with kcnj13 being expressed under somite promoter sequences. Within the plasmid construct, a red fluorescence gene, tdTomato, will yield qualitative results in zebrafish models after future embryonic injection of plasmids. Red fluorescent expression in zebrafish larvae will indicate successful incorporation of the plasmids into the Zebrafish genome. The current state of the project focuses on the plasmid construction, amplification, and purification preceding the embryonic injection and data analysis.

Mentor(s):

GuangJun Zhang, University College of Veterinary Medicine, Department of Comparative Pathobiology

**Poster Presentation Abstract Number: 305**:: Social Sciences/Humanities/Education

## Antisemitism within the United States of America in the Early 20th Century


Author(s):

Peyton Edelbrock, College of Liberal Arts, College of Liberal Arts



Abstract:

When one thinks of Antisemitism, the United States of America is often not the first nation to come to mind. Even with its strong support for and inevitable joining of the Allied powers during World War Two, its dislike towards Jewish people was intense. Through anti-immigration laws, many Jews could not escape the same enemy that the U.S. was trying to get rid of. Nazis had a platform to speak within the nation as well, holding rallies attended by the thousands and even going as far as spreading Antisemitic propaganda to their children. Many famous Americans were vehemently Antisemitic, using their influence to spread their hate-filled ideas, like Henry Ford and Charles Lindbergh. After World War Two, United States' disregard towards Jews continued through government-sponsored like Operation Paperclip. Jewish people were not passive actors during this period of history, though, going as far as creating many organizations to help fight against their discrimination and for others. This project explores how the United States' actions during World War Two had a substantial impact on Jewish people both within the nation and abroad, from direct actions from the government to giving a platform to Antisemites.



Mentor(s):

Olga Lyanda-Geller, Purdue University

**Poster Presentation Abstract Number: 306**:: Mathematical/Computation Sciences

**Pre-silicon Software Development for the AFTx06 and AFTx07 Processors**

Author(s):

Grant Goldenberg, College of Engineering

Abstract:

Pre-silicon software development, writing software for a digital design before the design can be fabricated is often completed using FPGAs, field-programmable gate arrays, and software simulation of hardware using RTL simulators. Pre-silicon software development can provide significant benefits in the software development process allowing for both embedded-level software and more highly abstracted software to be written in the absence of physical hardware in conjunction with a harness. This topic is particularly relevant considering the current economic downturn in the tech industry as well as a silicon shortage vivid in recent memory. This project intends to integrate pre-silicon software development into SoCET's tech stack for the AFTx06 and AFTx07 RISC-V processors. Software simulation to a cycle-accurate behavioral model in C++ will be accomplished by simulating the run of generic binaries on AFTx06 and AFTx07 using a free and open-source software tool called Verilator. Using this cycle-accurate 2-state simulation, drivers written in C and bound to the Rust programming will be written for AFTx06 and AFTx07. These drivers will be critical in order to develop more complex software for AFTx06 and AFTx07, to complete benchmarking using the Embench suite as well as produce software demos in order to demonstrate the capabilities of SoCET's technical abilities to outside parties.

Mentor(s):

Cole Nelson, Purdue University SoCET

**Poster Presentation Abstract Number: 307**:: Innovative Technology/Entrepreneurship/Design

## Efficient Vision Transformer for Embedded Systems


Author(s):

Te Yu Hsin, College of Engineering

Hasan Sultan, College of Engineering

Kevin Lin, College of Engineering

Vishal Urs, College of Engineering

Hrishav Biswas, College of Engineering



Abstract:

The self-attention based model, Vision Transformer, has been proven to reach state-of-the-art performance and become one of the leading backbones in computer vision tasks. Despite such a high achievement, it still suffers from high computation costs. To cope with such problem, we extend upon the results of Caleb et al. [Irrelevant Pixels are Everywhere: Find and Exclude Them for More Efficient Computer Vision, 2022] to include the effects of removing irrelevant pixels. We first demonstrate the relationship between removing pixels and increasing the efficiency of vision transformer and realize that directly eliminating pixels only has very little impact on efficiency. Then present an novel method to optimize the image and dramatically reduce the redundant computation of vision transformer. After identifying and removing all the irrelevant pixels, our new framework takes only relevant pixels as input. This innovative framework is then extended to a hierarchical structure, where uncorrelated tokens are in different length but computed in parallel, resulting in a considerable shrinkage of computational cost. We do the experiments on both image and video tasks on embedded systems with limited computation power and demonstrate that our method can outperform the original visual transformer.



Mentor(s):

Yung-Hsiang Lu, Purdue University

**Poster Presentation Abstract Number: 308**:: Innovative Technology/Entrepreneurship/Design

## Design of Closed-Loop System with Adaptive Interaction in Robotic Assisted Surgery

Author(s):

Iris Layadi, College of Engineering

Abstract:

New advancements in robotic surgical systems involve multiple streams of input and information that lead to operators' cognitive and physical overwhelming. With the increase in interface complexity, it becomes integral for surgical performance to be precisely and continuously assessed to ensure patient safety. However, currently available strategies for measuring performance, such as computer vision, require extensive training and often lack compatibility with existing surgical infrastructure. To combat this limitation, eye-tracking sensors can be implemented to record informative physiological data such as pupil position, eye fixation duration, and blink frequency in a non-invasive and minimally intrusive manner. Eye tracking metrics serve as an effective indicator of visual attention and mental stress by highlighting operator focus and deriving desired procedure-related information. As a result, eye tracking data can be utilized to predict surgical performance. In this study, quantitative measurements obtained during operators' usage of the Da Vinci surgical system before and after intervention via expert takeover are used to establish correlations between eye tracking and performance metrics. Results will be helpful in advising future surgeon training operations and proposed system's integration within current surgical infrastructure.

Mentor(s):

Denny Yu, Purdue University – HEAL Lab

**Poster Presentation Abstract Number: 309**:: Life Sciences

## DMSO-free cryopreservation of natural killer cells for immunotherapy of cancer

Author(s):

Emmett Niemeyer, College of Pharmacy

Abstract:

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

Mentor(s):

Sandro Matosevic, Purdue University

**Poster Presentation Abstract Number: 310**:: Life Sciences

## Identification of bioactive compound from newly isolated Streptomyces strain CS.62

Author(s):

Diane Santos, College of Science

Audrey Birch, College of Health & Human Sciences

Abstract:

Abstract redacted.

Mentor(s):

Amir Alwali, Purdue University

**Poster Presentation Abstract Number: 311**:: Life Sciences

## Disease Control and Survival Rate of Apocrine Gland Anal Sac Adenocarcinoma for Canines


Author(s):

Kelly Shin, College of Science



Abstract:

Anal sac tumors are quite frequent neoplasia in canines. The most common is apocrine gland anal sac adenocarcinoma (AGASACA), found in about 17% of canines. Even though AGASACA is often considered local cancer, it might spread to the lymph nodes and later onto the abdominal organs (liver) or lungs. This phenomenon, known as metastasis, worsens the prognosis. For many years, surgery was preferred as the initial treatment option for most canines but recent advancements in radiotherapy, imaging, and chemotherapy, it has left veterinarians to question what the best and most efficient way is to treat patients with AGASACA. In the radiation world, there are different therapy options based on the total dose and the dose per day - the fraction in Gy. The standard of treatment for this disease has been to treat with a small dose of 2.5 Gy times 20 days if the tumor was present in the anal sac and the lymph nodes. The current study wants to simplify the protocol. The Purdue radiation team is looking to search for the efficacy of disease control and survival for a short protocol of 4 Gy times 5 days consecutively. This method simplifies the logistic (less anesthesia and hospitalization) and is repeatable during disease progression. The goal is to retrieve ten years of Purdue’s protocol to compare with the standard of care for disease control and survival time.



Mentor(s):

Isabelle Vanhaezebrouck, College of Veterinary Medicine

**Poster Presentation Abstract Number: 312**:: Mathematical/Computation Sciences

## Space Applications of Commercial Airports

Author(s):

Anna Szakats, College of Engineering, Honors College

Abstract:

The commercial space industry in the United States is currently growing rapidly. As the commercial space industry continues to develop technologies, there will be more spaceplanes that have the capability to land on commercial airport runways. At the current rate of development, there will be no time (or space) to build specialized spaceports for these vehicles; therefore, analyzing existing airports is needed. This raises the question, which existing commercial airports are best suited to support space applications? I plan to analyze airports with respect to their location, runway characteristics, and how much of an impact potential space traffic has on the surrounding population.

Mentor(s):

Katie Jarriel, Purdue University

**Poster Presentation Abstract Number: 313**:: Social Sciences/Humanities/Education

**The Repo Pandemic: Cars, Collection, and the Socioeconomic Fallout of COVID-19**

Author(s):

Abigail Taylor, College of Health & Human Sci, College of Liberal Arts

Abstract:

Tens of millions of Americans are newly unemployed, and facing unprecedented financial hardships, and numbers are expected to grow due to the consequences of the COVID-19 pandemic. Automobiles are U.S. households' most valuable piece of movable property and are 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 the 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 into what repossession means for living conditions and economic opportunity as people attempt to recover from the pandemic's impact.

Mentor(s):

Spencer Headworth, Purdue University Department of Sociology

**Poster Presentation Abstract Number: 314**:: Physical Sciences

## Design of Delta-Sigma Analog-to-Digital Converter for Integration with a Complex SoC

Author(s):

Pranav Veluri, College of Engineering

Abstract:

Mixed-signal processing, or the simultaneous processing of digital and analog signal data, is a critical function of any system-on-chip, or SoC, as it allows for modulation and analysis of real-world data and information. One integral component of mixed-signal processing is Analog-to-Digital Conversion (ADC), as this mechanism allow an integrated circuit to interface with external signal systems and process complex data streams in both continuous and discrete-time form. My work focuses on construction of a Delta-Sigma Modulation-based ADC for use in the larger SoC to provide the chip with functionality beneficial to sensing and audio-processing. For the purposes of this design, I am working on constructing a model of a 1-bit Second-Order Delta-Sigma ADC in Cadence Virtuoso. I determined that delta-sigma modulation would be the optimal choice for this system as it relies on oversampling of a signal which can assist in higher-resolution processing of audio signals, it is very accurate at low frequency, and its circuitry is easier to implement with small process CMOS technology. Our converter utilizes second-order modulation in order to minimize the quantization noise that is correlated with error inherent to the integrator circuits used to drive the comparator circuit that is foundational to analog-to-digital conversion. Preliminary steps consist of constructing the converter using purely ideal components before tailoring it to the process and hardware specifications set by the digital and software subteams. Further testing will be done using behavioral circuit modeling software to assess functionality of the system under real-world constraints.

Mentor(s):

Sutton Hathorn, Purdue University

Mark Johnson, Purdue University

**Poster Presentation Abstract Number: 315**:: Mathematical/Computation Sciences

## Sigstore (Project Rekor)


Author(s):

Xingjian Wang, College of Engineering

Sreevickrant Sreekanth, College of Engineering

Vignesh Charapalli, College of Engineering

Li Chung Yang, College of Engineering

Brendan Gleim, School of Management

Uddipta Sarkar, School of Management



Abstract:

Sigstore, formerly Project Rekor, is part of a new, experimental product to provide “software supply chain transparency” --- the ability for software producers to identify software components throughout different vendors, communities, and sub-organizations. With this, high-assurance software products are able to identify counterfeit software, decommission vulnerable code, and stop hackers trying to poison software delivery pipelines. The sigstore team works in system building, security evaluation, and deployment of test infrastructure. There are three parts to this project. The first part, le-git-imate, develops a defense mechanism to mitigate attacks against web-based Git hosting services such as GitHub and GitLab. le-git-imate pioneers the ability to sign a web UI commit and thus create a true GPG-signed Git commit object in the browser. The second part, sigstore, builds a tool for developers, software maintainers, package managers, and security experts. Bringing together free-to-use open-source technologies like Fulcio, Cosign, and Rekor, it handles digital signing, verification, and checks for provenance needed to make it safer to distribute and use open-source software. The third part, rekor-monitor, works as a module that monitors Rekor, which is a technology used in sigstore as the second part. It records the working condition of Rekor, and it is written in Go.



Mentor(s):

Santiago Torres-Arias, Purdue University

**Poster Presentation Abstract Number: 316**:: Mathematical/Computation Sciences

## On the Use of Machine Learning for Causal Inference in Extreme Weather Events

Author(s):

Yuzhe Wang, College of Science

Abstract:

For extreme weather events, machine learning of causal models can provide helpful information for causal relationships. By using various causality models, such as Granger Causality, the algorithm for causal inference can be developed with Python implementation. Granger causality is a statistical hypothesis test for determining whether one time series is useful in forecasting another, which can help to test for causal relationships between two time series. The Python program reads real-world extreme weather data from atmospheric datasets like netCDF and generates time series based on the data. Then it takes the time series of two extreme weather events to the granger causality model and analyzes the causal inference between the two events. The result would show whether one time series has the causal relation on the other one. Through various causality models, the most suitable and efficient causal model will be selected and the algorithm can be developed.

Mentor(s):

Lei Wang, Purdue University

**Poster Presentation Abstract Number: 317**:: Innovative Technology/Entrepreneurship/Design

**BIDC VIP IoT - ML Team**

Author(s):

Jordan Ramirez, College of Engineering

Shreya Dua, College of Science

So Won Kim, College of Engineering

Alisher Sultansikhov, College of Engineering

Abstract:

The purpose of this project is to keep students safe on Purdue's campus, especially when they are in laboratory environments. To be able to achieve this, we use technologies and sensors to monitor the spaces. For the Machine Learning team, we are designing and improving the model to create predictive thresholds from collected data. The time series transformer architecture was found to be the most effective in predicting safety hazards in laboratory settings. To achieve the predictive model, data is collected from the device allowing attributes and classifiers to be assigned. Using these points, time series forecasting can be created. Python libraries implemented are PyTorch, Scikit, Tensorflow, Pandas, and MatplotLib. These libraries allow the creation of a regressive model that leads to the training of the ML model using the data from open-source datasets as well as real-world data collected by the Hardware and Software sub-teams. Manufacturers may want to consider this using this IoT device. This system will be able to monitor diverse environments such as CNC, composite manufacture, and woodworking. In addition, the IoT device will be able to accurately identify potential hazards and provide alerts to users in real-time. This system has the potential to improve safety in laboratories by reducing the number of accidents and injuries beyond simply reacting to accidents by initiating real-time prediction and prevention protocols.

Mentor(s):

Matthew Swabey, Purdue University

**Poster Presentation Abstract Number: 318**:: Mathematical/Computation Sciences

# Designing Analytics Solutions To Solve The Right Business Objective

Author(s):

Sitong Chen

Abstract:

This research study investigates design formulations that might result in more effective decision-making. We concentrate on using parametric linear regression-type formulations and apply the model to a real-world case, which is a carpet manufacturing application that came from a U.S.-based coatings supplier in the synthetic fibers industry. The manufacturer's job is to figure out the best manufacturing process parameters for a stain-resistant coating. Two commercial performance targets: product stability and stain resistance are produced by this coating, which is made up of three confidential chemical ingredients. Our objective in this study is to optimize the carpet manufacturing process setting to increase the antifouling ability of the carpet stain-resistant coating. We consider fitting a linear regression model having numeric features, then formulating an optimization model using those estimated parameter coefficients to identify “optimal” decision recommendations. We built three constraint combination optimization models to improve the effectiveness of the model. After that, we provide an approach to predict the antifouling ability of the carpet based on stability and stain resistance and then optimize the manufacturing process settings to improve the ability of carpet stain resistance.

Mentor(s):

Matthew Lanham, Krannert School of Management

# VIRTUAL TALKS

**Talk Presentation Abstract Number: 500** :: Life Sciences

## Analyzing High Cognitive Load To Optimize Nurse Decision Making

Author(s):

Anusha Bhardwaj, College of Engineering

Abstract:

Nurse Situational Awareness (SA) is essential as it relates to decision making (DM). Utilizing proper SA allows nurses to quickly identify changes in patient's health, hasten the adjustments made to treatment and improve patient outcomes. Cognitive load is an important factor when evaluating an individual's performance at a given task, as it describes the level of mental resources required of a person at any specific time. Higher cognitive workload has a negative effect on cognitive performance impacting attention and cognitive processing speed. Nurses are subjected to high volumes of complex information which can increase cognitive load and negatively affect DM. For this study, a convenience sample of 12 experienced nurses in a simulation setting was utilized. Heart-rate variability (HRV) and eye-tracking data was collected for the two patient care simulations which represented a stroke and patient complications due to COVID-19. HRV data and pupillary dilation data (i.e., from the eye tracker) were synced, and used to extract moments of high cognitive workload. This extracted time data was compared to the video files of the simulations to identify the stimulus immediately prior to and during the workload change. We hypothesize that this methodological approach to studying nurse cognitive load in simulations will allow us to determine what stimuli cause increase load for experienced nurses. In the future, we hope this data will inform our development of cognitive aids to lower cognitive load and optimize nurse DM.

Mentor(s):

Nicholas Anton, Purdue University

Denny Yu, College of Engineering, Industrial Engineering

Haozhi Chen, Purdue University

**Talk Presentation Abstract Number: 501** :: Physical Sciences

## Online Databases of Geologic Formations of China, Indian Plate and Indochina, With Display onto Plate Reconstructions of the Asian Region for Any Phanerozoic Time Horizon

Author(s):

Sabrina Chang, College of Engineering

Abstract:

Building paleogeographic maps onto tectonic plate reconstruction models requires team efforts to compile databases of regional sedimentary and volcanic facies, data sharing standards, and computer projection methods. Two goals of the Paleogeography Working Group of the Deep-Time Digital Earth program of the International Union of Geological Sciences are: (1) to interconnect online national databases for all geologic formations, and to compile these online "lexicons" for countries that currently lack these; (2) to display the merged paleogeographic output for any time interval of these distributed databases onto appropriate plate tectonic reconstructions.

Therefore, we have worked with regional experts to compile new cloud-based lexicons for Asian regions and developed new user-interfaces and interactive visualization techniques. Independent online lexicons with map-based and stratigraphic-column navigation are currently completed for the Proterozoic through Phanerozoic of the Indian Plate, China, Vietnam and Thailand. A multi-database search system enables all returned entries be displayed by-age or in alphabetical order. Then, if a geologic age had been specified, a user with a single click can plot the original extent of the corresponding regional formations (filled with their appropriate lithologic facies patterns) onto any of three different proposed plate reconstruction models. Essentially, the goal is to create a view of the sediments and volcanics that were accumulating onto the Earth's surface at any past time. Our team is currently working with the Macrostrat and eODP teams at Univ. Wisconsin (Madison) and the One-Stratigraphy to interlink to their regional facies-time compilations for the Americas, the ocean basins and other regions.

Mentor(s):

James Ogg, Purdue University

Wen Du, Deep-Time Digital Earth (DDE) program

Sabin Zahirovic, Sydney

**Talk Presentation Abstract Number: 502** ::

**Virtual Poster #318**

**Talk Presentation Abstract Number: 503** :: Innovative Technology/Entrepreneurship/Design

## Design, Layout and Implementation of Digital-to-Analog Converter using 2nd Order Delta-Sigma Modulation

Author(s):

Ishmam Iqbal, College of Engineering

Abstract:

The purpose of this project was to design an oversampling DAC (Digital-to-Analog Converter) using 2nd order Delta-Sigma modulation. This DAC will be a component that is implemented for the next chip tape-out by the Purdue SoCET team. A DAC converts discrete-time digital signals into continuous-time analog signals. Oversampling DACs sample the input signal at a rate higher than the Nyquist rate (twice the frequency of the input signal) using interpolation. Oversampling DACs utilize Delta-Sigma modulation for “noise shaping” – a technique used to reduce noise in signals at low frequencies. This project began with a review of materials regarding DACs, oversampling, and Delta-Sigma modulation, obtained from research papers, chip datasheets, textbooks and other online sources. Afterwards, a functional block diagram of the DAC was created and simulated in Simulink. The individual components of the DAC were then designed at the transistor schematic level in Cadence Virtuoso. The components were simulated using testbenches in Virtuoso ADE Explorer, to verify that they were functioning as expected. Afterwards, the design schematics will be used to create physical layouts of the components, and simulated again for verification. The final result of this project is a design and layout of a functioning oversampling DAC, which will be ready for integration onto a System-on-Chip. The DAC will add Digital-to-Analog conversion features for the chip and can be applied in audio signal processing applications.

Mentor(s):

Sutton Hathorn, Purdue University

**Talk Presentation Abstract Number: 504** :: Innovative Technology/Entrepreneurship/Design

## Blockchain: Protecting Against the Newest Trend in Financial Crime

Author(s):

Daniel Logan, School of Management, Honors College

Abstract:

Corporate standards are responsive to changes in behavior, but with new technological possibilities come new methods of engaging in fraudulent activities. One growing trend in the fraudster toolkit is blockchain technology. This report is intended to produce a preventive solution against the use of blockchain technology in corporate fraud schemes. This is being done by analyzing blockchain’s features and dissecting how these features can be manipulated for laundering, embezzlement, and investment schemes. This report will also highlight the current environment of auditors and corporations in terms of controlling blockchain-related financial crimes, as well as evaluate control systems for possible deficiencies. The purpose of this report is to emphasize the opportunities that blockchain presents to fraudsters, and whether there is a solution to prevent, rather than detect, blockchain-related financial crimes.

Mentor(s):

Paula Conroy, Purdue University

**Talk Presentation Abstract Number: 505** :: Life Sciences

## Maternal Anxiety among Breastfeeding Mothers


Author(s):

Megan Rach, College of Health & Human Sciences, Honors College



Abstract:

Purpose: To assess and evaluate the relationship between methods of breastfeeding and maternal anxiety. To determine the differences in breastfeeding outcomes and anxiety between the mothers who completed and dropped out of the study.

Background/Significance: Exclusive breastfeeding (EB) decreases the child's chance of developing illnesses and promotes bonding. Maternal anxiety leads to shorter duration and low breastfeeding exclusivity.

Methods: This is a cross-sectional observational study. The sample consists of 64 breastfeeding mothers who were recruited in a Tele-lactation study. Forty-six mothers completed the study and 18 dropped-out. Breastfeeding mothers with infants 0 to 6 months, ≥ 18 years old, and fluent in reading/speaking English were eligible for the study. The State Trait Anxiety Scale was used to measure anxiety and the mothers self-reported methods of breastfeeding. Scores of ≥ 40 indicated anxiety. Breastfeeding methods were self-reported. Descriptive statistics/Chi square were used to analyze data.

Results: 31(48.4%) of participants reported EB when recruited to the study, 29(45.3%) EB expressed breast milk, and 4 (6.3%) reported partial breastfeeding. EB was 42(91.1%) in the completed and 18 (100%) in dropped. Around 39% had anxiety scores ≥ 40, 22(88%) of mothers with anxiety were on EB. Anxiety mean score was high among mothers who dropped-out (39.26±9.80) compared to mothers who completed study (34.93±10.78). No significant relation was found between methods of feeding and anxiety scores ($p=0.119$).

Conclusions: Anxiety level was high in breastfeeding mothers. Anxiety levels were higher in moms who dropped the study. Strategies for screening/management of maternal anxiety are needed.


Mentor(s):

Azza Ahmed, Purdue University

**Talk Presentation Abstract Number: 506** :: Innovative Technology/Entrepreneurship/Design

**Efficient IEEE single precision Floating point multiplier hardware implementation**

Author(s):

Abinands Ramshanker, College of Engineering

Abstract:

There has been extensive research on designing an area efficient floating point multiplier on hardware. A typical IEEE Single Precision Floating point Multiplier has the following components - a 12-bit exponent adder, normalization, sign extraction and 24-bit mantissa multiplier. Among the different components, the 24-bit Mantissa multiplier consumes more resources and delay. There are various floating pointm multipliers in literature but there is a need to improve the speed, power efficiency and area efficiency of multipliers for various applications such as Signal Procesing, Computer Vision,etc. This paper proposes a novel multiplier architecture which uses principles of a booth multiplier and Karatsuba approach for the mantissa multiplier. In our multiplier circuit, we utilised the carry look ahead adder for the addition of partial products. The designed multiplier is developed using Very High Speed Integrated Circuit (VHSIC) Hardware Description Language (VHDL) and implemented on Xilinx Spartan 6 FPGA. It is then compared in terms of area, delay and power with the conventional booth multiplier. The proposed floating point multiplier is found to be superior in performance compared to a conventional booth multiplier and multipliers in literature. In comparison with the conventional 24 bit booth multiplier, the delay has been reduced from 44.382 to 39.25ns, the power has reduced from 256mW to 193mW and the number of LUTs decreased from 1104 to 1025 LUTs.

Mentor(s):

Mark Johnson, Purdue University

**Talk Presentation Abstract Number: 507** :: Social Sciences/Humanities/Education

**A for Aristocracy, Not Effort: An Examination of Meritocracy and Legacy Admissions**

Author(s):

Michaela Rice, College of Education, Honors College

Abstract:

We hold these truths to be self-evident, that all men are created equal… At the cornerstone of the American education system and the backbone of the American Dream is the protection—or endowment, as the Declaration writes it—of equality of opportunity. However, unequal educational opportunities continue to persist within the United States. Operation Varsity Blues and multiple racial discrimination lawsuits have called into question the fairness and transparency of the collegiate admissions process, but similarly unjust practices have been perpetuated for decades with little scrutiny. Legacy admissions, or the practice of favoring an applicant because of their relation to an alum, have existed since the creation of the collegiate application system. However, such practices inherently favor certain applicants for non-meritocratic attributes. Legacy applicants are granted significant advantages that meaningfully favor their odds of acceptance to elite universities, which undermines the principle of meritocracy that the education system is supposedly founded on. In a true meritocratic process, students should be admitted on the basis of effort and achievement, rather than wealth or family relation. The collegiate admissions process determines who gets accepted and on what grounds, yet the practice of legacy admissions is a glaringly impartial criteria that warrants admission to elite universities. Ensuring that the American education system reflects meritocratic rather than aristocratic principles requires the elimination of legacy admissions and the implementation of transparent and equitable admissions processes.

Mentor(s):

Amanda Case, Purdue University

**Talk Presentation Abstract Number: 508** :: Innovative Technology/Entrepreneurship/Design

## Improving the Online Time Scale Creator Experience Abstract

Author(s):

Xander Shillings, College of Engineering

Mahad Faruqi

Abstract:

The Time Scale Creator was created to allow anybody the ability to look at global geological data in depth. The current free program is free to download and our goal is to make an online version of it. On the website, downloading the app is not necessary and you can view charts quickly. Our project is to improve the beta version of the Time Scale Creator website (https://show.timescalecreator.com:3000) to work more similarly to the JAVA package. We have been tasked to add ways to personalize the user's experience by adding a settings pop-up to change font color and other graphic settings for the generated charts. Our goal is to overall create a better user experience in the web app. There are many things that we can enhance such as our settings pop-up, a map interface, and time browser.

Mentor(s):

James Ogg, Purdue University

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