




# SPRING UNDERGRADUATE RESEARCH CONFERENCE

APRIL 9-16, 2024

PURDUE UNIVERSITY, WEST LAFAYETTE, INDIANA

# SCHEDULE OF EVENTS

## APRIL 9, 2024 | PMU BALLROOMS

| | |
|---|---|
| **9:00AM-10:00AM** | **Poster Session 1** |
| **10:30AM-11:30AM** | **Poster Session 2** |
| **12:00PM-1:00PM** | **Poster Session 3** |
| **1:30PM-2:30PM** | **Poster Session 4** |

## APRIL 11, 2024 | STEW 214 & 218

| | |
|---|---|
| **9:00AM-5:00PM** | **Research Talks** |
| **10:00AM-4:00PM** | **Literature, Linguistics, Languages, & Culture Colloquium** |

## APRIL 9 - 16, 2024 | ONLINE

**Virtual presentations**

*View them at* ***purdue.edu/undergrad-research/conferences/spring***

We encourage those with a Purdue account to provide feedback to presenters.
**To submit feedback, please scan this QR code with your device's camera!**

# POSTER SYMPOSIUM

*Posters are delivered in the Purdue Memorial Union North and South Ballrooms on April 9, 2024.*

*Posters sorted by last name of first author within each session.*

## FIRST POSTER SESSION | 9:00AM-10:00AM

1000 *Teagan Ames-Majeski†*
Mentor(s): Matthew Scarpelli; Joseph Speth; R. Timothy Bentley

1001ΩΔ *Anahita Amirpour†; Grace Turner*; Amanda Veile**
Mentor(s): Amanda Veile

1002 *Nathan Arnold†; Alexander Eiguren†; Anna Radulski†; Grant Sims†; Alan Chao†*
Mentor(s): James Goppert; Nicole Adams; Nan Kong; Worawis Sribunma

1003 *Janathan Balakrishnan†*
Mentor(s): James Gibert; Hongcheng Tao

1004 *Hannah Bard†; Perry Curtis*; Tamia Austin**
Mentor(s): Ellen Wells

1005 *Ella Barnes†; Emily Klaiber‡*
Mentor(s): Soojung Jo; Min Sook Park; Yeseol Cho

1006 *Olivia Battaglia†; Jacqueline O'Malley†*
Mentor(s): Arielle Borovsky; Philip Curtis

1007 *Kara Benbow†; Gabriela Surdyka‡*
Mentor(s): Joe Kokini; Harrison Helmick

1008 *Michael Bezick†; Vea Iyer†*
Mentor(s): Alexandra Boltasseva; Blake Wilson

1009 *Anika Bhoopalam†*
Mentor(s): Letian Dou; Arun Mannodi Kanakkithodi

1010Ω *Sarah Bhuiya†*
Mentor(s): Melissa Franks; Alexander Francis

1011 *Livia Bogdan†*
Mentor(s): Angeline Lyon; Kadidia Samassekou

1012ΨΔ *Lucy Bolles†; Emma Johnson†*
Mentor(s): Logan Strother

1013 *Emily L Bond†*
Mentor(s): Yumary Ruiz; Madeline Moser

1014 *Lindsay Brncick†; Boxi Gong‡; Julia Flowers‡*
Mentor(s): Qiuhong He; MacKenzie McIntosh; Boxi Gong

1015 *Jaden Brooks†*
Mentor(s): Kim Kinzig; Sydney Trask; Brent Bachman; Erisa Met Hoxha

1016 *Tori Burke†; Roma Kamat‡; Parker Davis‡*
Mentor(s): Julia Chester; Soyol Enkh-Amgalan

1017Ω *Lorenzo Cacciapuoti†*
Mentor(s): Mark Johnson; John Peterson

1018 *Alexis Carroll†; Aidan Dibble†; Ann Marie Uhlmansiek†; Amanda Wolf†*
Mentor(s): Adam Quinn; Daphne Fauber; AJ Gin; Harry Ashbaugh; Kari Clase

1019 *Jonah Chang†*
Mentor(s): Pat Kerstein; Labony Khandokar

1020 *Yuan-Jung Chen†; Andre Ponsot†; Angus Moore†*
Mentor(s): Kendra Erk; Ala Eddin Douba; Akul Seshadri

1021 *Briana Chen†; Ashley Ortiz†*
Mentor(s): Danny Milisavljevic

1022 *Yashvi Choudhary†; Sirish Kayam‡; AnhThu Pham‡*
Mentor(s): Jeffrey Dick; Vanshika Gupta

1023 *Vladimir Condino†; Jaiveer Dutta†; Andrew Nilsson†; James Strayhorn†; Andrew Coleman†*
Mentor(s): Andreas Jung; Santosh Bhandari

1024 *Catherine Conway†*
Mentor(s): Michael Johnson

1025Ω *Ashton Cotton†*
Mentor(s): Taimoor Qazi; Scotty Secrist

1026 *Soumalya Das†*
Mentor(s): Debayan Das

1027 *Vamsi Deeduvanu†; Tanvi Dhawade†; Alexander Aylward†; Nihar Atri†; Ron Natarajan†; Akshath Raghav Ravikiran†; Adrien Qi‡*
Mentor(s): Yung-Hsiang Lu

1028Ψ *Luke DeLion†; Alyson Owen†; Nicholas Zolnierczuk†; Junezuh Ghang‡*
Mentor(s): AJ Gin; Harry Ashbaugh; Adam Quinn; Daphne Fauber; Kari Clase

1029 *Aniket Dev Roy†*
Mentor(s): Jonathan Delph

1030Ω *Tanvi Dhawade†*
Mentor(s): Qingchun Li; Noori Kim; Tianle Duan

1031Ω *Brian Dodd†; Fraser Dougall‡*
Mentor(s): Peter Bermel; Stylianos Chatzidakis; Allen Garner

1032 *Sohil Doshi†*
Mentor(s): Deepak Suthar

1033 *Nikita Dubrovskyi†; Abhishek Kini*; Aayush Iyengar**
Mentor(s): Ran Dai

1034 *Gavin Duffy†; Ruth Wei‡*
Mentor(s): Caitlin Proctor; Aliya Ehde

1035 *Molly Dye†; Nicole Nagel†*
Mentor(s): Bradley Duerstock; Thomas Everett; Mitchell Sanchez

1036 *Mary Earp†*
Mentor(s): Shubhra Bansal; Haohan Guo

1037Ω *Youssef Errihani†*
Mentor(s): Steve Lindemann; Miguel Gonzales

1038 *Elizabeth Christine Farrell†*
Mentor(s): Qing Deng; Tyler Pikes; Scotty Secrist

1039Ω *Abigail Foley†*
Mentor(s): Melissa Franks; Alexander Francis

1040 *John Frandina†; Gabrielle Pedigo†*
Mentor(s): Aaron Specht; Chandler Burgos

1041 *Roy Galazka†; Raymond Glowner†; Devyani Tyagi†; Tiancheng Zhang†*
Mentor(s): Danny Milisavljevic; Ziwei Ding

1042 *Rohan Gangaraju†; Pranav Srisankar†; Sean Greenley†*
Mentor(s): Mark Johnson; Cole Nelson

1043 *Brianna Gast†; Lauren Jones‡; Addison Hill‡; Michayla Dinn‡; Ellie Ketcham‡*
Mentor(s): Theresa Casey; Linda Beckett

1044 *Madelyn Gearld†; Julia Flowers†*
Mentor(s): Kathryn LaRoche

1045 *Brandon Goeppner†*
Mentor(s): Shreya Ghosh

1046Ω *Samuel Gomez†*
Mentor(s): Sudip Vhaduri

1047Ω *Son Ha†; Jonah Nichols†; Vinay Gupta†; Aaditya Doiphode†*
Mentor(s): David Purpura; Avery Closser

1048 *Jaya Hari†; Alice Dragnea†; Dheepa Hari†; Yash Ashtekar†; Aryan Srivastava†; Nikhil Saxena†; Shuangding He†; Nikitha Suraj†; Geervan Bhattacharjee†*
Mentor(s): Yung-Hsiang Lu; Kylie Sommer-Kohrt

1049 *Ashley Hartman†; Madeline Douglas†*
Mentor(s): Laura Claxton; Paige Thompson

1050 *Kyle Harvey†; Nicholas Bogan†*
Mentor(s): Gustavo Rodriguez-Rivera

1051 *Khaleel Ibrahim Hassan†*
Mentor(s): Muhammad Hussain; Andres Castillo

1052 *Amirah Haweit†; Isabela Ramirez Ortiz**
Mentor(s): Amanda Deering; Hansel Mina; Adriana Vanegas Torres

1053 *Zachery Heppner†; Drake Strait†; Hudson Schneider†; Michael Perrin†; Derek Temple†; Katherine DeMarco†*
Mentor(s): Adam Quinn; Harry Ashbaugh; AJ Gin; Daphne Fauber; Kari Clase

1054Ω *Brogan Holt†; Daniel Wu*; Tristan Darby*; Dylan Hall*; Zach Tan*; Carl Chandra*; Ayan Hossain*; Apoorva Bahl*; Kexin Han*; Grant Goldsmith**
Mentor(s): John Sheffield

1055 *Jon Hurley†*
Mentor(s): Soojung Jo; Tatiana Ringenberg

1056 *Luca Iacobucci†; Sierra Hunnicutt‡; Hannah Reyes Charles‡; Katie Hong‡; Zhixin Cai‡; Ryan Feller‡; Anthony Tan‡*
Mentor(s): Kristen Bellisario

1057 *Lourdes Ignacio†; Selina Lin†; Shreeya Ettireddy†*
Mentor(s): Brett Meyers; Pavlos Vlachos

1058 *Rachel Isaac†; Maria Armenta†*
Mentor(s): Bridgette Kelleher; Wei Siong Neo

1059 *Clayton Jarosinski†; Claire Middendorf‡*
Mentor(s): Marika Santagata; Luis-Enrique Garzon-Sabogal

1060 *Lauren Jones†; Addison Hill‡; Brianna Gast‡; Ellie Ketcham‡*
Mentor(s): Theresa Casey; Linda Beckett

1061 *Christina Joslin†*
Mentor(s): Nadia Gkritza; Bruno Cesar Krause

1062 *Elisabeth Justice†*
Mentor(s): Aaron Thompson; Yiwei Huang; Erin Percevault

1063 *Connie Kang†; Rongbo Hu†; Nicholas Martel†; Qinjia Xu‡; Jessica Lyng‡; Jiaming Fang‡*
Mentor(s): Abolfazl Hashemi; Shivam Bhat; Zijian He

1064Ω *Temirlan Karataev†; Tim Nadolsky†; Calvin Tseng†; Caasi Boakye†; Shrish Senthilkumar†; Ping-Hung Ko†; Rixin Chen†; Minsoo Oh†*
Mentor(s): Yung-Hsiang Lu; Kristen Yeon-Ji Yun

1065Ω *Ishita Kataki†*
Mentor(s): Lara Balian; Jacqueline Linnes; Natalia Rodriguez

1066 *Bethany Kettleborough†*
Mentor(s): Lisa Welp

1067 *Julie Kim†*
Mentor(s): Denny Yu; Guoyang Zhou

1068Ω *Debora Kim†; Elliott Shi†*
Mentor(s): Michelle Garrison; Garrett Price

1069 *Caleb Klopfenstein†*
Mentor(s): Pat Kerstein; AJ Alqahtani

1070 *Anna Klupshas†; Jacob Strietelmeier†*
Mentor(s): Andreas Jung; Lingqiang He

1071 *Rachel Kuhn†; Kayleigh Jennings‡*
Mentor(s): Kranthi Varala; Rajeev Ranjan

1072 *Andy Lam†; Yu-Wei Chang†; Yiyuan Zhang†*
Mentor(s): Edward Delp

1073 *Megan Lawson†*
Mentor(s): Cat Searle; Paradyse Blackwood

1074 *Sangjin Lee†; Andrew Liu‡; Benjamin Miller‡; Ansh Gangapurkar‡; Hyun (Eric) Kang‡; Rahul Menon‡*
Mentor(s): Tillmann Kubis; Logan Melican; Daniel Lemus

1075 *Harry Lee†*
Mentor(s): Eduardo Barocio

1076 *Sarah LeFever†*
Mentor(s): John Mulrow

1077 *Sydney Leohr†*
Mentor(s): Seema Mattoo; Ben Watson

1078 *Isabella Levine†*
Mentor(s): Peter Bermel; Sayan Roy; Stylianos Chatzidakis; Allen Garner

1079Ω *Brianna Lewis†; Alexis Hawkins†; Claire Maurer†*
Mentor(s): Pavlos Vlachos; Brett Meyers; Rozhin Derakhshandeh

1080Δ *Selina Lin†; Chris Farber*; Neel Sarathy**
Mentor(s): Soojung Jo; Min Sook Park

1081 *Erica Long†*
Mentor(s): Tim Johnson; Isabela Garcia Mendes de Araujo Santos; Madison Simonds; Ruth Centeno Martinez; Jacquelyn Boerman

1082 *Noah Lyon†*
Mentor(s): Cathie Aime; Samira Fatemi

1083Ω *Yashwanth Reddy Mahesh Kumar†*
Mentor(s): Deniz Besiktepe

1084 *Carson Mann†*
Mentor(s): Matthew Scarpelli; Mackenzie Coon

1085 *Gabe Martinez†; Abhilash Saravana†; Christopher Lee†; Nandini Pande†*
Mentor(s): Edward Delp

1086 *Annie McCarthy†*
Mentor(s): Michael Johnson

1087 *Aidan McDonough†*
Mentor(s): Denny Yu; Ryan Villarreal

1088 *Karrick McGinty†; Mason Giacchetti*; Travis Hastreiter**
Mentor(s): Andreas Jung; Andrew Wildridge; Yao Yao; Ethan Colbert

1089 *Stan Melkumian†; Elizaveta Filippova†; Prakhar Saxena†; Adam Weber†; Ethan Shatz‡; Dean Stornello‡*
Mentor(s): Adam Quinn; Daphne Fauber; Harry Ashbaugh; AJ Gin; Kari Clase

1090 *Breeann Mild†*
Mentor(s): Jennifer Freeman

1091 *Mickayla Miller†*
Mentor(s): Ximena Bernal; Katherine González

1092 *Giovanni Minghetti†; Seth Jimenez†; Adelaide Bullard†; Lillian Woolley†*
Mentor(s): AJ Gin; Harry Ashbaugh; Daphne Fauber; Adam Quinn; Kari Clase

1093 *Hannah Murawski†*
Mentor(s): Kristine Marceau; Li Yu

1094 *Kathryn Myers†*
Mentor(s): Ximena Bernal; Katherine González

1095Ω *Andrew Nelson†; Noor Owayni†*
Mentor(s): Betsy Parkinson; Noah Moriarty

1096Ω *Aarohi Panzade†; Akhil Kasturi†; Rahul Ghosh†*
Mentor(s): David Purpura; Avery Closser

1097 *Karina Paone†*
Mentor(s): Chad Carroll; Eric Gutierrez

1098Ω *Mitul Patel†*
Mentor(s): Riyi Shi; Martina Dalolio

1099Ω *Vidhi Patel†*
Mentor(s): Lisa Bosman

1100 *Stanislav Pelipad†*
Mentor(s): Lucas Cohen

1101Ω *Emileo Peralta†*
Mentor(s): Cat Searle; Kurt Lutz; Mark Williams

1102 *Megan Perr†*
Mentor(s): Michael Johnson

1103 *Giulio Pettenati†*
Mentor(s): Zhi Zhou; Ejike Ken-Opurum

1104 *Vinh Pham Ngoc Thanh†*
Mentor(s): Smriti Bhatt

1105 *Enos Pray‡; Armand Destin‡; Adalene Stangeland‡; Amy Murdock‡; Anagha Gaitonde‡; Megan Painter‡*
Mentor(s): AJ Gin; Adam Quinn; Harry Ashbaugh; Daphne Fauber; Kari Clase

1106 *Owen Rahman†*
Mentor(s): Robin Tanamachi

1107Ω *Zachary Ramirez†*
Mentor(s): Tho Le

1108 Withdrawn.

1109 *Harini Ravichandran†*
Mentor(s): Lynn Parrish; Alfred Lopez

1110 *Bronwyn Rigsby†*
Mentor(s): Jill Newton; Doris Fulwider; Bima Sapkota

1111 *Ben Roberts†*
Mentor(s): Sidney Ducleroir

1112 *Jeremy Roos†*
Mentor(s): Tong Ren; Leobardo Rodriguez Segura

1113 *Jonathan Ryan†*
Mentor(s): Justin Weibel; Boyu Duan; Liang Pan

1114Ω *Joao Paulo Schott Ymayo†; Mateo Llerna*; Corey Auerbach**
Mentor(s): Shreyas Sundaram; Charles D'Onofrio

1115 *Chris Selig†*
Mentor(s): Breanya Hogue

1116Ω *Shatakshi Shelar†; Yu Lu†*
Mentor(s): Nasreen Lalani; Bhagyashree Katare

1117 *William Shumway†; Zachary Ryan**
Mentor(s): Erik Otarola-Castillo

1118Ω *Richard Silvester†; Aadi Jangid†; Alejandra De la Torre Garcia†; Aarohi Panzade‡; Philip Liu‡; Pavan Sathengeri‡; Katelin Mcalli Rainey‡; Ji Yeon Lee‡*
Mentor(s): Wenzhuo Wu; Robert Ccorahua-Santo; Jing Jiang; Katelin Mcalli Rainey; Ji Yeon Lee

1119 *Chiho Song†; Vir Toshniwal†; Ruby Woudneh†; Kareena Patel‡; Haichang Lu‡; Tim Nadolsky‡*
Mentor(s): Kristen Yeon-Ji Yun; Yung-Hsiang Lu

1120 *Aavya Srivastava†*
Mentor(s): Deva Chan; Cameron Villarreal

1121Ω *Sophie Stahl†*
Mentor(s): Leanne Nieforth; Sara Kaufman

1122 *Emma Summers†*
Mentor(s): J. Peter Moore

1123 *Eva Taylor†; Ashlita Lodha‡; Mark Naguib‡; Isabella Wilson‡*
Mentor(s): Alvin Kao; Salim Onbasi

1124 *Krish Thakkar†; Taylor Vicente†*
Mentor(s): Xiaoyu Liu

1125 *Ameera Trady†*
Mentor(s): Michael Johnson

1126 *Calla Tucker†*
Mentor(s): You-Yeon Won; Seyoung Kim

1127 *Sophia Ung†*
Mentor(s): Cary Troy; Hazem Abdelhady

1128 *Nathaniel Veach†*
Mentor(s): Sidney Ducleroir

1129Ω *Andrew Walke†; Emmaleigh Shinno‡*
Mentor(s): Shalini Low-Nam; Kevin Scrudders; Vinay Menon; Jean Chmielewski; Thomas Dietsche

1130 *Ellen Wei†*
Mentor(s): John Tesmer; Mackenzie Imhoff

1131 *Jasmine White†*
Mentor(s): Doug Samuel

1132 *Gwyneth Wong†*
Mentor(s): Leifu Chang; Indranil Mukherjee

1133 *George Youssef†*
Mentor(s): Denny Yu; Pramiti Sarker; Jingkun Wang

1134 *Zirui Zhang†; Priyam Gupta‡; Shannon Cheng‡; Lauren Britten‡; Sean Ruda‡; Kevin Xiao‡*
Mentor(s): Mahdi Hosseini

1135 *Anel Zhussupbekova†*
Mentor(s): Jan Olek; Alberto Castillo

# SECOND POSTER SESSION | 10:30AM-11:30AM

1200 *Shams Adigozalzade†*
Mentor(s): Betty Feng

1201 *Divij Agarwal†; Vasileios Kalaitzidis†; Liam Gallagher†*
Mentor(s): Andreas Jung; Husheng Guan

1202 *Maggie Anderson†*
Mentor(s): Tesfaye Mengiste; Madylin Schaider; Chao-Jan Liao

1203 *Lillian Andis†*
Mentor(s): Alex Pasternak; Alyssa Smith

1204 *Megan Ashby†*
Mentor(s): Alex Pasternak

1205 *Kyala Augustin†*
Mentor(s): Michael Johnson

1206 *Tamia Austin†*
Mentor(s): Ellen Wells

1207 *Aaron Banks†*
Mentor(s): Jan-Anders Mansson; Patrick Cavanaugh; Teal Dowd

1208 *Shawn Belongia†*
Mentor(s): Vilas Pol; Annie Sun

1209 *Saraf Bhuiya†*
Mentor(s): Jennifer Freeman

1210 *Rachit Bisht†; Aiyan Alam†*
Mentor(s): Marco Hadisurya

1211 *Alexandra Britto†; Kayla Osen‡*
Mentor(s): Keith Cherkauer; Zhi Zhou

1212 *Meghan Brown†*
Mentor(s): Lisa Welp; Alexandra Meyer

1213 *Sydney Brown†*
Mentor(s): Alexandria Johnson; Gouri Prabhakar

1214 *Alexa Burke†*
Mentor(s): Daniel Suter; Laura Pulido Cifuentes

1215 *Joseph Carrig†; Jingyu Xiao†; Massimo Lapina†*
Mentor(s): James Garrison; Archana Choudhari

1216 *Jacob Carroll†; David Lender†; William Jiang†; Dogyu Ryu†; Mihika Sharma†; Anthony Petrescu†*
Mentor(s): Matthew Swabey

1217 *Kaubfar Changkanjana†*
Mentor(s): Matthew Scarpelli; Philip Durham; Mackenzie Coon

1218Ω *Leo Chen†; Adarsh Veerapaneni*; Amy Tong*; Saandiya KPS Mohan*; Jadden Picardal*; Zilu (Johnny) Jin*; Ata Ulas Guler*; Alicia Zhou*; Jin Hyun Kim**
Mentor(s): Dave Barbarash

1219 *Jingyu Chen†*
Mentor(s): Garam Kim; Waterloo Tsutsui

1220 *Veronica Cheng†*
Mentor(s): Shubhra Bansal; Faharia Hasan Bhuiyan

1221 *Ella Rose Chianis†*
Mentor(s): Brittany Allen-Petersen; Samantha Tinsley

1222 *Yu Chung†; Sophie Mbongo‡*
Mentor(s): Amanda Veile

1223 *Meredith Clark†; Benjamin Krugman†*
Mentor(s): Xiaoyu Liu

1224 *Quinn Clemenz†; Lauren Voss*; Olivia Richter*; Samantha Maari**
Mentor(s): Elliot Friedman

1225 *Alexander Collins†; Adrian Romo-Loomis*; Doren Cohen*; Jackson Thompson*; Prahlad Shelvapille**
Mentor(s): Shreya Ghosh

1226 *Gabby Conjelko†; Sam King‡*
Mentor(s): Emily Dykhuizen

1227 *Aaron Coppeta†*
Mentor(s): Deva Chan; Alex Nguyen

1228 *Matthew Corson†; Sofia Schumann‡*
Mentor(s): Jason Cannon; Fatema Currim; Josephine Brown-Leung; Reeya Tanwar

1229 *Wyatt Crain†*
Mentor(s): Adam Wasserman; Yuming Shi; Alvin Uppgård

1230 *Lauryn Crumbley†; Ryan Mason*; Kinaya Hines**
Mentor(s): Michael Johnson

1231 *Perry Curtis†; Hannah Bard*; Tamia Austin**
Mentor(s): Ellen Wells; Edem Sededji

1232Ψ *Arianna Dejoie†*
Mentor(s): Yvonne Pitts; Scotty Secrist

1233 *Aryaman Dewan†*
Mentor(s): Raluca Ostafe

1234Ψ *Sophia DeWitt†*
Mentor(s): Michele Buzon; Sarah A Schrader

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement
Ω Interdisciplinary Project; Ψ Archival Project; Δ Digital Humanities Project

1235 *Fraser Dougall†; Brian Dodd‡*
Mentor(s): Peter Bermel; Stylianos Chatzidakis; Allen Garner

1236Ω *Avi Dube†; Peter Zakariya†; Sully Cisco*; Justin Gan*; Sahithi Gokavarapu*; Josh Krohn*; Derek Matthei*; Anne Mitten*; Pranati Patchigolla**
Mentor(s): Shreyas Sundaram; Younggil Chang

1237 *Elena Eberwine†*
Mentor(s): Dan Foti; Kimberly Galvez-Ortega; Kaylin Hill

1238 *Jiaming Fang†; Qinjia Xu‡; Zay Linn Htet*; Drew Philhower*; Rongbo Hu**
Mentor(s): Abolfazl Hashemi; Zijian He

1239Δ *Chris Farber†; Neel Sarathy‡; Selina Lin‡*
Mentor(s): Soojung Jo; Min Sook Park

1240 *Maximillian Farrell†; Jack Scarfo†; Anish Asthi†; Minh Vu†; Vinh Tran†; Mateo Hackett†; Michael Piper†; Anthony Wachowski†; Avinash Ignaczak†*
Mentor(s): Matthew Swabey; Jaeeun Kim

1241 *Mia Fleisher-de Kozan†*
Mentor(s): Aaron Bowman; Anke Tukker; Jennifer Schmitz

1242 *Mason Fleming†*
Mentor(s): Peter Bermel; Hannah Pike

1243 *Madison Flowers†*
Mentor(s): Mark Lipton; Kaif Rashid Khan

1244 *Madyson Foster†*
Mentor(s): Wayne Campbell

1245 *Ethan Fox†*
Mentor(s): Daniel Raudabaugh; Cathie Aime

1246 *David Fries†*
Mentor(s): Hana Hall; Kendall Cottingham

1247 *Anaelle Gackiere†*
Mentor(s): Shelley MacDermid Wadsworth

1248 *Darshak Gadagkar†*
Mentor(s): Riley Barta

1249 *Kylee Gall†*
Mentor(s): Lisa Hilliard

1250 *Mridulla Ganesh†*
Mentor(s): Lisa Bosman

1251 *Ansh Gangapurkar†; Sangjin Lee*; Andrew Liu*; Rahul Menon*; Hyun (Eric) Kang**
Mentor(s): Tillmann Kubis; Logan Melican

1252 *Andrew Gangstad†; Shaiv Mehra†; Tommy Mullin†; Joshua Sexton†*
Mentor(s): Sherry Harbin; Stacey Halum; Theodore Puls

1253 *Junezuh Ghang†*
Mentor(s): Teresa Carvajal

1254 *Grace Gilbert†; Trina Tagamolila‡; Sarah Ramsey‡*
Mentor(s): Sarah Karalunas; Sarah Pieper

1255 *Jennifer Gillette†; Jaron Hunt†; Danny Thornewell†*
Mentor(s): Shreya Ghosh; Samuel Labi

1256 *Emma Gordon†*
Mentor(s): Kathryn LaRoche

1257 *Paige Greenfield†*
Mentor(s): Tillmann Kubis; William LeFever

1258 *Kayla Grennes†*
Mentor(s): Ying Li; Ryan Patrick

1259 *Vinay Gupta†; Shrienidhi Gopalakrishnan‡*
Mentor(s): Alejandro Strachan; Brian Lee

1260 *Riddhi Gupta†*
Mentor(s): Lisa Bosman

1261 *Jarren Haggard†; Katie Peterson**
Mentor(s): Sarah Renkert

1262 *Anna Hardy†*
Mentor(s): Brandon Kistler

1263 *Audrey Harrison†*
Mentor(s): Edward Bartlett; Meredith Ziliak

1264 *Abigail Heppelmann†*
Mentor(s): Steve Steinhubl

1265 *Marco Herbsommer†*
Mentor(s): Vikas Tomar; Sushrut Karmarkar; Meghana Sudarshan; Mahavir Singh

1266 *Addison Hill†; Lauren Jones‡; Brianna Gast‡; Ellie Ketcham‡*
Mentor(s): Theresa Casey; Linda Beckett

1267 *Seoyeon Hong†*
Mentor(s): Maria Olivero-Acosta

1268 *Hoang Hua†; Areli Viveros-Hernandez†*
Mentor(s): Tho Le

1269 *Sierra Hunnicutt†; Zhixin Cai‡; Ryan Feller‡; Katie Hong‡; Luca Iacobucci‡; Hannah Reyes Charles‡; Anthony Tan‡*
Mentor(s): Kristen Bellisario

1270 *Dabin Jung†*
Mentor(s): Chitta Das; Rishi Patel; Zach Budimir; Yu Nishio; Betsy Parkinson

1271 *Alex Karns†*
Mentor(s): Steven Son; James Cooper; Tim Manship

1272 *Mingyu Kim†; Heesoo Kim†*
Mentor(s): James Davis; Wenxin Jiang

1273 *Andree Kolliegbo†*
Mentor(s): Nadia Lanman

1274 *Molly Kosiba†*
Mentor(s): Sharon Kessler; Sienna Ogawa

1275 *Ashlyn Kwan†*
Mentor(s): Matthew Scarpelli; Scotty Secrist

1276 *Briana Lavine†*
Mentor(s): Kerrie Douglas; Melissa Dyehouse

1277 *Seungho Lee†*
Mentor(s): John Mulrow; Kendrick Hardaway

1278 *Lisa Li†*
Mentor(s): Tyler Tallman

1279 *Nathaniel Lindsay†; Bonnie Cimack*; Katie Tooley*; Catherine Bell**
Mentor(s): Jeff Lucas; Rebecca Trapp

1280 *Joseph Lopez†; Caleb Suhy**
Mentor(s): Pramey Upadhyaya; Abhishek Solanki

1281 *Samantha Maari†; Lauren Voss*; Quinn Clemenz*; Olivia Richter**
Mentor(s): Elliot Friedman

1282 *Rohan Malavathu†*
Mentor(s): Alexandra Boltasseva; Blake Wilson

1283 *Lillian Maldia†*
Mentor(s): Caitlin Proctor

1284 *Mia Martinez†; Paige Davis‡*
Mentor(s): Gaurav Chopra; Guang Yang; Pooja Saklani; Harshit Arora; Caitlin Randolph

1285 *Michael Maslowski†*
Mentor(s): Nandhini Giri

1286Δ *Kathryn McGregor†; Ellen Densmore*; Madison Miller*; Katelyn Decker**
Mentor(s): Amanda Yuile; Arielle Borovsky

1287 *Vihaan Mercchant†*
Mentor(s): Michael Johnson

1288 *Valentina Micolisin†; Emily Bell‡; Andy Navarro‡*
Mentor(s): Edward Bartlett; Meredith Ziliak

1289 *Audrey Middaugh†*
Mentor(s): Annabelle Atkin; Nathan Lieng; Rich Lee; Amelia Blankenau

1290 *Joanna Miller†*
Mentor(s): Christopher Oakley; Samuel Mantel

1291 *Lillian Millspaugh†*
Mentor(s): Sarah Karalunas; Madelyn Blake Heise

1292Ψ *Nicholas Mitchell†*
Mentor(s): Ellen Wells

1293 *Alexander Nishio†; Dhanush Tipparaju†; Jayson Stansbury**
Mentor(s): Abolfazl Hashemi; Zijian He; Shivam Bhat

1294 *Darbin Oh†; Benjamin Tofil‡; Gangsan Lee*; Cheong Eun Kim*; Lyu Jia Sue*; Rakhmatillokhon Abdubaev*; Jozue Kim**
Mentor(s): Zhihong Chen; Joerg Appenzeller

1295 *Kennedy Outlaw†*
Mentor(s): Angeline Lyon; Isaac Fisher

1296 *Raahil Pattan†*
Mentor(s): Akanshu Sharma; Gaurav Chobe

1297 *Adam Piaseczny†*
Mentor(s): Christopher Brinton; Eric Ruzomberka; Rohit Parasnis

1298 *Holly Pickett†*
Mentor(s): Lisa Hilliard

1299 *Hurshal Pol†*
Mentor(s): Jason Cannon; Josephine Brown-Leung; Fatema Currim

1300 *Alejandra Porras Hernandez†*
Mentor(s): Yumary Ruiz; Alexia Carrizales; Zoe Taylor

1301 *Zachary Purcell†; Rauf Erkiletlioglu*; Minh Nguyen**
Mentor(s): Junfei Li

1302 *Rineet Ranga†; Akila Abeyaratna‡*
Mentor(s): Yang Yang; Brody Deming

1303 *Jaixai Reineke†; Misri Shah‡*
Mentor(s): Molly Scudder

1304 *Emily Ren†*
Mentor(s): Laura Murray-Kolb; Elina Dawoodani

1305 *Oliwia Rentley†*
Mentor(s): Anne Sereno; Daniel Larranaga

1306 *Olivia Richter†; Lauren Voss*; Quinn Clemenz*; Samantha Maari**
Mentor(s): Elliot Friedman

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement
Ω Interdisciplinary Project; Ψ Archival Project; Δ Digital Humanities Project

1307 *Mia Rodriguez†*
Mentor(s): Youli Mantzicopoulos; Xiang Zhou; Brenda Shein

1308 *Avigdor Roytman†; Ashwin Sreedhar†; Abhiram Nambiar†; Chris Sigmund†; Kris Gurung†*
Mentor(s): Edward Delp; Carla Zoltowski

1309 *Gustavo Saez Cruz†*
Mentor(s): Arnab Banerjee

1310 *Ryan San Juan†*
Mentor(s): David Warsinger; Jinwoo Oh; Junyan Ren; Makena Thompson

1311 *Kali Sayovitz†*
Mentor(s): Patricia Wolf; Apekshya Chhetri; Jellie Snyder; Mirandia Szramowski

1312 *Vinayak Shankar†*
Mentor(s): Yang Yang

1313 *Anshi Shastry†*
Mentor(s): Toni Rogat; Hyeree Cho

1314 *Jonathan Shimizu†*
Mentor(s): Mike Saunders

1315 *Yashashwini Singh†; Leo Malachowski†; Tushar Singh†; Alex Tauriainen†; Michael Lee†; Arjun Siderys†; Duc Pham†; Eduard Tanase†; Khanh Nguyen†; Justin Sanchez†; Venya Bhardwaj‡; Geetika Chitturi‡*
Mentor(s): Mark Johnson; Jude Pinto; Cole Nelson

1316 *Lyndsey Sipe†*
Mentor(s): Michael Johnson

1317 *Shelby Sliger†*
Mentor(s): Joe Ogas; Jiaxin Long

1318 *Katherine Stockhausen†*
Mentor(s): A.J. Schwichtenberg; Carolyn McCormick; Claire Rosenberger; Mehreen Hassan

1319 *Kirsten Strout†; Jason Cachur*; Joshua Harp*; Chris Parrett*; Reagan Fahey*; Olivia Phillips*; Ashley Lund*; Kellyn Bucceri*; Hannah Negash*; Anabelle Nelson**
Mentor(s): Laura Moffat

1320 *Dayoon Suh†*
Mentor(s): Byung-Cheol Min; Go-Eum Cha

1321 *Christopher Tan†*
Mentor(s): Somali Chaterji; Saurabh Bagchi; Yin Li; Pengcheng Wang; Fangzhou Mu

1322 *Lauren Thompson†; Bradley Shannon†; Ryan Houser†; Priyanshu Datta Roy†*
Mentor(s): Harry Ashbaugh; Kari Clase; AJ Gin; Daphne Fauber; Adam Quinn

1323 *Austin Throckmorton†*
Mentor(s): Justin Weibel; Alexander Ceperley

1324 *Enzo Tiptur†; Elliot Wong*; Christian Davus*; Jack Slater*; Nicholas Gano*; Andrew Song**
Mentor(s): James Goppert; Worawis Sribunma

1325 *Adeline Waltz†; Xinmeng Zhou†*
Mentor(s): Youli Mantzicopoulos

1326 *Bruce Ward†*
Mentor(s): Jeff Lucas; Jonathan Jenkins

1327 *Ryan Weiss†*
Mentor(s): Sidney Ducleroir

1328 *Carter Wilson†*
Mentor(s): Michael Johnson

1329 *Claire Wolfer-Jenkins†*
Mentor(s): Jimmy Dooley

1330 *Madeleine Yee†*
Mentor(s): Samuel Nielson

1331 *Benjamin Zirkle†*
Mentor(s): Yang Yang; Maria Olivero-Acosta; Kyle Wettschurack

1332 *David Zis†; Anna McCoy†*
Mentor(s): Lauren Stoczynski; Stephanie Gardner

1333 *Caroline Zu†*
Mentor(s): Betsy Parkinson; Haylie Hennigan; Lauren Wilbanks

1334 *Aarav Zutshi†*
Mentor(s): Kaitlyn Hood

# THIRD POSTER SESSION | 12:00PM-1:00PM

1400 *Saleh Alaayed†*
Mentor(s): Junfei Li

1401 *Natalie Anderson†*
Mentor(s): Sidney Ducleroir

1402 *Kihunn Anderson†*
Mentor(s): Vetria Byrd

1403 *Kay Annunziata†*
Mentor(s): Daniel Raudabaugh; Cathie Aime

1404 *Abigail Antonishek†; Emma Jeffries†; Madeline Stevenson†; Molly Shean†; Faith Wagner†; Emma Kessinger†*
Mentor(s): Adam Quinn; Harry Ashbaugh; AJ Gin; Daphne Fauber; Kari Clase

1405 *Ari Arzumanian†*
Mentor(s): Jo Davisson; Vallabh Suresh

1406Ω *Ishaan Bajpai†; Adithi Praveenkumar†; Parth Doshi†; Jonathan Oppenheimer†; Julia Dolpies‡; Ivan Ni*; Vaibhav Turaga**
Mentor(s): Santiago Torres-Arias

1407 *Nikolai Baranov†*
Mentor(s): Li Qiao; Holman Lau

1408 *Emily Bell†; Andy Navarro‡*
Mentor(s): Edward Bartlett; Meredith Ziliak

1409 *Isabella Belperio†; Irina Zhilinskaya†; Laney Shafer†; Alexander Higgins†*
Mentor(s): Adam Quinn; Daphne Fauber; AJ Gin; Harry Ashbaugh; Kari Clase

1410 *Arjun Bhadoria†*
Mentor(s): Raj Gounder; Enrique Iglesia

1411 *Aanant Bhagat†*
Mentor(s): Bryan Duarte

1412 *Praneel Bhandari†; Akhilesh Prasad†*
Mentor(s): Mark Johnson; Jude Pinto

1413 *Adi Bhatnagar†*
Mentor(s): Lucas Cohen

1414 *Taylor Buchowski†; Sarah Choi†; Anabela Djurovic-Topalovic†; Aishwarya Menon†; Amalia Rosenthal†; Amelia Winkelman†*
Mentor(s): Adam Quinn; Harry Ashbaugh; AJ Gin; Daphne Fauber; Kari Clase

1415Ω *Zhixin Cai†; Saloni Parkar*; Isabella Duzman**
Mentor(s): Kristen Bellisario; Christine Elliott

1416 *Siddarth Calidas†; Jerry Chen†; Yilin Xu†*
Mentor(s): Mark Johnson; Jude Pinto

1417 *Daniel Ceglio†; Catie Fleming‡*
Mentor(s): Caitlin Proctor

1418 *Evan Chen†; Andrew Huang†; Aditya Mittal†*
Mentor(s): Shreya Ghosh

1419 *Camryn Clapper†; Valeria Rodríguez‡*
Mentor(s): Matthew Scarpelli; Jessica Veenstra

1420Ω *Braiden Doane†; Rachel Durham†*
Mentor(s): Inna Abramova

1421 *Abhigyan Doshi†*
Mentor(s): Steve Wereley; Pranshul Sardana; Varun Aggarwal

1422 *Aaron Du†*
Mentor(s): Tiwei Wei; Keyu Wang

1423 *Alexandra Earle†*
Mentor(s): Brian Tackett; Hwiyoon Noh

1424 *Mallory Eller†*
Mentor(s): Laura Moffat

1425 *Jacob Eyster†*
Mentor(s): Jonathan Shannahan; Arjun Pitchai; Li Xia; Bruce Cooper; Amber Jannasch

1426 *Elizaveta Filippova†; Seth Graber†; Isabelle Baggio‡; Christopher Miotto‡; Brandon Mar‡*
Mentor(s): Aaron Lottes; Andrew Sivaprakasam

1427 *Claire Fisher†; Sophia Horn‡; Hallie Jackson‡; Emma Engel*; Olivia Zaragoza**
Mentor(s): Maria Sepúlveda; Tyler Hoskins; Nathan Mak

1428 *Delilah Flora†; Gangmin Kim‡*
Mentor(s): Harm HogenEsch; Ahmed AbdelKhalek; Raluca Ostafe

1429 *Matthew Fortino†*
Mentor(s): Chad Carroll

1430 *Augustine Gallespen†; Autumn Reynolds†*
Mentor(s): Michelle Garrison; Sumin Im

1431 *Yunfei Gao†; Carson Denoo†; Chuan-Chen Ko†*
Mentor(s): Boyuan Chen; Sergey Zakharov

1432 *Lauren Gartenhaus†*
Mentor(s): Jason Hanna; Annaleigh Powell-Benton

1433 *Alexandra Gillman†; Lucy Ehmann†; Carolina Kim†; Natalie Haynes†; Henrietta Ndubuokwu†; Danae Youngstedt‡*
Mentor(s): Harry Ashbaugh; Daphne Fauber; Adam Quinn; AJ Gin; Kari Clase

1434 *Kush Gogia†; Yash Mehta†*
Mentor(s): James Davis

1435 *Claire Gourlay†*
Mentor(s): Brandon Kistler

1436 *Anna Grobengieser†*
Mentor(s): Jimmy Dooley; Alexandros Nanos

1437 *Nolan Gronowski†*
Mentor(s): Amy Marconnet; Ritwik Kulkarni; Pranay Nagrani

1438 *Keira Hagen†*
Mentor(s): Sidney Ducleroir

1439 *Francesca Hamacher†*
Mentor(s): Jacqueline Linnes; Sayeh Dowlatshahi

1440 *Alexander Harman†; Roma Kamat*; Maria Armenta**
Mentor(s): Sebastien Helie; Alyssa Randez

1441 *Jacob Henley†; Xinmeng Zhou†; Madhura Kawar†*
Mentor(s): Anne Sereno; Daniel Larranaga; Aditya Shanghavi

1442 *Carl Henry†; Katie Smith†; Conwy Zheng†; Alex Martin†; Salem Hallab†; Thanh Nguyen†*
Mentor(s): AJ Gin; Daphne Fauber; Harry Ashbaugh; Adam Quinn; Kari Clase

1443 *Mia Herzog†*
Mentor(s): Matt Murawski

1444 *Katie Hong†; Sierra Hunnicutt‡; Hannah Reyes Charles‡; Zhixin Cai‡; Ryan Feller‡; Luca Iacobucci‡; Anthony Tan‡*
Mentor(s): Kristen Bellisario

1445 *Oliver Hu†; Liying Che**
Mentor(s): Amr Elkabbany; Jo Davisson

1446Ω *Josh Hyatt†; Atharv Bhatter†; Aditya Chandra†; Ethan Farkas†; Evan Cahoon†; Joseph Redle†; Kabir Malik†; Makeda Duey†; Niall Moloney†; Yashwanth Muppidi†*
Mentor(s): Charles D'Onofrio; Curtis Marshall

1447 *Vinay Jagan†; Colby Acton†; Gaetano Iannotta‡; YiRuei Weng‡; Shreyas Khot‡; Aditi Anand‡; Nathan Huang‡; Annapoorna Prabhu‡; Ruth Sugiarto‡; Vihaan Chinthakindi‡; Rahul Siddharth‡; Wei-Cheng Lee‡; Yuren Chen‡; Saisravani Kuchibhotla‡; Pranav Konda‡; Jiefu Zhang‡; Michael Suo‡*
Mentor(s): Qiang Qiu; Wei Zakharov; Zichen Miao

1448 *Aakar Jain†*
Mentor(s): Xiulin Ruan; Daniel Carne

1449 *Mahee Jain†*
Mentor(s): Yumary Ruiz; Madeline Moser; Carlyn Kimiecik

1450 *Lillian Ji†*
Mentor(s): Kejie Zhao; Nikhil Sharma

1451 *Ali Kalmagambetov†*
Mentor(s): Maria Miria Velay-Lizancos; Alberto Castillo; Jan Olek

1452 *Gunvanth Reddy Kandula†; Ilan Benschikovski†; Kyung Min Ko†; Ishaan Rath†; Kanav Atre†; Udayan Pandey†*
Mentor(s): Edward Delp; Carla Zoltowski

1453 *Akshith Karri†; Phoebe Zhou‡; Cade Rigg‡*
Mentor(s): Danny Milisavljevic; Braden Garretson

1454 *Jillian Kelley†*
Mentor(s): Natalia Rodriguez; Rebecca Ziolkowski

1455 *Dhruv Khatri†; Ann Zi Lau†*
Mentor(s): Mark Johnson; Cole Nelson; Ryan Montsma

1456 *Seeun Kim†*
Mentor(s): John Peterson; Dali Lai

1457 *Seongyun Kim†; Harry Lee‡*
Mentor(s): Garam Kim; Eduardo Barocio

1458 *Abhishek Kini†; Ethan Walker†; Nikita Dubrovskyi†; Craig Cheung†; Megan Collins†; Aayush Iyengar†; Yooseung Choi‡; Clifford Gamble‡*
Mentor(s): Ran Dai

1459 *Arnav Kumar†*
Mentor(s): Yang Yang; Manasi Halurkar

1460 *Sejal Kumar†; Paolo Gumasing†; Jaehyuk Lee†; Jiaqing Li†; Leyton Bostre†; Rohan Nachnani†; Toby Onyekwere†; Rebecca Rupp‡; Aditya Sivathanu‡*
Mentor(s): Jim Ogg; Aaron Ault

1461 *Dhriti Laddha†*
Mentor(s): Matthew Scarpelli

1462 *Sarah Larsen†*
Mentor(s): Sujith Puthiyaveetil; Steven McKenzie

1463 *Elizabeth Lawson†*
Mentor(s): Jennifer Brown; Stephen Beegle; Luis Gomez

1464 *Chloe Lin†; Samitha Ranasinghe†; Rajit Khatri†; Vignesh Charapalli†*
Mentor(s): Aravind Machiry; Ritvik Stanksal

1465 *Jerry Liu†*
Mentor(s): Aparajita Jaiswal; Prateek Jaiswal

1466 *Mauro Lopez-Carrillo†; Shlok Kulkarni‡*
Mentor(s): Arezoo Ardekani; Harsa Mitra

1467 *Jonah Lovitz†; Alex Kmetko†; Joseph Forster†; Anshuman Samanta†; Aron Dutia†; Alexander Ciccarelli†; Akash Kumar†; Pranav Krishnamoorthy†; Matthew Genatempo†; Chase Hamdan†*
Mentor(s): James Goppert

1468 *Kathryn Lund†*
Mentor(s): Yang Yang; Jingliang Zhang; Brody Deming

1469 *Kailin Ma†; Anh Duong†*
Mentor(s): Brandon Keehn; Yesol Kim

1470 *Brandon Mar†; Morgan Gyger†*
Mentor(s): Kari Clase

1471 *Nicholas Martel†; Tom O'Donnell†; Thomas Greer†; Yash Mehta‡*
Mentor(s): Carla Zoltowski; Zijian He; Shivam Bhat

1472 *Malcolm McClymont†; Burkay Sahin†; Devin Singh‡*
Mentor(s): Mark Johnson; Cole Nelson

1473 *Kiera Meyer†; Faith McPhee*; Autumn Bretwisch*; Grace Pearson*; Zoe Wilks*; Katelin Schwab**
Mentor(s): William Graziano; Regina Henares

1474 *Claire Middendorf†*
Mentor(s): Marika Santagata; Luis-Enrique Garzon-Sabogal

1475 *Stephen Mills†*
Mentor(s): Christopher Oakley

1476 *Areej Mirani†; Shubham Saluja Kumar Agarwal†; Dennis Dai†; Leo Chen†; Zihao Ye†; Vidisha Singhal†; Sejal Kumar†; Aishwarya Anand‡*
Mentor(s): Yung-Hsiang Lu

1477 *Katlynn Mistina†*
Mentor(s): Pat Kerstein

1478 *Karina Morar†*
Mentor(s): Terry Meyer; Matthew Hoeper

1479 *Mark Naguib†*
Mentor(s): Alvin Kao; Nicholas Baumgartner

1480 *Khanh Ha Nguyen†*
Mentor(s): Riyi Shi; Casey Adam

1481 *Emma Niecikowski†*
Mentor(s): Claney Outzen; Michelle Erskine; Arielle Borovsky

1482 *David OBrien†*
Mentor(s): Michael Johnson

1483 *Chaewon Oh†; Samskrithi Sivakumar†; Ridhi Tamirasa Kandala‡; Thomas Huss‡*
Mentor(s): Deborah Spoerner; Khue Tran

1484 *Rio Ohtake†*
Mentor(s): Danzhou Yang; Yichen Han

1485 *Abigail Origer†*
Mentor(s): Wenzhuo Wu; Robert Ccorahua-Santo

1486 *Gladys Osakwe†*
Mentor(s): Aaron Specht; Thomas Grier

1487Ω *Amanda Pawlecki†; Aryaman Dewan**
Mentor(s): Marxa Figueiredo; Raluca Ostafe; Ying Cheng Chen; Omnia Ibrahium

1488 *Rachel Pfeifer†*
Mentor(s): Sudip Vhaduri

1489 *Alexander Piet†*
Mentor(s): Gaurav Chobe

1490 *Ethan Pinarski†*
Mentor(s): Kyoung-Soo Lee; Vandana Ramakrishnan; Nicole Firestone

1491 *Reeya Ramasamy†*
Mentor(s): Kathryn Seigfried-Spellar; Tatiana Ringenberg

1492 *Hannah Reyes Charles†; Sierra Hunnicutt‡; Katie Hong‡; Zhixin Cai‡; Ryan Feller‡; Luca Iacobucci‡; Anthony Tan‡*
Mentor(s): Kristen Bellisario

1493 *Shyeonna Robinson†*
Mentor(s): Logan Strother

1494 *Kenneth Rodriguez-Lopez†*
Mentor(s): Shalini Low-Nam; Kevin Scrudders; Suriya Selvarajan

1495 *Ana Rojas†*
Mentor(s): Pam Sari; Stewart Chang-Alexander

1496 *Ryan Rushing†; Eleazar Gonzalez‡*
Mentor(s): Ken Ritchie

1497 *Felipe Sandoval†; Naren Rachapalli†; Ben Eng†; Nicholas Helushka†; Gokulkrishnan Harikrishnan†; Truman Mohr†; Nicholas Detwiler†; Warat Vijitbenjaronk†; Ron Bejerano†*
Mentor(s): Thomas Roth; Samuel Elkin; Soomin Moon

1498ΨΔ *Neel Sarathy†; Selina Lin*; Chris Farber**
Mentor(s): Soojung Jo

1499 *Sofia Schumann†; Dia Jhaveri‡; Matthew Corson‡*
Mentor(s): Jason Cannon; Reeya Tanwar; Fatema Currim; Josephine Brown-Leung

1500 *Tanishaa Shah†; Cheng-Hao (Ryan) Chen*; Samantha Sudhoff*; Cole Scheidler*; Yu-Hsu (Josh) Chang*; Sai Meda**
Mentor(s): Yung-Hsiang Lu; Kristen Yeon-Ji Yun

1501 *Neha Sharma†; Mir Yim†; Rohit Lala†; Andrew Lykken†*
Mentor(s): Ryan Montsma; Cole Nelson; Mark Johnson

1502Ω *Kennedy Sheppard†; Noa Shoval†*
Mentor(s): Michelle Garrison; Saira Shah

1503 *Chi Hun Shin†*
Mentor(s): Keith Cherkauer; Dongseok Yang

1504 *Anushka Shome†*
Mentor(s): Edward Bartlett

1505 *Serena Shughoury†*
Mentor(s): Aaron Bowman; Anke Tukker

1506 *Shiv Shukla†*
Mentor(s): Lia Stanciu; Teresa Carvajal; Abbey Koneru; Karen Gutierrez Parra; Amit Barui

1507 *Erik Sillaste†*
Mentor(s): Shihuan Kuang; Jingjuan Chen

1508 *Vidisha Singhal†*
Mentor(s): Mark Johnson; Cole Nelson; Ananya Srivastava

1509 *Harrison Smith†*
Mentor(s): Junfei Li

1510 *Parker Smith†*
Mentor(s): Venkat Athmanathan; Terry Meyer; Chintan Rank

1511 *Colby Smock†; Gabriela Nivar‡; Rachael Herring‡*
Mentor(s): Aaron Thompson

1512 *William Stevens†; Vishal Urs†; Karthik Selvaraj†; Gabriel Torres†; Gaurish Lakhanpal†*
Mentor(s): Edward Delp; Carla Zoltowski

1513 *Madeline Stevenson†; Faith Chapman†; Krttika Goel†*
Mentor(s): Arezoo Ardekani; Harsa Mitra

1514Ω *Gianna Stinsa†; Kate Stanton†; Joyce Yu†; Alyssa Hudgins†; Jingyi Ji†; Morgan Laskowski†*
Mentor(s): Harry Ashbaugh; Kari Clase; Daphne Fauber; Adam Quinn; AJ Gin

1515Ω *Drake Strait†*
Mentor(s): Teresa Carvajal; Karen Gutierrez Parra

1516 *Erik Sveen†*
Mentor(s): Julia Laskin; Miranda Weigand

1517 *Anthony Tan†; Sierra Hunnicutt‡; Hannah Reyes Charles‡; Katie Hong‡; Zhixin Cai‡; Ryan Feller‡; Luca Iacobucci‡*
Mentor(s): Kristen Bellisario

1518 *Emma Teng†; Rongbo Hu†; Nicholas Martel†; Connie Kang†; Mary Earp‡; Kalea Gin‡*
Mentor(s): Abolfazl Hashemi; Shivam Bhat

1519 *Arav Tewari†*
Mentor(s): James Davis

1520 *Andy Trinh†*
Mentor(s): Sidney Ducleroir

1521 *Steven Turnbull†; Lisa Li†; Cheyenne Huang†; Ananya Prasad†; Tatiana Varela†; Pranav Singh†*
Mentor(s): Tyler Tallman; Saranya Ravva; Estheru Talasila; Kelsey De La Trinidad; Andrew Nguyen

1522 *Vanessa Grace Uy†; Sharma Kashish**
Mentor(s): Akanshu Sharma; Dheeraj Waghmare

1523Ω *Daniela Valencia†*
Mentor(s): Yumary Ruiz; Xue Jiang; Zoe Taylor

1524 *Emory Walker†; Mara Welty†; Emma Creviston†*
Mentor(s): Jacob Adler

1525Δ *Julia Weeden†; Priyadevi McNamara†*
Mentor(s): Eric Waltenburg

1526 *Tristen West†; Zion Hackett*; Lucas Urquiaga*; Umbert Creighton Caseres*; Dane Phillips*; Ryan Lee**
Mentor(s): Harry Ashbaugh; Daphne Fauber; AJ Gin; Adam Quinn; Kari Clase

1527 *Mark Wise†; Akshay Padmanabhuni‡; Lance Berendes‡*
Mentor(s): Jason Ostanek; Bill Hutzel

1528 *Cayden Woolery†*
Mentor(s): Marissa Tremblay; Nick Meszaros

1529Δ *Madeleine Yang†; Enice Zhu†; Maggie Collins†*
Mentor(s): Swati Srivastava; Alexander Wilhelm

1530 *Fa Yan†; Arjun Gupte†; Bryan Lee†*
Mentor(s): James Davis

1531 *Kevin Yu†*
Mentor(s): Peter Bermel; Jie Zhu; Ruihan Chen

1532 *Irina Zhilinskaya†; Evan Hanson‡*
Mentor(s): Herman Sintim; Chris Vennard

# FOURTH POSTER SESSION | 1:30PM-2:30PM

1600 *Akila Abeyaratna†; Rineet Ranga‡*
Mentor(s): Yang Yang; Brody Deming

1601 *Cornelius Adeola†*
Mentor(s): Michael Johnson

1602 *Teja Akella†; Divya Manvikar†; Laasya Thiagarajan†; Ishank Shekhar†*
Mentor(s): Carla Zoltowski; Edward Delp

1603Ω *Morgan Albertson†*
Mentor(s): Uma Aryal

1604 *Aditya Arjun Anibha†*
Mentor(s): Ken Oguri

1605 *Rebeca Appelmann†*
Mentor(s): Rebecca Appelmann

1606Δ *Gurtej Bagga†; Shrinand Perumal†; Anthony Wang†; Brian Qi†; Josh Kamphuis**
Mentor(s): Kristen Yeon-Ji Yun; Yung-Hsiang Lu; Benjamin Shiue-Hal Chou

1607 *Samyukta Balaji†; Ava Fasano†; Aditya Sivathanu‡*
Mentor(s): Jim Ogg; Aaron Ault

1608 *Joe Basti†; Mario Arenas†; Grant Capps†; Max Kerkhove†; Rushil Khandelwal†; Eric Wang**
Mentor(s): Shreya Ghosh

1609 *Emma Benefiel†; Jeanelle Castro†*
Mentor(s): Philip Low; Reuben Dass

1610 *Daniel Berggren†*
Mentor(s): Terry Meyer; Robert (Bebe) Wang

1611 *Spencer Bowles†; Vidisha Singhal†*
Mentor(s): Peter Bermel; Jie Zhu

1612 Withdrawn.

1613 *Adrian Calderon†*
Mentor(s): Gaurav Nanda

1614 *Samantha Campbell†*
Mentor(s): Jacqueline Linnes; Emilee Madsen

1615 *Carmela Campbell†*
Mentor(s): Yumary Ruiz; Madeline Moser

1616Ψ *Dylan Caudill†; Thomas Slamecka‡*
Mentor(s): Jeffrey Gerber

1617 *Jacob Chappell†; Harnoor Cheema†*
Mentor(s): Mark Johnson

1618 *Coco Chen†; Rae Fu†; Jackson Novak†*
Mentor(s): Petronio Bendito

1619 *Sooraj Chetput†; Johnathan Hong†; Alex Chitsazzadeh†; FangLing (Victor) Zhang†; Khoi Pham†; Zengxiang (Tim) Han†; Justin Cambridge†; Htet Yan†; Spencer Bowles‡*
Mentor(s): Tim Rogers; Mark Johnson; Gagan Gundala; Anusuya Nallathambi

1620 *Ethan Chiao†; Luke Zhang†*
Mentor(s): Lucas Cohen

1621 *Geetika Chitturi†; Trang Do†*
Mentor(s): Alexandra Boltasseva; Vladimir Shalaev; Yuheng Chen; Blake Wilson; Alexander Senichev

1622 *Indrayudh Chowdhury†*
Mentor(s): Mark Johnson; Jude Pinto

1623 *Min Yong Chun†*
Mentor(s): Garam Kim; Sung Jun Choi

1624 *Sydney Clifford†*
Mentor(s): Brittany Allen-Petersen; Claire Pfeffer; Jukka Westermarck; Jennifer Morton

1625 *Kendall Conaway†*
Mentor(s): Susan South; Samantha Dashineau

1626 *Ronald Cutler†*
Mentor(s): Julia Laskin; Hugo Samayoa-Oviedo

1627 *Gino Daniels†; Sean Wall†; Cole Murphy†; Ishan Goel†; Bornik Nag†; Ayusha Patra†; Fabiana Correa†*
Mentor(s): Andreas Jung; Robin Carpenter

1628 *Noelle Dennis†*
Mentor(s): Aaron Thompson; Deb Arseneau

1629 *Atin Dewan†*
Mentor(s): Aparajita Jaiswal; Sakhi Aggrawal

1630 *Nancy Dooley†; Grace Vavra†; Quinn Loughran†; Abigail Finney*; Noelia Alvarez*; Maggie Collins**
Mentor(s): Clarence Maybee; Rachel Fundator; Secret Permenter

1631 *Avik Dutta†*
Mentor(s): Nikhilesh Chawla; Eshan Ganju

1632 *Ayden Fahey†*
Mentor(s): Michael Johnson

1633Ω *Kiki Finlayson†; Emma Gordon‡; Alana Powell‡*
Mentor(s): Kathryn LaRoche; Scotty Secrist

1634 *Athanasios Flessas†; Carson Rockwell†; Bailey Williams†; Hayley Wong-Liong†*
Mentor(s): Bruce Applegate; Kal Holder; Keyshla Narváez-Dávila; Trevor Lim

1635 *Viviana Galindo†*
Mentor(s): Marxa Figueiredo; Grace Mulia

1636 *Alaina Gartner†; Keila Jellings‡*
Mentor(s): Leonor Boavida

1637 *Antonio Gil†*
Mentor(s): Sidney Ducleroir

1638 *Evelyn Girardi†*
Mentor(s): Robin Tanamachi

1639 *Greenley Goedde†*
Mentor(s): Pete Pascuzzi; Jason B. Reed

1640Ω *Ata Ulas Guler†; Alicia Zhou†; Zilu (Johnny) Jin†; Jadden Picardal*; Saandiya KPS Mohan*; Leo Chen*; Adarsh Veerapaneni*; Amy Tong*; Jin Hyun Kim**
Mentor(s): Dave Barbarash

1641 *Arjun Gupte†*
Mentor(s): Byung-Cheol Min; Ruiqi Wang; Vishnunandan Venkatesh

1642 *Carlos Guzman Garcia†*
Mentor(s): A.J. Schwichtenberg; Amy Janis

1643 *Emerson Haines†; Evy Tobolski‡*
Mentor(s): Theresa Casey; Linda Beckett; Wonders Ogundare; Aridany Suarez-Trujillo

1644 *Timothy Hein†*
Mentor(s): Mark Johnson; Conor Green; Swapnil Bansal

1645 *Opal Heltzel†*
Mentor(s): Rakesh Agrawal; Shubhanshu Agarwal; Kiruba Catherine Vincent

1646 *Rachael Herring†*
Mentor(s): Aaron Thompson; Patrick Lydon

1647 *Jasper Hochbaum†; John Min†; Ella Goodrich†; Alex Hartman†; Mohammed Khan†; Grace Gellatly†*
Mentor(s): Shreya Ghosh

1648 *Daniel Hristov†*
Mentor(s): Julia Laskin; Hugo Samayoa-Oviedo

1649 *Elaine Huang†*
Mentor(s): Youli Mantzicopoulos

1650 *Vivian Hurn†*
Mentor(s): Wei Zheng

1651 *Paige Ittig†*
Mentor(s): Yumary Ruiz; Madeline Moser

1652 *Jaylen Jackson†*
Mentor(s): Aaron Thompson

1653 *Jacob Jenkins†; Emma Jones‡*
Mentor(s): Jasmine Begeske; Jennifer Smith

1654 *Joshua Kaluf†*
Mentor(s): Joe Ogas; Jiaxin Long

1655 *Chaeeun Kim†; Nikhita Anantha Madhavan†; Joseph Huang†; Shivam Rastogi†; Emily Loiselle†*
Mentor(s): Edward Delp; Carla Zoltowski

1656 *Sam King†; Gabby Conjelko‡*
Mentor(s): Emily Dykhuizen; Sandra Ordonez; Sijie Wang

1657 *Katie-Jane Klembarsky†*
Mentor(s): Mo Rastgaar; Gabriel Andres Torres Rivera; Ahmed Soliman

1658 *Haleigh Kolosso†*
Mentor(s): Michael Johnson

1659 *Hayden Krisko†*
Mentor(s): Alex Chortos

1660 *Shlok Kulkarni†; Gabi Layman‡; Elsa Davis*; Hala Haddad*; Braden Stock*; Amanda Martin*; Mithran Periassamy**
Mentor(s): Jeffrey Haddad

1661 *Yahor Lechanka†; Matt Wheeler†; Mason Whittington†; Rohan Iyer†; Angus Wai†; Aubrey Gatewood†*
Mentor(s): Jesus Meza; Steven Pugia; Anthony Cofer; Alina Alexeenko

1662Ω *Elena Lehner†; Julie Kim†; Dalton Aaker‡; Twinkal Barai‡; Khushi Choksi‡; Shreya Krishnan‡; Simran Nadig‡; Akarsh Ojha‡; Abigail Origer‡; Jean Paul Pertuit‡; Sage Turner‡; Ethan Weiss‡; Sugru Yahaya‡*
Mentor(s): Aaron Lottes; Neal Patel

1663Ω *Rebecca Lewis†*
Mentor(s): Chad Carroll; Harrison Cottingham; Camila Reyes; Nathan Campbell

1664 *Van Tha Bik Lian†*
Mentor(s): Akanshu Sharma; Deepak Suthar

1665 *Manasvi Lingampally†; Ashley Cumbee†; Grace Troyer†; Kayla Grennes‡; Amanda Pawlecki‡; Faith Chapman‡*
Mentor(s): AJ Gin; Harry Ashbaugh; Daphne Fauber; Adam Quinn

1666 *Andrew Liu†; Ansh Gangapurkar*; Ben Miller*; Eric Kang*; Rahul Menon*; Sangjin Lee**
Mentor(s): Tillmann Kubis; Logan Melican; Daniel Lemus

1667 *Jingqing Liu†*
Mentor(s): Antonio Bobet; Juan Jimenez

1668 *Hecun Liu†*
Mentor(s): Thomas Redick; Robert Proctor

1669 *Lionel Loo†*
Mentor(s): Linlin Li

1670 *Riley Mann†*
Mentor(s): Dongming Gan; Muhammad Hammad Alvi

1671 *Gianna Martire†; Kris Sass†*
Mentor(s): Laura Elenbaas; Megan Norris; Jane Singman

1672 *Luke Matheny†*
Mentor(s): Tianyi Li

1673 *Allison Matovic†; Sanjana Muniraj**
Mentor(s): Deva Chan; Mikayla Roach; Shrea Roy; Clarisse Zigan

1674 *Liam McCormack†; Eveyln McCarthy‡*
Mentor(s): Brittany Newell; David Moreno; Diana Narvaez

1675 *Shaiv Mehra†; Tyler Merrill†*
Mentor(s): Bradley Duerstock; Mitchell Sanchez

1676 *Ronit Mehta†*
Mentor(s): Mahesh Sunkula

1677 *Maxwell Michalec†; Fahad Aloufi†; Om Gupta†*
Mentor(s): Mark Johnson; Cole Nelson

1678Ω *Chawin Mingsuwan†*
Mentor(s): Adrian Tepole

1679 *Uday Mittal†; Juliana Asencion†; Luke Johnson†; Matthew Schaller†*
Mentor(s): Aaron Lottes; Neal Patel

1680 *Wyatt Montgomery†*
Mentor(s): Andreas Jung; Yao Yao; Ethan Colbert

1681 *Kamanda Mosongo†*
Mentor(s): Chien-Tsung Lu; Haoruo Fu

1682Ω *Asmi Mukherjee†*
Mentor(s): Douglas Brubaker

1683Ω *Keisuke Nakamura†*
Mentor(s): Noori Kim

1684 *Andy Navarro†; Emily Bell‡*
Mentor(s): Edward Bartlett; Meredith Ziliak

1685 *Henrietta Ndubuokwu†*
Mentor(s): Qing Deng; Chang Ding; Scotty Secrist

1686 *Long Nguyen†*
Mentor(s): Sutton Hathorn

1687 *Alec Pannunzio†*
Mentor(s): Samuel Labi; Shreyas Sundaram

1688 *Elainna Papandrea†; Subbi Sathya†; Ethan Lin†; Elena Warble†; Duc Le†; Devin Reynolds†; Vicky Zheng†; Linda Zou†; Aneesh Poddutur†; Yen Lai**
Mentor(s): Laura Moffat

1689Ω *Stefano Parducci†*
Mentor(s): Aaron Specht; Kolawole Adesina

1690 *Saloni Parkar†; Isabella Duzman*; Zhixin Cai**
Mentor(s): Christine Elliott; Kristen Bellisario

1691 *Marcos Daniel Pastrana†*
Mentor(s): Hinayah Rojas de Oliveira; Henrique Mulim

1692 *Rohan Patel†; Cara Suh†; Xiaoyu Liu†; Yicheng Wu†; Amelia Binau**
Mentor(s): Andreas Jung

1693 *Nicholas Pecoraro†; Shane Limas†*
Mentor(s): Jae Hong Park; Chang Geun Lee

1694 *Ashley Phoenix†; Austin Lu**
Mentor(s): Nicholas Noinaj

1695 *Michael Piper†*
Mentor(s): Mark Johnson

1696Ω *Tyler Ramsey†*
Mentor(s): Justin Hess; Andrew Brightman; Nicholas Fila; Alison Kerr

1697 *Sarah Ramsey†*
Mentor(s): Annabelle Atkin

1698 *Jordan Reynolds†*
Mentor(s): Esteban Fernandez-Juricic; Carlay Latour Teed

1699Ω *Paula Rivera Carrasquillo†; Audrey Harrison*; Emily Bell*; Andy Navarro*; Morgan DesEnfants*; Sahil Desai*; Anushka Shome*; Valentina Micolisin**
Mentor(s): Edward Bartlett; Meredith Ziliak

1700Ω *Alexia Rodrigues†; Joseph Cromp†; Thanmaya Pattanashetty†*
Mentor(s): Alexandria Volkening

1701 *Valeria Rodríguez†; Camryn Clapper**
Mentor(s): Matthew Scarpelli; Jessica Veenstra

1702Δ *Zachary Ryan†; William Shumway**
Mentor(s): Erik Otarola-Castillo

1703 *Aishani Sakalabhaktula†*
Mentor(s): Lisa Bosman

1704 *Rahul Saproo†; Rohan Aryan†*
Mentor(s): Seema Mattoo

1705 *Nandhitaa Satya†; Perion Sharp†*
Mentor(s): Stephanie Gardner; Anupriya Karippadath

1706 *Jenna Schoonmaker†*
Mentor(s): Maria Sepúlveda; Priyanka Baloni; Tyler Hoskins; Nathan Mak

1707 *Faith Scott†*
Mentor(s): Uma Aryal; Rodrigo Mohallem; Allison Schaser

1708 *Sharma Kashish†; Vanessa Grace Uy**
Mentor(s): Akanshu Sharma; Dheeraj Waghmare

1709 *Anvit Sinha†; Shruti Goyal†; Zachary Will Sy†*
Mentor(s): Andres Bejarano; Ethan Dickey

1710ΨΩ *Hyerin Sohn†*
Mentor(s): Michael Johnson

1711 *Braeden Strahm†*
Mentor(s): Tatiana Ringenberg

1712 *Daanish Suhail†; Kshitij Shah†; Jack Willard†; Troy Madden†; Pryce Tharpe†*
Mentor(s): Chih-Chun Wang; David Love; James Krogmeier; Manish Kumar Krishne Gowda

1713 *Trisha Suresh†; Paul Michael Vasquez*; Joshua Fan**
Mentor(s): Greg Michalski

1714 *Maheen Syed†*
Mentor(s): Denny Yu; Marian Obuseh

1715 *Ethan Szajko†*
Mentor(s): Daniel Szymanski

1716 *Pranav Tallapaka†*
Mentor(s): Shauna Adams

1717 *Sarthak Tandon†; Advay Welling†*
Mentor(s): Blake Wilson; Vahagn Mkhitaryan

1718 *Shou-Fu Tseng†; Brandon Farber†*
Mentor(s): Tho Le

1719 *Lauren Urban†*
Mentor(s): Anita Panjwani; Bridgette Kelleher; Regan Bailey; Steve Lindemann

1720 *Alex Valdes†*
Mentor(s): Brittany Newell

1721 *Theoni Vlachos†; Sophia Vlachos†*
Mentor(s): Peristera Paschou; Apostolia Topaloudi

1722 *Lauren Voss†; Quinn Clemenz*; Olivia Richter*; Samantha Maari**
Mentor(s): Elliot Friedman

1723 *Samantha Wadas†; Caden Cowles†; Sinhong Park†*
Mentor(s): Garam Kim; Jacob Montrose; Noori Kim

1724 *Nicole Wang†; Asav Gandhi†; Stephen Fetterman†*
Mentor(s): Mark Johnson; Sutton Hathorn

1725 *Dulani Wijayarathne†; Siddharth Prabakar*; Shah Mahir**
Mentor(s): James Davis

1726Ψ *Nah'Shon Williams†*
Mentor(s): Ashima Krishna

1727 *Austin Willis†*
Mentor(s): Gouri Prabhakar

1728 *Clayton Wimmersberger†*
Mentor(s): Michael Johnson

1729 *Sucheol Woo†; Min Yong Chun‡; Seongyun Kim‡*
Mentor(s): Garam Kim; Ronald Sterkenburg; Yuwei He; Kangseok Lee

1730 *Lexing Xu†; Anish Tilak‡; Alexandre Chevalier*; Nicholas Erikson**
Mentor(s): Andreas Jung; Sushrut Karmarkar

1731Ω *Yahan You†*
Mentor(s): Erin Percevault; Yiwei Huang; Aaron Thompson



† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement
Ω Interdisciplinary Project; Ψ Archival Project; Δ Digital Humanities Project

**Poster Presentation Abstract Number: 1000**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Evaluation of Cytotoxic Effects and Anti-Tumor Efficacy of Targeted Tumor-Associated Macrophage Treatment Using Ferumoxytol in Canine Gliomas

Life Sciences


Author(s):

Teagan Ames-Majeski† (HHS)



Abstract:

Glioblastomas are identified as frequently reoccurring cancerous tumors in the brain, causing uncontrollable cell growth. This project determines the efficiency of integrating tumor-associated macrophages (TAMs) targeted therapy while continuing with relevant chemo and radiotherapy treatments in gliomas. TAM targeting will be achieved using ferumoxytol, an iron-replacement product often used to treat iron deficiency anemia. The hypothesis is that ferumoxytol (0, 6, 12 mg/kg) will reduce immunosuppressive and tumor-promoting TAMs. Said hypothesis is assessed through four canines possessing gliomas, two canines treated with ferumoxytol and chemotherapy alongside two canines with exclusive surgery and chemotherapy. Each canine was followed from diagnosis to post-op via magnetic resonance imaging (MRI) to track the growth of the glioma. MRI scans were taken at the time of diagnosis and then again a few weeks later before surgery (in the case of canines 3 and 4, occurred 24 hours after ferumoxytol injection). Following surgery, all canines underwent chemotherapy until tumor progression. Tumor appearance on MRI scans is evaluated and compared with tumor histology samples. So far, research shows that ferumoxytol led to noticeable signal changes on MRI that correlated with histologic assessment of iron, confirming iron uptake in canine gliomas, and suggesting it may be a viable therapy. This research is ongoing and performed alongside an identical study using mice glioblastomas; therefore, upon completion, this study could impact future cancer patients.



Keywords: Canine; Glioblastoma; Tumor-Associated Macrophages; Ferumoxytol; Chemotherapy


Mentor(s):

Matthew Scarpelli (HHS); Joseph Speth (HHS); R. Timothy Bentley (Veterinary Medicine)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1001**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Predictors and Outcomes of Migration in Rural and Urban Peruvian Indigenous Women

Social Sciences/Humanities/Education

Author(s):

Anahita Amirpour† (HHS); Grace Turner* (HHS); Amanda Veile*

Abstract:

Objective: In Peru, internal migration of indigenous people has increased recently due to poor socioeconomic conditions and political instability, often with negative consequences for migrant metabolic health. We examine demographic predictors and health outcomes associated with migration in Peruvian indigenous women from a rural versus an urban community. Methods: Demographic, socioeconomic, and migration data (via maternal interview) and anthropometrics were collected cross-sectionally (rural n=92; urban n=93 Peruvian indigenous women). Data are compared using t-tests, independent median tests, and chi-square tests. Binary logistic regression models were used to examine demographic predictors of migration and test associations between migration and obesity (adjusting for women's age and community). Results: The migration rate was lower in the rural (17%) versus the urban community (86%). In both communities, migrants and non-migrants did not differ in age, parity, nor marital or employment status. In both communities, there was a threefold increase in migration among women whose mothers were deceased. The obesity rate was similar for rural and urban women (33% versus 32%). In both settings, the obesity rate was higher amongst migrants compared to non-migrants (rural: 44% versus 30%; urban: 35% versus 8%). This was only statistically significant in the urban community (rural: chi-square=1.10, p=0.38; urban: chi-square=3.98, p=0.046). Conclusions: There is a slight increase in the obesity rate of migrants compared to non-migrants in the rural and urban communities. However, the effect was non-significant in the rural community. In the urban community, it reflects a lower obesity rate in non-migrants, rather than an increase in migrants.

Keywords: Migration; Rural; Urban; Indigenous; Women

Mentor(s):

Amanda Veile (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1002**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Biomedical Drone for Narcan Delivery

Innovative Technology/Entrepreneurship/Design

Author(s):

Nathan Arnold† (Engineering); Alexander Eiguren† (Engineering); Anna Radulski† (Engineering); Grant Sims† (Engineering); Alan Chao† (Engineering)

Abstract:

Opioid overdose is a growing public health crisis in Indiana with a 50% increase in opioid overdose deaths from 2019 to 2020, and an additional 16% by 2021. 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, whereas 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 ahead of EMS arrival.

We derived vehicle flight performance requirements modeling current EMS infrastructure and the impact of cooperatively deployed UAVs. Using physics simulations, we designed and built a UAV capable of meeting these requirements. The design process also included an evaluation of various path-planning methods given various speeds. This UAV would double the EMS coverage area of Indiana in a six-minute window. The vehicle would navigate to a victim using a planned flight path with forward and downward collision sensors to prevent accidents, as well as a 4G-enabled companion computer for added reliability. A bystander could retrieve 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.

Keywords: Drone; Narcan Delivery; Opioid Epidemic

Mentor(s):

James Goppert (Engineering); Nicole Adams (HHS); Nan Kong (Engineering); Worawis Sribunma (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1003**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Excitation amplitude variations that lead to non-linear responses of sympodial tree-like structure

Physical Sciences

Author(s):

Janathan Balakrishnan† (Engineering)

Abstract:

This study examines the amplitude conditioning needed to initiate internal resonance of tree-like structures. Trees are regularly exposed to large amplitudes of motion, mostly due to strong climactic events, yet typically remain standing with minimal or no damage. Exploring the energy transfer mechanisms within trees presents a promising avenue for the design of man-made structures. With this motivation, a sympodial tree with first-level branches is mechanically modeled as rigid beams coupled with torsional springs and viscous dampers. The governing equations of the system are used to determine the natural frequencies and modal shapes, before harmonically exciting the trunk and analyzing the corresponding dynamical response. Specifically, the conditions on the amplitude of forcing that determine a nonlinear response are identified using frequency amplitude plots and spectrograms. This analysis focuses on bleeding or other non-linear behavior based on conditions for different internal resonances. The study has implications in the design of resilient structures that transfer energy from their main structural components to secondary components that may be sacrificial to prevent catastrophic damage.

Keywords: Sympodial Structure; Natural Frequency; Dynamical Response; Amplitude of Forcing; Non-Linear Behavior

Mentor(s):

James Gibert (Education); Hongcheng Tao (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1004**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Understanding The Rural Environmental Health Landscape: Exploring The Link Between Lead, Arsenic, And Chromium Exposure And Cancer Rates In Hartford City, Indiana

Life Sciences


Author(s):

Hannah Bard† (HHS); Perry Curtis* (HHS); Tamia Austin* (HHS)



Abstract:

Hartford City citizens have expressed concern that elevated cancer rates may be linked to metal contamination from a local industry. Rural Americans confront many health disparities, which are worsened by resource and treatment availability; thus they are likely more susceptible to impacts of environmental pollution. The objective of this analysis is to see if there is a correlation between lead, arsenic, or chromium exposure with self-reported cancer in Hartford City, IN. This cross-sectional study recruited adult participants using posters, announcements through community partners, and door-to-door canvassing. Demographic and self-reported health data were collected from May through December 2022 using an online survey. Participants provided soil samples which were analyzed for metals using X-ray fluorescence (XRF). Data were managed and analyzed with Microsoft Excel, including descriptive statistical analysis and determination of correlations between metals and cancer. 79 participants successfully completed the entire study, providing soil samples from their residences. The median concentration of chromium in the soil samples was 38 ppm, (interquartile range (IQR): 24, 48). For soil arsenic, corresponding values are median: 10 ppm (IQR: 9.5, 13.7). The median soil lead was 48 ppm (IQR: 24.5, 86.4). Of the 79 participants, 5.1% (standard deviation (SD)=0.2%) had been diagnosed with breast cancer, colon cancer, or female reproductive cancers at some point in their lifetime. Additionally, 10.1% (SD: 0.03%) of participants reported a diagnosis of skin cancer. Moreover, 1.3% (SD=0.11) of participants reported having a cancer diagnosis in their kidney, bladder, male reproductive system, or blood. Analyses of this project are ongoing. This analysis of data will help us understand the connection between lead, arsenic, and chromium exposure and cancer rates in Hartford City, Indiana.



Keywords: Cancer; Soil; Arsenic; Lead; Chromium


Mentor(s):

Ellen Wells (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1005**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Current State of parental HPV Vaccine Hesitancy: An Integrative Review

Social Sciences/Humanities/Education

Author(s):

Ella Barnes† (HHS, JMHC); Emily Klaiber‡ (Science, JMHC)

Abstract:

[Abstract Redacted]

Keywords: HPV vaccine; Parental Hesitancy; Adolescents; Vaccine Hesitancy Scales

Mentor(s):

Soojung Jo (HHS); Min Sook Park (University of Wisconsin Milwaukee); Yeseol Cho (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1006**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Language in Action: The Association between Toddlers' Motor Skills and Language Learning**

Social Sciences/Humanities/Education

Author(s):

Olivia Battaglia† (HHS); Jacqueline O'Malley† (HHS, JMHC)

Abstract:

Children born prematurely display both impaired motor and language development. There is extensive literature documenting an association between language and motor development in young children. However, we do not know whether children's motor development impacts the types of words that they learn. Some words possess a high degree of motor involvement (e.g., scissors) while other words have a low degree of motor involvement (e.g., moon). This study investigated the link between child motor skills and language learning by comparing a group of premature infants and full-term infants. Participants were drawn from Wordbank, an online repository of parent-reported vocabulary data. Parents completed the MacArthur-Bates Communicative Development Inventory (MBCDI), indicating the words that their child produced from a list of 680 words. Data was analyzed from a group of premature infants (PT N=17) and a group of full-term infants (FT N=17), matched on child race, expressive vocabulary, caregiver education, sex, and age. The Lancaster Sensorimotor Norms, a database of adult ratings of the degree of motor involvement for a large sample of words, was used to calculate an average motor-involvement score for each child's expressive vocabulary. Results revealed no statistical difference between FT and PT infants for the motor involvement of either nouns or verbs. The current sample does not contain any ratings of children's motor development, a limitation of the study. In an ongoing project, we are directly measuring children's motor development and will analyze the association between their motor skills and vocabularies in future analyses.

Keywords: Language Development; Motor Development; Prematurity

Mentor(s):

Arielle Borovsky (HHS); Philip Curtis (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1007**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Addition of Glutaraldehyde to Biodegradable Plant-based Films as an Alternative to Plastic Packaging

Physical Sciences

Author(s):

Kara Benbow† (Agriculture); Gabriela Surdyka‡ (Engineering)

Abstract:

Single-use plastics, like Saran Wrap, are used in the food industry to protect products from oxygen, light, and physical hazards, but plastics are accumulating into large amounts of waste and pollution. This leads researchers to develop biodegradable alternatives made from carbohydrate and protein-based sources. Pea protein offers an affordable opportunity to create alternative packaging but often exhibits inferior mechanical strength and flexibility. Additionally, research targeting flexibility and elongation is largely absent in food science literature. This study aims to replicate the mechanical properties of plastic packaging through plant-based films made with Glutaraldehyde, which was added to increase secondary structure crosslinking to create stronger films. This research places an emphasis on film strength, flexibility, and elongation to reduce the environmental impact of single-use plastics. Films were fabricated using a solution of 10% (w/v) pea protein adjusted to pH 8 and glycerol at 90%/10% (pea protein/glycerol, w/w) and 0.05% (w/w) Glutaraldehyde. A constant weight (8g) was poured into petri dishes and baked for 15 minutes at 180℃ and 200℃. After baking, the films were peeled, and characterized for mechanical strength and elongation to determine if Glutaraldehyde improved strength in the films. The films were also dried in a vacuum oven and characterized again for mechanical properties. Preliminary results indicate the addition of Glutaraldehyde may lead to stronger films, especially baked at lower temperatures, such as 180℃. As further research is conducted, results could suggest future pea protein use in packaging alternatives in lieu of single-use plastics based on their mechanical properties.

Keywords: Plant-Based; Mechanical Properties; Elongation; Biodegradable; Packaging Alternatives

Mentor(s):

Joe Kokini (Agriculture); Harrison Helmick (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1008**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Applications of Variational Neural Annealing for Machine Learning-Assisted Topological Optimization

Mathematical/Computation Sciences

Author(s):

Michael Bezick† (Science); Vea Iyer† (Science)

Abstract:

Current industry optimization challenges can be reduced to combinatorial optimization problems. This research explores the potential of using machine learning to map topology optimization problems to Quadratic Unconstrained Binary Optimization (QUBO), Polynomial Unconstrained Binary Optimization (PUBO), and other analogous problem spaces. By constructing this mapping, solving the optimization problem in the QUBO, PUBO, and other domains likewise solves the topology optimization problem. We implement variational neural annealing: a collection of classical and quantum autoregressive methods to efficiently map topology optimization problems to target domain spaces. We use binary variational autoencoders (bVAEs) to map to Quadratic/Polynomial Unconstrained Binary Optimization (QUBO/PUBO) and analogous problem spaces. We evaluate recurrent neural networks (RNNs) and variational Monte Carlo (VMC) on problems with difficult energy landscapes and compare their convergence to low energy solutions. Preliminary results demonstrate the feasibility of this approach, showcasing promising improvements in topology optimization.

Keywords: Machine Learning; Combinatorial Optimization; Topology Optimization; Variational Neural Annealing; Simulated Annealing

Mentor(s):

Alexandra Boltasseva (Engineering); Blake Wilson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1009**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Narrow-Bandgap Perovskite Discovery**

Physical Sciences

Author(s):

Anika Bhoopalam† (Engineering, JMHC)

Abstract:

The purpose of this study was to discover new promising narrow-bandgap perovskite compounds with applications into solar technology. Narrow-bandgap perovskite materials can be used as tandem layers in solar cells and increase the efficiency, so it is desirable to search for more of these materials. The method used to search for promising narrow-bandgap perovskites consisted of 3 steps: 1. Use machine learning results to identify novel low-bandgap perovskite compositions; 2. Perform Density Functional Theory (DFT) on compositions predicted to be stable; 3. Experimentally test selected compositions in the lab. In the first step, the machine learning models used were trained on a combination of computational and experimental data. They enable quick prediction of the thermodynamic stability and bandgap of thousands of possible perovskite compositions. In the second step, DFT is a first principles-based modeling approach that can accurately predict ground state structures, relative stability, and optoelectronic properties of semiconductors, so chosen compounds from the first step were analyzed thoroughly using this technique. In the third step, compounds that yielded favorable results could then be tested in the laboratory. Film studies were used to analyze experimentally computed material properties, and promising compounds could then be tested in fabricated solar cells.

Keywords: Solar; Density Functional Theory; Thin Films

Mentor(s):

Letian Dou (Engineering); Arun Mannodi Kanakkithodi (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1010**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Care Partner Involvement in Spouses Use of Hearing Aids

Social Sciences/Humanities/Education

Author(s):

Sarah Bhuiya† (HHS, JMHC)

Abstract:

Hearing loss is one of the most common chronic disabilities in the United States. Hearing loss is associated with increased risk of falling and can interfere with independence in daily activities. Hearing loss also can limit social engagement and detract from quality of life. It is recognized that being socially disconnected increases risk to one's health and survival. Hearing aids are an effective treatment for hearing loss. Use of hearing aids can help persons with hearing loss to maintain social connection, and family/friend support can promote hearing aid use. We investigate involvement (i.e. social support and social control) of care partners in promoting their spouses' use of hearing aids. Health-related support is an interpersonal resource that can facilitate proper management of chronic illness. Health-related social control involves attempts to bring about change in another person when they are not actively or consistently performing a health enhancing behavior. We explore the associations between spouses' reports of their exchanges of support and control for hearing aid use with dyadic data from 15 couples. Results indicate that reports of persuasion from hearing aid users and care partners were associated (r=0.67, p < .01). However, no association was detected between hearing aid users' and care partners' reports of either support or pressure. Both hearing aid users and care partners reported infrequent use of persuasion or pressure. Importantly, hearing aid users and care partners may have different perspectives regarding their supportive exchanges to promote the use of hearing aids.

Keywords: Hearing Loss; Social Support; Social Control; Marriage

Mentor(s):

Melissa Franks (HHS); Alexander Francis (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1011**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Investigating the GEF activity of Phospholipase Ce

Life Sciences

Author(s):

Livia Bogdan† (Science)

Abstract:

Phospholipase Ce (PLCe) is essential for normal cardiovascular function and its dysregulation can lead to cardiovascular disease, the leading cause of death in the United States. PLCe is activated by direct binding of the small GTPase Rap1A which allows for the hydrolysis of phosphatidylinositol phosphates into inositol phosphates and diacylglycerol. This pathway is required for maximum cardiac contractility, but sustained activation leads to cardiac hypertrophy. PLCe contains a highly conserved catalytic core that is flanked by unique N- and C-terminal regulatory domains. At the N-terminus, the CDC25 domain acts as a guanine nucleotide exchange factor (GEF) for Rap1A. The C-terminus contains two Ras association domains, RA1 and RA2, important for stability and binding active Rap1A, respectively. Guided by our cryo-electron microscopy reconstruction, an AlphaFold2 model, and sequence conservation, we identified extensive interdomain contacts between the CDC25 and PH module, and clusters of positively charged and hydrophobic residues that may be involved in membrane binding. Using site-directed mutagenesis, we mutated residues of interest in the background of full-length PLCe and assessed their effect on basal and Rap1A-stimulated activity using our cell-based functional assays. From this, we determined a group of mutants that were shown to decrease both basal and Rap1A-mediated activity. We are currently investigating the impact of these mutants on PLCe GEF activity for Rap1A through pulldown assays.

Keywords: Cardiovascular Disease; Phospholipase C Epsilon; Rap1A; Guanine Nucleotide Exchange Factor

Mentor(s):

Angeline Lyon (Science); Kadidia Samassekou (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1012**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## United States Court of Claims Court History

Social Sciences/Humanities/Education


Author(s):

Lucy Bolles† (Liberal Arts); Emma Johnson† (Liberal Arts, DSB)



Abstract:

The United States Court of (Federal) Claims is a little-studied but crucially important federal court. Its primary duty is to resolve money and contract claims made against the national government. In doing so, however, it plays an important role in implementing federal policy; for this reason, it is a frequent site of litigation against government policies. People sue the government in the Court of Federal Claims for a huge variety of reasons, including enforcement of Indigenous peoples' rights under treaties, reparations for wrongful criminal convictions, natural disaster mitigation actions, management of water rights, enforcement of intellectual property rights (e.g., patent and copyright), and much more. Despite its importance, the work of the Court of Claims has not received the attention it deserves from scholars. The Court of Claims Lab is working to fix that. Once complete, the Court of Claims Database will be publicly available for all to use.



Keywords: Law; Policy; Court of Claims; Government; Database



Mentor(s):

Logan Strother (Liberal Arts)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1013**

*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Parent-Child Communication Regarding Substance Use in Latino/a Youth

Social Sciences/Humanities/Education

Author(s):

Emily L Bond† (HHS)

Abstract:

Evidence shows that Latino/a adolescents are at high-risk for early substance use initiation due to unique stressors such as discrimination and acculturative stress. Current adolescent research asserts that parents can aid in delaying substance use initiation through parent-child anti-substance use communication. Given Latino/a youth's vulnerability to substance use, it's important to understand Latino/a families' communication about substance usage. This study examined the literature to understand parent-child anti-substance communication among Latino/a families and how communication impacts use. Methods: ResearchRabbit, an artificial intelligence tool that reviews articles and provides similar publications in a literature map, was used. Article eligibility included publications from the last decade on Latino/a adolescent substance use and parent-child communication. Results: Of the 10 papers identified, 9 papers fit inclusion criteria. Findings revealed that targeted, expressive, and direct parent-child anti-substance-use communication delayed substance use initiation. While discouraging usage, suggesting refusal strategies, and telling stories to emphasize harmful effects were found to be influential, sharing stories of parental past usage was not. Perceived legitimacy of messages moderated the effects of this communication. Latino/a parents discussed culturally specific themes, including how substance use defied religious beliefs and was disrespectful due to its violation of family values, including familismo and respeto. Conclusion: Parent-child communication shaped anti-drug attitudes in Latino/a adolescents and strong anti-drug attitudes were associated with initiation delay. However, studies were cross-section, thus longitudinal research is needed. Understanding how parent-child communication can delay substance use in youth is essential for program development that seeks to prevent substance use in Latino/a youth.

Keywords: Substance-Use; Latino/a Adolescents; Parent-Child Communication; Literature Review; ResearchRabbit

Mentor(s):

Yumary Ruiz (HHS); Madeline Moser (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1014**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Bacteria-based M1-like macrophage infiltration and CD8+ T cell activation in immunologically cold tumors treated with tumor-trophic Salmonella Typhimurium expressing anticancer proteins.**

Life Sciences

Author(s):

Lindsay Brncick† (HHS, JMHC); Boxi Gong‡ (HHS); Julia Flowers‡ (HHS)

Abstract:

Bacteria-based cancer therapy has recently been on the rise to discover safe ways to effectively treat cancer in humans, specifically by using genetic engineering modifications. We engineered a strain of tumor-trophic Salmonella Typhimurium VNP20009 that expresses anticancer proteins. In this study, we aim to address one of the current issues with cancer immunotherapy: infiltration of cold solid tumors that elicit an innate immune response and T cell activation. Previously, we have shown that the Salmonella Typhimurium VNP20009 strain expressing recombinant methioninase (rMET-ase) and/or Tumor Necrosis Factor (TNF-α) caused rapid tumor destruction of cold Lewis Lung Carcinomas (LLC) grown on immunocompetent C57BL/6 mice. Several mechanisms of this anticancer bacteria were investigated including the innate and adaptive immune responses and cancer cell apoptosis. In a pilot study, we selected eight tumor tissues treated with several different bacteria strains and performed a histological analysis to observe the effectiveness of each. We found that in the tumor tissues treated with VNP20009_rMETase_TNF-α, there was infiltration and activation of CD8+ T cells coupled with reduced amounts of T regulatory cells and an increased ratio of M1-like to M2-like macrophages. We also observed increased tumor apoptosis associated with an elevated detection of an apoptosis enzyme and a suppressed amount of the Ki67 tumor growth signal. These findings indicate that the VNP20009_rMETase_TNF-α strain was able to disrupt the tumor microenvironment in the cold LLC tumors in immunocompetent mice and induce both an innate and adaptive immune response.

Keywords: Bacteria-Based; Cancer; Immunotherapy; Macrophage; Genetic Engineering

Mentor(s):

Qiuhong He (HHS); MacKenzie McIntosh (Veterinary Medicine); Boxi Gong (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1015**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Weak Shock Exposure Is Behaviorally Different From Extinction In Reducing Stress-Enhanced Fear

Social Sciences/Humanities/Education

Author(s):

Jaden Brooks† (Science)

Abstract:

Exposure to extreme stress can negatively alter behavior and lead to prolonged fear sensitization. This can be studied using the stress-enhanced fear learning (SEFL) behavioral paradigm in which prior exposure to an extreme stress renders later contextual conditioning resistant to extinction. Our lab has recently characterized a way to reduce behavior through presentations of a weaker version of the unconditional stimulus (termed ‘deflation’) that is behaviorally and neurobiologically distinct from extinction. We predict that deflation, but not extinction, will weaken a stress-enhanced fear memory. Following either footshock stress or matched chamber exposure (i.e., no stress), male and female Long Evans rats were given contextual fear conditioning. Animals were then given either extinction or deflation prior to behavioral testing. Blood plasma was collected before and after each day’s behavioral session. Behavioral data showed that while prior stress rendered extinction ineffective, both the stress and no stress deflation groups showed a decrease in freezing behavior. Suggesting that the deflation group rodents began to characterize the context as safe. Whereas, the hormone data displayed similar levels of corticosterone in both extinction and deflation groups independent of prior stress. This is possibly due to the added stress of blood collection before behavioral testing making the weak shock appear more aversive.

Keywords: Context Fear Conditioning; Extinction

Mentor(s):

Kim Kinzig (HHS); Sydney Trask (HHS); Brent Bachman (HHS); Erisa Met Hoxha (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1016**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Alcohol exposure during aging: Effects on recognition memory and compulsive-like behaviors.**

Life Sciences

Author(s):

Tori Burke† (HHS, Liberal Arts, JMHC); Roma Kamat‡ (HHS); Parker Davis‡ (Science)

Abstract:

Alcohol consumption during aging is a risk factor for memory impairment. This experiment assesses the effects of binge-like alcohol drinking on memory and anxiety-related compulsive behaviors in aged mice. Fourteen to fifteen-month-old, eight female, and ten male mice selectively bred for low alcohol preference (LAP) underwent a three-week Drinking-in-the-Dark (DID) procedure that induced binge-like drinking. During DID, mice either had a 20% alcohol solution for four days per week or tap water. One and eleven days after DID, mice completed marble-burying tasks that assess anxiety-related repetitive compulsive behavior. The next day, mice underwent an Object Recognition Memory (ORM) task where the recognition of a familiar over a novel object was assessed. If mice's memory is not impaired, they will explore the novel object more than the familiar object. On average, LAP mice displayed low alcohol intake (average 0.41 g/kg/hour and total 13.13 g/kg) throughout three weeks. Mice buried more marbles on the second than on the first test, but alcohol exposure did not affect marble burying. LAP mice displayed low levels of object exploration that hindered reliable memory assessment. Despite comparable low object exploration across all groups, alcohol-exposed females had significantly longer latency in exploring the objects compared to control females during their initial encounter. This effect was not seen in LAP males. There were no sex differences in other tests. The findings suggest that aged LAP mice overall exhibit diminished motivation for exploration and that alcohol consumption in LAP female mice may increase anxiety and/or neophobia toward novel objects.

Keywords: Alcohol; Aging; Memory Impairment; Anxiety; Compulsion

Mentor(s):

Julia Chester (HHS); Soyol Enkh-Amgalan (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1017**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Decentralized Wireless Microchip Array For Large-Scale Neural Spike Recording

Innovative Technology/Entrepreneurship/Design

Author(s):

Lorenzo Cacciapuoti† (Engineering)

Abstract:

The vast majority of current neural recording technology follows the model of a central implanted chip equipped with an array of electrodes. While this model has been the standard for many years and used in many successful studies, its implantation process is complex and simply too invasive for most human applications. The complex surgical procedure for implanting these devices makes it hard to accurately replicate on a large scale, and the devices can become relatively bulky depending on the application. In an attempt to solve these problems, I propose a new neural recording device, the Neural Microchip Array. The recording device consists of an array of microchips instead of a central chip with electrodes, each chip responsible for tracking the membrane potential of a single neuron. These chips communicate wirelessly with an out-of-body receiver whenever they sense an action potential so that it can be tracked. Simultaneously, the receiver provides power to the chips to remove the need for on-chip power storage, decreasing chip area. The chips can easily be placed on the cortex from a small cranial opening without needing a mounted headplate. This topology can easily record spiking patterns from large portions of the cerebral cortex with minimal implantation complexity. The project is currently focusing on the design of the analog circuitry required to accurately detect the neural spikes using a CMOS architecture.

Keywords: Neural Recording; Analog Design; Microchip; Implantable Devices; Wireless Transmission

Mentor(s):

Mark Johnson (Engineering); John Peterson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1018**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Gene Conservation and Comparison Between Host Bacteria Arthrobacter globiformis and Phage MellowYellow

Life Sciences


Author(s):

Alexis Carroll† (Agriculture); Aidan Dibble† (Agriculture); Ann Marie Uhlmansiek† (Agriculture); Amanda Wolf† (Engineering)



Abstract:

When a bacteriophage infects its host bacteria, errors can occur, thus transferring genes between the bacteriophage and the host bacteria. These transferred genes can make up significant portions of the two respective genomes and contribute to key characteristics that distinguish one species of bacteria or bacteriophage from another. It is not well understood which genes become most frequently shared between phage and host, but understanding which genetic elements are transferred between the two can provide insights into bacteria and phage coevolution, and species differentiation. In this project, the genome of the bacteriophage MellowYellow was compared to its host bacteria Arthrobacter globiformis (A. Glob) to search for conserved genetic domains or gene matches, with a focus on the nature and function of any components shared between the genomes. NCBI blast was used to find phage genes which were significantly like A. Glob domains. HHpred was used to determine functions for unknown gene products which were NCBI Blast. Conserved regions were expected to be small, independent functional domains. This implies that entire genes larger than 60 subunits would ideally not be conserved between host and phage. Additionally, transposon genomes were not likely to be transferred into phage genomes. This transfer of specific genes, such as ones which encode antibiotic resistance, is of special importance, due to the rising prominence of resistant bacteria in agriculture and hospital settings.



Keywords: Bacteriophage; Virus; Genome; Prophage; Gene Transfer


Mentor(s):

Adam Quinn (Agriculture); Daphne Fauber (Engineering); AJ Gin (Engineering); Harry Ashbaugh (Engineering); Kari Clase (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1019**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Effects of Lead Exposure on Mouse Optic Nerve**

Life Sciences

Author(s):

Jonah Chang† (HHS, JMHC)

Abstract:

Lead is a toxic heavy metal that causes adverse health effects throughout the mammalian central nervous system, including the visual system. Our project aims to investigate how lead exposure results in visual impairments. We hypothesized that lead toxicity affects myelination and glial cell types in the optic nerve. To test this hypothesis, for four weeks, we exposed adult male and female mice to varying amounts of lead – control (33 mM Na-acetate), low (33 mM Pb-acetate), and high (66 mM Pb-acetate) – before harvesting their optic nerves. To quantify glial cell types and myelination, we immunolabeled optic nerve sections for microglia (Iba1), astrocytes (SOX9), and the paranode (CASPR) and node (Nav 1.6) regions of the myelin sheath. Immunolabeled optic nerve sections were imaged using a confocal microscope. We then performed cell image analysis using ImageJ software. We found no significant difference in the paranode measurements, but internode lengths significantly increased from control to low and high lead exposure groups. We also found that node lengths decreased significantly from the control and low lead to the high lead exposure group. We found no significant difference in astrocyte numbers between the lead exposure groups. However, we found a significant decrease in microglia numbers from control to high lead groups. Our findings suggest that lead exposure in the optic nerve may lead to visual impairments in two ways. First, lead exposure causes changes to the structure of the myelin sheath. Second, lead exposure decreases the number of microglia in the optic nerve.

Keywords: Heavy Metal Toxicity; Ocular Toxicity; Vision; Pb-Induced Neurotoxicity; Sensory Neuroscience

Mentor(s):

Pat Kerstein (HHS); Labony Khandokar (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1020**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Investigating the Efficacy of Synthesized Foam Gels, Carbopol, or Shampoo as Polymeric Admixtures for Concrete Additive Manufacturing

Physical Sciences


Author(s):

Yuan-Jung Chen† (Engineering); Andre Ponsot† (Engineering); Angus Moore† (Engineering, JMHC)



Abstract:

[Abstract Redacted]



Keywords: Polymeric Admixtures; Concrete Additive Manufacturing



Mentor(s):

Kendra Erk (Engineering); Ala Eddin Douba (Engineering); Akul Seshadri (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1021**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Background Star Subtraction for Supernovae Remnant N132D

Physical Sciences

Author(s):

Briana Chen† (Engineering, Science, JMHC); Ashley Ortiz† (Science)

Abstract:

When massive stars reach the end of their life, they explode in a supernova, leaving behind debris fields known as supernovae remnants (SNR). 3D reconstructions of SNR from observational data provide insight into the explosion mechanisms of supernovae and asymmetries in their progenitor star system. These reconstructions show element distribution around the remnant, kinematics of high-velocity ejecta, and unique structures resulting from these explosions. For the SNR N132D, we have isolated and created 2d maps of emission lines in the ejecta by removing stars to highlight gas and other element distributions. N132D is of interest because it is a young SNR (~2250 years old) which can contain information about the explosion and progenitor star prior to environmental effects. Recent observations of N132D are in the form of a 3D integrated field unit (IFU) cube with two spatial axes and a wavelength axis containing flux information in each entry. Background stars in the observations produce a dark streak along the wavelength axis due to their continuous spectrum. To remove these background stars, we perform a fit of the stellar continuum across the cube and apply a neural network star removal program called Starnet++ to the image at each wavelength slice. By removing background stars, we are able to more clearly identify different emission lines, an example being FeXIV, which can identify forward shock structures in the ejecta. Using this star removal process, we can remove stars from the IFU cube to create the highest resolution 3D reconstruction of N132D reconstruction.

Keywords: Supernova Remnant; Subtraction; N132d; 3D Reconstruction; Astrophysics

Mentor(s):

Danny Milisavljevic (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1022**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Analyzing matrix complexity for improved aptamer sensor calibration

Physical Sciences

Author(s):

Yashvi Choudhary† (Science); Sirish Kayam‡ (Science); AnhThu Pham‡ (Science)

Abstract:

Aminoglycosides are a class of antibiotic that have an effective range such that an excess results in kidney failure in patients while a lower dose causes bacterial resistance. With the advent of MRSA and other multi-drug resistant bacteria, it is becoming increasingly necessary to monitor the administered dosage of such drugs in real-time. Electrochemical aptamer-based sensors offer a new platform for real-time monitoring for such molecules with high selectivity. The sensors are equipped with DNA strands called aptamers that undergo a reversible conformational change induced by binding of the target to the aptamer which modifies the electron transfer rate from the redox tag linked to the aptamer. The electron transfer can be visualized using voltammetry in current versus potential graphs such that as the concentration of target increases, there is a corresponding increase in peak current. The correlation can be used to obtain a calibration curve, a way to determine unknown concentration of the analyte in a sample. In this field, it is common to obtain calibration curves in phosphate buffer. However, the buffer calibrations fail to consider the complexity of biological fluids. Thus, there remains a need to analyze how systematically increasing the complexity of the matrix impacts the aptamer sensor readings. Herein, we used whole blood and human blood serum as matrices to observe how the aptamer reading changes with the changing complexity of the matrix. We show that there is variation in the curves obtained in different matrices and provide a possible method to improve this disparity.

Keywords: Aptamer Sensors; Electrochemistry; Antibiotics; Calibration Curves; Biological Fluid

Mentor(s):

Jeffrey Dick (Science); Vanshika Gupta (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1023**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Separating Standard Model and SUSY Dataframes Using Neural Networks**

Mathematical/Computation Sciences

Author(s):

Vladimir Condino† (Science); Jaiveer Dutta† (Science, JMHC); Andrew Nilsson† (Science); James Strayhorn† (Science); Andrew Coleman† (Science)

Abstract:

This project proposes a novel strategy to enhance signal-background differentiation in particle physics by integrating datasets from Supersymmetry (SUSY) and the Standard Model (SM) using a neural network algorithm. Initially, the project aims to extract key kinematic variables—such as mass, eta, and momentum—by implementing Minitree code on both SUSY and SM datasets. Subsequently, the approach involves constructing combined histograms for SUSY and SM datasets using these kinematic variables, with SM serving as background and SUSY as signal. Finally, the project aims to leverage the PyTorch neural network classifier to effectively separate signal from background data. By training the model to discern patterns effectively in the dataset, this approach offers a powerful alternative to traditional methods, especially in the context of particle physics where small signals are challenging to separate from complex backgrounds. This method significantly contributes to the precision of signal detection in high-energy research beyond the Standard Model.

Keywords: Signal-Background Differentiation; Supersymmetry (SUSY); Standard Model (SM); Neural Network Algorithm; Kinematic Variables

Mentor(s):

Andreas Jung (Science); Santosh Bhandari (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1024**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Purdue University's Complex Dance with Sexual Assault

Social Sciences/Humanities/Education

Author(s):

Catherine Conway† (HHS, Liberal Arts)

Abstract:

Purdue University, similar to many college campuses, faces high rates of underreporting of sexual assault cases (PSG Safer, 2022). Many people, particularly women, don't report their cases to the university or the police department. This exploratory research project investigates why students don't come forward and is key to helping prevent and lower the number of offenses. Interviewing females on campus, talking with those who assist victims, and surveying people on campus about general knowledge and experiences is critical for the conversation. Along with interviews and surveys, content analysis explaining underreporting, and how other schools handle the issue are essential. It was found that many people don't know their resources, don't feel comfortable reporting, and don't believe their perpetrators will be punished. Women are also expected to feel it is a part of college life and don't realize the long-term impacts. With a greater understanding of underreporting, steps can be taken to encourage victims to come forward to get the necessary help, arrest sex offenders, and keep other people safe. Understanding why women don't come forward will allow for an influx in reports, helping understand a previously ignored problem. With more clarity, it can create a safer environment for Purdue's campus and protect everyone from repeat offenders and sexual assault.

Keywords: Sexual Assault; Underreporting; Repercussions; Resources

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1025**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Simulating Granular Materials to Characterize the Effect of Particle Shape on Pore Interconnectivity and Mass Transport

Life Sciences


Author(s):

Ashton Cotton† (Engineering)



Abstract:

Granular hydrogels are a type of biomaterial composed of small, discrete particles aggregated via packing. Changes in the size, shape, and composition of these particles can influence overall material properties, such as porosity and mechanical strength, which are important for tissue engineering applications. However, it can be challenging and time-consuming to design and fabricate new particle shapes at a large scale. The goal of this project is to use simulation software as a predictive tool to investigate how particle shape may impact the structural properties and mass transport through granular materials.

Using Blender simulation software, we created particles with unique shapes such as spheres, rods, cylinders, stars, cubes, and ellipsoids organized into a granular system. We then simulated the mobility of beads smaller in size than the interstitial pores through the granular system. We will extract this data from simulation results using Blender and then utilize MATLAB for processing and analysis, enabling us to gain deeper insights into the relationship between particle morphology and mass transport behavior in these hydrogels. In future work, we plan to quantify parameters such as pore size distribution, porosity, and connectivity within the granular hydrogel systems and examine the implications of these matrices in real-life scenarios, including their interactions with biological tissues. We will utilize this data to better understand and optimize the performance of hydrogel-based materials in various biomedical and tissue engineering applications. Overall, this research sheds light on the intricate interplay between particle morphology, pore characteristics of resulting granular systems, and mass transport behavior within hydrogel-based biomaterials, offering valuable guidance for the design of next-generation tissue and biomaterial engineering frameworks.



Keywords: Biomaterials; Granular Hydrogels; Porosity; Microparticles; Tissue Regeneration



Mentor(s):

Taimoor Qazi (Engineering); Scotty Secrist (VP Diversity and Inclusion)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1026**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Diving into Qualitative Research: A Practical Guide to Getting Started**

Social Sciences/Humanities/Education

Author(s):

Soumalya Das† (Engineering)

Abstract:

In this commentary, we present an overview of qualitative research, aiming to assist others in avoiding common pitfalls and leveraging insights from our experiences. We delve into the definition and significance of qualitative data and research, highlighting the exceptional qualities of qualitative research. Additionally, we explore the methods of collecting and utilizing qualitative data in the context of undergraduate research. Our guidance is tailored for researchers initially trained in fields that may undervalue qualitative research, offering insights and recommendations. Drawing from our own and others' research in undergraduate settings, we furnish examples to illustrate key points. To aid researchers in their ongoing exploration and implementation of qualitative studies, we include a valuable table of resources.

Keywords: Qualitative Data; Qualitative Research; Provide Guidance; Advice for Researchers; Qualitative Studies

Mentor(s):

Debayan Das (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1027**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Reproducible AI Software (RAIS)

Mathematical/Computation Sciences


Author(s):

Vamsi Deeduvanu† (Science); Tanvi Dhawade† (Engineering); Alexander Aylward† (Engineering, JMHC); Nihar Atri† (Science); Ron Natarajan† (Science); Akshath Raghav Ravikiran† (Engineering); Adrien Qi‡ (Science)



Abstract:

Artificial Intelligence (AI) today is seeing a wide range of applications, from autonomous vehicles to medical diagnosis, financial decisions to product recommendations, and so much more. Unfortunately, there is significant doubt as to whether most machine learning methods are reproducible. Quite often, creators of AI software cannot reproduce the results reported by themselves. As AI software and pre-trained machine learning models are being adopted as components of complex software, reproducibility becomes paramount to ensure that these components function as expected. Our research aims to investigate methodologies to create Reproducible AI Software (RAIS). The project first identifies a list of essential factors that may contribute to or hurt reproducibility through case studies of machine learning research and scraping data from arXiv and GitHub. The project will then explore the capabilities of large language models (LLMs) in improving software engineering and reproducibility. We plan to use LLMs to eliminate the need for human efforts in determining the reproducibility of machine learning research. LLMs can analyze text from research papers, documentation, and code, and suggest improvements. Finally, the project aims to analyze software submitted to competitions organized by this research team. The project will create template repositories for future sample solutions and help participants develop software that is more likely to be reproducible. By investigating the factors that contribute to reproducibility and automating the process, this project will advance our understanding of machine learning reproducibility and promote public confidence in AI technologies.



Keywords: Artificial Intelligence; Reproducibility; Large Language Model; Machine Learning; AI



Mentor(s):

Yung-Hsiang Lu (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1028**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Confirming transmembrane protein potentials using algorithm-based prediction models

Life Sciences

Author(s):

Luke DeLion† (Engineering); Alyson Owen† (Engineering); Nicholas Zolnierczuk† (Engineering); Junezuh Ghang‡ (Engineering)

Abstract:

DeepTMHMM is a popular, algorithm-based prediction model that is used to analyze the structure of membrane proteins and predict their functions. Using deep learning, it predicts using a model based on the amino acid sequence and suggests possible classes of transmembrane proteins using an algorithm designed to detect alpha helix and beta barrel protein structures. Although DeepTMHMM predicts transmembrane proteins (TMPs) with high accuracy, confirmation is required to fully analyze domain size and protein structure as well as functionality of the protein. Bacteriophages are viruses that infect, multiply, and lyse their host bacteria. The target bacteriophage, named DoctorPepper, has been extracted, purified, and amplified. After sequencing at the Howards Hughes Medical Institute, its genome and proteome were preliminarily annotated by DNA Master. In the stage of determining functionality of the proteins based on the amino acid sequence, DeepTMHMM was used to determine the location of potential transmembrane domains. Afterwards, DeepTMHMM's domain calls on specific, case-study genes were compared against other prediction models (e.g. TMBed, CCTOP, Alphafold, and TOPCONS2). DeepTMHMM showed superior accuracy compared to the other algorithms when predicting secondary structures and signal potentials. Because the classification of protein function is a priority, it is crucial for these types of algorithm-based models to predict with high accuracy. For confirmation, alternative predicting models were used to either support or contradict the credibility of DeepTMHMM. This proves that DeepTMHMM is the optimal algorithm to determine membrane potential.

Keywords: Bacteriophage; Transmembrane Proteins; AI; Bioinformatics

Mentor(s):

AJ Gin (Engineering); Harry Ashbaugh (Engineering); Adam Quinn (Agriculture); Daphne Fauber (Engineering); Kari Clase (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1029**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Shallow Seismic Velocity Estimation using Earthquake Particle Motion to estimate Seismic Hazard Potential

Physical Sciences


Author(s):

Aniket Dev Roy† (Science)



Abstract:

The shallow (<3 km) seismic velocity structure of Earth determines the amount of ground shaking during an earthquake and is thus important to be accessed to estimate regions of potential major damage during earthquake shaking. The usual approach to estimate shallow velocities is through manually intensive and often expensive methods, including borehole drilling and velocity logging and the deployment of linear arrays of seismic instruments paired with controlled energy emissions (e.g., "hammering" or underground explosions), which can disrupt the environment. To mitigate these issues, we use a recently developed method that estimates the polarization angle of incoming seismic waves from earthquakes to recover the shallow velocity structure below a seismic array. We test the sensitivity of the analysis on a synthetic dataset over a suite of models of variable shallow velocity structure with various frequency content, layer thickness, and time window over which the analysis is applied. We find that the use of Principal Component Analysis (PCA) in the standard workflow to estimate the semi-major axes of polarization results in large errors due to the assumption of consistent covariation in a dataset. We address this through changing the misfit function from PCA to a covariation-agnostic technique that provides robust estimates of the semi-major axes, which accurately recovers velocity structure to the theoretical resolution of the synthetic dataset. We then apply this method to real earthquake data from a seismic array in northern California, a region prone to damaging earthquakes.



Keywords: Principal Component Analysis; Polarization; Shallow Seismic Velocity Structure; Covariation; Northern California



Mentor(s):

Jonathan Delph (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1030**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Analyzing Spatial-Temporal Dynamics of the Hearing-Impaired Population to guide Sustainable Urban Development

Mathematical/Computation Sciences

Author(s):

Tanvi Dhawade† (Engineering)

Abstract:

Ensuring the development of cities that are safe, inclusive, resilient, and sustainable is pivotal to realizing the Sustainable Development Goals (SDGs) outlined by the United Nations.  Also, the World Health Organization estimates that, by 2050, 10% of the world's population will be diagnosed with hearing loss; it is vital to prioritize the needs of these marginalized groups to enhance social equity and forge truly inclusive and sustainable urban environments. As such, this project focuses on the hearing-impaired population within the United States, conducting a spatial-temporal analysis which emerges as a vital tool in crafting targeted interventions and policy responses that adapt to the changing landscape of urban demographics. High infrastructure density counties have low hearing loss rate, which is opposite of our intuition. In between 2012-2022 for the counties surveyed by American Community Surveys (ACS), 1944 counties showed an increase in hearing loss rate, and 1266 counties showed a decrease in hearing loss rate. 1487 counties showed that the female hearing loss rate had increased more while 1723 counties showed that the male hearing loss had increased more. Further temporal analysis will reveal how the hearing loss rate has changed with change in infrastructure density per county. The project inaugurates a series of research endeavors related to urban sustainability and human hearing matters, with findings poised to establish a solid groundwork for subsequent studies. These will aim at enhancing infrastructure systems and will guide planning and policy development through a lens of both inclusivity and sustainability.

Keywords: Hearing Loss; Sustainable Infrastructure; Spatial-Temporal Analysis

Mentor(s):

Qingchun Li (Polytechnic); Noori Kim (Polytechnic); Tianle Duan (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1031**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Evaluating the Radiation-Hardness of Varying COTS EEPROMs in a Thermal Neutron Environment

Physical Sciences

Author(s):

Brian Dodd† (Engineering); Fraser Dougall‡ (Engineering)

Abstract:

The space industry requires robust and high performance devices for optimal performance in missions, such as the electrically erasable programmable read-only memory (EEPROM). Due to EEPROMs playing host to mission critical data, it is essential that they are able to hold up in a space radiation environment. This research intends to explore the degradation of commercial-off-the-shelf (COTS) EEPROMs in a thermal neutron environment to improve device radiation-hardness for future space applications. The experiment will use the Nuclear Engineering Department's Subcritical Pile to expose the devices to thermal neutrons. A literature review was done to find a COTS EEPROM with several memory capacities and package types available for testing. A printed circuit board (PCB) capable of hosting several EEPROMs at once will be designed to test the devices. The test PCB will allow communication between each EEPROM and a microcontroller on a device-by-device basis, with each EEPROM dumping data to the microcontroller for evaluation at specific time intervals during testing. With the proper device selection and PCB optimization, we expect it will be easier to observe the degradation differences between memory capacities and package types in these devices at varying neutron fluxes. However, communication and integration with the software and digital design aspects of the test setup being worked on in the lab will be critical to the success of the research. We expect our research to find that EEPROMs with higher densities due to higher memory capacity or thinner package type degrade faster when compared to their lower density counterparts.

Keywords: EEPROM; Radiation-Hardness; Thermal Neutrons; Integrated Circuit Package Types; Memory Capacity

Mentor(s):

Peter Bermel (Engineering); Stylianos Chatzidakis (Engineering); Allen Garner (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1032**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Modeling in Concrete Anchors

Mathematical/Computation Sciences

Author(s):

Sohil Doshi† (Science)

Abstract:

The strength of a concrete anchor is tested by putting a certain amount of force to pull the anchor out of the concrete. The problem at hand is that in different situations, there are optimal anchors to use, and the purpose of this project is to find these anchors for those various situations. What is currently happening is that in the civil engineering lab, experiments are being conducted to generate data that is usable for research. Using this data, it will be inputted into a custom-built software which will analyze all of this data using matrix analysis and SAP2000 and outputs its analysis into a data file. A spring-based model for analysis will be created in order to give a more accurate prediction of how a certain concrete anchor will behave in a general situation. This will enable others to use an accurate prediction, given by the model, of what the behavior of a certain anchor will be when in a certain situation and will enable them to make a proper decision when choosing what type of anchor to use.

Keywords: Anchors; Model; Prediction; Strength; Situation

Mentor(s):

Deepak Suthar (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1033**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Autonomous In-air Charging System for Unmanned Aerial Vehicles

Innovative Technology/Entrepreneurship/Design

Author(s):

Nikita Dubrovskyi† (Engineering); Abhishek Kini* (Engineering); Aayush Iyengar* (Engineering, JMHC)

Abstract:

Currently, with the rapid expansion of unmanned aerial vehicles (UAVs), one of the major limiting factors is battery life time. It is one of the most significant design challenges, as well as operational drawbacks in the industry. Often an aircraft is forced to land early for a battery swap, or the usage of multiple aircraft for one task is required. Our project aims to provide a solution to these problems by implementing an in-air charging dock solution for UAVs. This allows the aircraft to stay in the air while its battery recharges.

In this project I am responsible for designing the UAV which completes its mission, and is then recharged mid-air. The aircraft must be able to fly autonomously, and hold its position in place while the charging UAV flies up to it for docking. For the positioning I am working on implementing a solution using only GPS and barometer, without the extra weight of a vision system. I am testing the accuracy of position based on these sensors, and if it will be precise enough for docking to take place.

The preliminary results show that the GPS/barometer system is capable of performing autonomous flight, however the position holding has yet to be tested. It is expected to be powerful enough to maintain its position in favorable flying conditions, but the biggest concern is fighting wind gusts, which I am working on resolving by providing a motor/propeller combination powerful enough.

Keywords: UAV; In-Air; Charging; Drone; Autonomous

Mentor(s):

Ran Dai (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1034**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Growth of Pathogens During Stagnation in Controlled Copper Plumbing System

Life Sciences


Author(s):

Gavin Duffy† (Engineering); Ruth Wei‡ (Science)



Abstract:

During the COVID-19 pandemic, there was a concern about the quality of tap water in buildings that were shut down due to stay-at-home orders. While many studies were conducted in real buildings, these had mixed results in part due to the lack of control. At Purdue, researchers constructed a large-scale plumbing testing system to study the relationship between stagnation and chemical and microbiological water quality in a more controlled setting. This plumbing system consists of four identical subsystems fed by municipal water, monitored in real-time for pH and residual chlorine. Each subsystem has a water softener, a water heater (used as a storage tank), and triplicate 50’ copper pipe loops.

This study aims to understand how low-use plumbing scenarios affect water quality when there is stagnation. The study involves three subsystems with different water usage intervals: daily (n=1), weekly (n=1), and sporadic (n=2) flushing, which represents similar conditions that several buildings experienced at the beginning of the pandemic. Water quality was sampled monthly for six months, and microbial concentrations were analyzed using flow cytometry and qPCR to quantify specific pathogens. Preliminary results indicate that long-term stagnation of at least two weeks sustained less microbial loadings in plumbing than intermediate stagnation periods of one week. This is likely due to a combination of the competing effects of nutrient loading and disinfectant delivery. The results from this study will be used to develop flushing protocols that can better inform building owners and ultimately improve public health.



Keywords: Tap Water Quality; Plumbing Stagnation; Microbial Growth; Drinking Water Pathogens; Flushing Protocols



Mentor(s):

Caitlin Proctor (Agriculture); Aliya Ehde (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1035**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Design of Physiological Monitoring Device to Detect Autonomic Dysreflexia

Innovative Technology/Entrepreneurship/Design


Author(s):

Molly Dye† (Engineering); Nicole Nagel† (Engineering)



Abstract:

This abstract outlines the hardware design of a wearable physiological monitoring device which uses skin sympathetic nerve activity (SKNA) to predict the onset of autonomic dysreflexia (AD). AD is a condition which usually emerges after an upper spinal cord injury and involves the dysregulation of the autonomic nervous system. AD occurs in response to a noxious stimulus below the level of injury, resulting in overactivity of the sympathetic nervous system. This leads to uncontrolled hypertension that will persist until the stimulus is removed. The activity of the sympathetic nervous system can be indirectly measured using SKNA. SKNA correlates to stellate ganglia nerve activity and can be acquired non-invasively by bandpass filtering raw electrocardiogram (ECG) signals between 500 Hz and 1,000 Hz. Current ECG acquisition devices lack the necessary specifications to accurately capture SKNA data. To accurately collect low amplitude SKNA data, a sampling frequency of at least 2 kHz, a bandwidth of 1000 Hz, and a high signal-to-noise ratio is needed. To achieve these specifications, this device uses a Texas Instrument ADS1299-4 low-noise 24-bit analog front-end which achieves sampling frequencies of 4kHz, has a bandwidth of 1000, and contains all amplifiers and ADCs necessary for collecting SKNA data. The ADS1299-4 chip, microcontroller, and surface electrodes are configured on a printed circuit board and encased on an adhesive patch, which is placed on the patient's sternal region. The wearable and compact design of the patch allows patients to constantly monitor AD, improving quality of life.



Keywords: Physiological Monitoring Device; Wearable Technology; Autonomic Dysreflexia; Skin Sympathetic Nerve Activity (SKNA); Spinal Cord Injury



Mentor(s):

Bradley Duerstock (Engineering); Thomas Everett (Indiana University); Mitchell Sanchez (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1036**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Resistance Calculator for Compliant Pillar Interconnects for Heterogeneous Integration

Innovative Technology/Entrepreneurship/Design

Author(s):

Mary Earp† (Engineering, JMHC)

Abstract:

Miniaturization has been one of the main driving factors in devising new technologies and new innovations since the advent of the semiconductor industry. As integrated circuits become smaller and smaller, the limiting factor in size and scalability lies in the interconnects between components and layers. However, reducing the size of an interconnect by changing its physical dimensions or the material is likely to decrease the electrical conductivity because of increasing mutual inductance and capacitance. This project aims to study the effect of interconnect material, pitch and aspect ratio on interconnect resistance. A model is created using Python to calculate structure inductance, capacitance, and resistance based on basic analytical equations found in existing literature. Comparing the simulated parasitic inductance for physical heights of the interconnects from 50μm to 5μm, pitch and aspect ratio for copper, rhenium, ruthenium, aluminum, molybdenum, and cobalt-based pillar interconnects will quantify this tradeoff between size and conductivity. We expect to find that as the pillar height decreases, these parasitic inductances increase, and that each material shows a similar pattern over a range unique to the material.

Keywords: Semiconductors; Interconnect; Parasitics

Mentor(s):

Shubhra Bansal (Engineering); Haohan Guo (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1037**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Utilizing Wheat-Bran Derived Phenolics to Optimize Human Gut Microbiome

Life Sciences

Author(s):

Youssef Errihani† (HHS, JMHC)

Abstract:

The evolving connection between the gut-brain axis has gained lots of attention due to its relationship with several diseases like diabetes, Alzheimer's, and irritable bowel syndrome (IBS). Phenolic compounds (PC) are known to relate to growth of certain microbes in the human gut, impacting health parameters associated with the aforementioned and other chronic diseases. In the first part of our study, we conducted a bacterial screening under anaerobic conditions to determine which bacterial strains in the human gut microbiome grew in the presence of three phenolic compounds (ferulic acid, vanillin, p-coumaric acid) at differing concentrations (0.1 mM, 0.5 mM, 1 mM, and 10 mM) . Based on previous work in our lab, three different nutritional media (RC, MRS, TYG) specific to 20 bacterial strains were used to culture each strain. We chose representative strains from abundant phyla present in the human gut microbiome. Our screening method highlighted the large potential for Erysipelatoclostridum ramosum to use PCs as a carbon source and/or electron sink. We are presently utilizing HPLC-UV to measure biotransformation of ferulic acid to 3-hydroxy-propionic acid (3-HPPA) by E.ramosum and other gut microbial strains. An increase in 3-HPPA or its oxidized form, 3-OHPPA, could have systemic benefits on the human body. To further research this, next steps should explore PC biotransformations in batch fermentations using more complex human fecal microbiota.

Keywords: Gut-Brain Axis; Phenolic Compounds; Gut Microbiome; Ferulic Acid; Biotransformation

Mentor(s):

Steve Lindemann (Agriculture); Miguel Gonzales (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1038**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## MicroRNA-31 Regulates Neutrophil Migration and Activation

Life Sciences

Author(s):

Elizabeth Christine Farrell† (Science)

Abstract:

Neutrophils are a type of white blood cell that play a crucial role in immunity by fighting off infections and triggering inflammation. On the other hand, over activity of neutrophils can contribute to autoimmune diseases such as arthritis. Hence, the regulation of neutrophil activity plays a vital role in preserving immune system homeostasis, but the specific mechanisms or molecules involved have not yet been discovered or fully understood. Previous studies in our lab discovered microRNA-31 (miR-31) was associated with neutrophil motility in zebrafish and identified a specific target gene of miR-31, EFNB2B. EFNB2B is a cell surface ligand for Eph receptors which together mediate bi-directional signaling, activating various signaling pathways involved in heart morphogenesis, angiogenesis, as well as other things. Although ephrins are widely researched in other fields, they have yet to be characterized in the immune system. This study aims to validate the function of EFNB2B in regulating neutrophil motility to verify the phenotype previously observed in miR-31 overexpression fish and determine whether miR-31 directly targets it. A rescue experiment was conducted after a tissue specific knockout (TSKO) of EFNB2B replacing GFP with full-length EFNB2 resistant gene (Tol2-LyzC-2A-mcherry-efnb2) allowing coexpression of rescue gene and sgRNAs.

Keywords: Zebrafish; Ephrin; microRNA; Neutrophil; Knockout

Mentor(s):

Qing Deng (Science); Tyler Pikes (Science); Scotty Secrist (VP Diversity and Inclusion)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1039**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# “CAN YOU HEAR ME NOW?”: HEARING AID USER AND CARE PARTNER AGREEMENT ON PERCEIVED HEARING DIFFICULTIES

Social Sciences/Humanities/Education

Author(s):

Abigail Foley† (HHS)

Abstract:

An estimated 40 million adults in the US experience hearing loss. Problems associated with hearing loss can be debilitating and often are not faced alone. Rather, the effects of hearing loss can extend to close partners when difficulties are experienced while communicating with others. In this study, we examine perceived hearing difficulty and benefits of hearing aids from the perspectives of hearing aid users and their care partners. In this study, we examine hearing difficulty, and benefits of hearing aids in reducing hearing difficulty from the perspectives of hearing aid users and their care partners (N = 15 dyads). Hearing aid users and their care partners reported hearing difficulty and benefits of hearing aid use using the Abbreviated Profile of Hearing Aid Benefit (APHAB). Associations between hearing aid user and care partner reports were tested for the global score on the APHAB, and for each of three subscales (Ease of Communication, Background Noise, Reverberation). Consistent with expectations, significant association was detected between hearing aid user and care partner reports for the global scale of the APHAB (r=.8, p<.01), and for each of the three subscales; Ease of Communication (r=.72, p<.01), Background Noise (r=.8, p=.001), and Reverberation (r=.53, p=.10). Findings from our dyadic study reveal that care partners often are knowledgeable about their spouses’ hearing difficulty and benefits of their hearing aid use. Importantly, associations between spouses’ reports were stronger in context where care partners may observe hearing difficulty and hearing aid benefits.

Keywords: Hearing Loss; Hearing Aid; Marriage; Communication

Mentor(s):

Melissa Franks (HHS); Alexander Francis (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1040**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Understanding of Radiation and Health Physics in High School Students

Physical Sciences

Author(s):

John Frandina† (Science); Gabrielle Pedigo† (HHS)

Abstract:

Health physics encompasses the study and safe use of radiation, radioactive materials, within society with special care for protection of people and the environment. As much of the workforce ages out of the field, there is a deficit of people entering, creating high demand for well-trained employees. As such, we decided to engage in a survey of high school students to gauge their interest and understanding of health physics, STEM, and radiation. A survey was given to 112 students asking about their post high school education plans, their understanding and opinions of radiation, and their interest in health physics. We found that 82% of students had plans for an associates degree or higher with 23% of the students interested in STEM related paths. Before the presentation, 66% of students had little to no understanding of radiation and 51% thought it was dangerous. Only 5% of students were interested in the field. 66% of students with self-reported little understanding of radiation and 51% that have the belief that it is extremely dangerous shows that a lack of understanding leads people away from health physics. All the students who answered little to no understanding of radiation, 50% thought it was dangerous. Only 27% of students even know of the field's existence. As such, the best way to increase interest in health physics is to increase students' understanding of radiation. A potential avenue to increase understanding, and thus interest in the field, is through outreach programs to high schools such as career fairs.

Keywords: Health Physics; Radiation; High School

Mentor(s):

Aaron Specht (HHS); Chandler Burgos (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1041**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Developing a new filter in ANTARES to identify scientifically distinct supernovae

Physical Sciences

Author(s):

Roy Galazka† (Science); Raymond Glowner† (Science); Devyani Tyagi† (Science); Tiancheng Zhang† (Science)

Abstract:

The field of time domain astronomy has benefitted significantly with the advent of the synoptic survey telescope. One of these telescopes, the Zwicky Transient Facility (ZTF), is currently at the forefront of the study of transient events, cataloguing hundreds of thousands of transients as they are detected every second. With the Vera C. Rubin Observatory's Legacy Survey of Space and Time (LSST) on the horizon, this data stream is expected to increase at least tenfold. Several data brokers have been created to handle this flood of astronomical data, such as ANTARES, which filters the data acquired from ZTF based on certain transient parameters. We are creating a filter in ANTARES to make the search of distinct supernovae accurate and efficient. We will be using the location of supernovae and the light curves with enough data points having a different shape than usual supernovae light curve. The events of interest found by our filter will play a key role in assisting time-domain astronomers to classify supernovae with these properties.

Keywords: Filter; ANTARES; Transients; Supernovae; Time Domain Astronomy

Mentor(s):

Danny Milisavljevic (Science); Ziwei Ding (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1042**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Implementation of Hardware Multithreading on RISC-V Microcontroller**

Mathematical/Computation Sciences

Author(s):

Rohan Gangaraju† (Engineering); Pranav Srisankar† (Engineering); Sean Greenley† (Engineering)

Abstract:

The AFT-series chips are RISC-V based microcontrollers developed by the System-on-Chip Extension Technologies (SoCET) team. This project focuses on the addition and performance analysis of hardware multithreading to the future AFT-series chips. Hardware multithreading is a technology that allows a single physical CPU core to execute multiple thread contexts simultaneously. This is often used in semiconductor companies such as Intel (Hyperthreading) and AMD to improve the overall performance and throughput of a processor. In the context of a microcontroller, it can enhance the responsiveness to the outside world by mapping sensor interrupts to threads such that data processing and real-time data acquisition can occur concurrently for multiple peripherals. This technology is achieved by replicating architectural state such as general purpose registers (GPRs) along with additional hardware to facilitate the switching of threads. Though multithreading adds more hardware for the state, it provides benefits such as increased processor resource utilization as threads stalling due to cache misses or long latency operations can be switched out for other threads to keep execution units busy and processor throughput high. This project group is committed to implementing and analyzing the performance implications of hardware multithreading through custom micro-benchmarks which identify the optimal use case scenarios for this design. Through this rigorous evaluation, this group aims to enhance hardware efficiency and create frameworks for future AFT microcontroller generations to build on.

Keywords: Microcontrollers; Computer Architecture; Embedded Systems; High Performance

Mentor(s):

Mark Johnson (Engineering); Cole Nelson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1043**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Characterization of lipid laden macrophages in colostrum and mature milk from multiparous dairy cows

Life Sciences

Author(s):

Brianna Gast† (Agriculture, JMHC); Lauren Jones‡ (Agriculture); Addison Hill‡ (Agriculture); Michayla Dinn‡ (Agriculture); Ellie Ketcham‡ (Agriculture, JMHC)

Abstract:

Lipid laden macrophages, also known as foam cells, are present in milk, but their function is not known. We hypothesize foam cells play a role in transporting-secreting fats, and thus predict that milk fat percentage will correlate with foam cell number in colostrum and mature milk. The objective of this study was to phenotype cells in colostrum and mature milk and correlate these findings to the percentage of fat. Holstein cows (n=12) were enrolled at calving, and colostrum was collected within 4h of parturition and mature milk 14d later. Milk production was collected from Afi milking system, and mature milk composition was analyzed in a commercial lab. Milk was transported to the lab where fat percentage of colostrum was measured using creamatocrit. Milk cells were isolated by centrifugation of 10 mL, and then pellets were resuspended in 100 µL of phosphate buffered saline. Ten µL of cell suspension was smeared onto a glass slide and allowed to dry, and then fat droplets in cells were stained with Oil-Red-O and counterstained with hematoxylin. Slides were imaged at 20X using an Echo Revolution microscope. Immune cells were counted, and those with red staining identified. Colostrum yield averaged 7.98 kg with an average Brix refractometer of 26.7%, which is considered good quality colostrum. Average milk yield between d1 and d14 of lactation was 35.6±11.48 kg/day, average colostrum fat % was 6.46 ± 0.38%, and mature milk was 4.47±0.46%. Analysis of the milk slides for lipid staining and immune cell populations is ongoing.

Keywords: Foam Cell; Lipid; Colostrum/Milk Composition

Mentor(s):

Theresa Casey (Agriculture); Linda Beckett (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1044**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Evaluating the Quality of Health Education Materials About Substance Use During Pregnancy from County Health Departments in Indiana

Social Sciences/Humanities/Education

Author(s):

Madelyn Gearld† (HHS); Julia Flowers† (HHS)

Abstract:

Background: Indiana has the third highest rate of maternal mortality in the country; overdose is the leading cause of maternal death. Like many states, Indiana law considers substance use during pregnancy as child abuse. Pregnant women who use drugs are more likely to receive little to no prenatal care which is associated with a variety of negative health outcomes in and of itself, including increased maternal and infant mortality. Research shows that fear of legal repercussions and being reported to Child Protective Services (CPS) influences the decisions of pregnant alcohol- and drug-users not to seek prenatal care. Within this context, we set out to examine materials from county health units across the state to understand what resources and information are available to pregnant substance-users.

Methods: Between 2023 and 2024, we systematically contacted each county health department in Indiana via email and asked for resources and materials for pregnant women about substance use during pregnancy. We contacted each health unit a maximum of three times, and we received responses from 38 out of 92 health units. We will evaluate all materials for medical and legal accuracy, congruence, tone, and reading level.

Implications: Indiana is experiencing a maternal health crisis. It is critical to understand what resources and information are currently available to determine possible areas for intervention. In the next phase of this project, we will work with pregnant people to assess their understanding of these materials and generate suggestions for how to ensure the information is patient-centered, medically accurate, and easy to understand.

Keywords: Health Communication; Health Promotion; Pregnancy; Maternal Mortality

Mentor(s):

Kathryn LaRoche (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1045**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## AMP Li-Ion BMS

Innovative Technology/Entrepreneurship/Design

Author(s):

Brandon Goeppner† (Engineering)

Abstract:

The Autonomous Motorsports team at Purdue is continuously working to improve their kart. This year the main focus has been working on moving from lead acid batteries to lithium ion batteries. In order to use lithium ion batters, a battery management system is needed. A battery management system is needed in order to maintain a healthy battery pack as well as controlling the outputs of the pack. It is my responsibility to research what a BMS is, can have within in it, and find a suitable BMS for our kart. Once a BMS is found, I will share this information with the team and we will move to incorporate this into our kart.

Keywords: Research; Compatibility; Assembly

Mentor(s):

Shreya Ghosh (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1046**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Do Pilot and Non-Pilot Trainees Perceive the Same Stress and Fatigue? A Detailed Group Comparison

Life Sciences

Author(s):

Samuel Gomez† (Polytechnic)

Abstract:

This research paper examines the variances in stress, sleep quality, and fatigue levels between pilot and non-pilot college students, utilizing the Perceived Stress Scale (PSS), Jenkins Sleep Scale (JSS), and Multidimensional Fatigue Inventory (MFI) for subjective assessment. The study aims to uncover the significant differences in these two groups' stress and fatigue profiles, with non-pilots reporting higher stress and sleep issues and pilots facing more severe fatigue. Contrary to the original hypothesis that pilots would exhibit higher stress levels, fatigue, and poor sleep quality, findings revealed that non-pilot students experienced greater stress and sleep disturbances, while pilots reported more significant fatigue. These unexpected results highlight the complexity of stress and fatigue factors in different student populations. Given these unanticipated outcomes, the study recommends employing objective measures through various sensors in future research to gather more precise data and reduce biases. This approach aims to provide a deeper understanding of the specific challenges faced by each group, guiding the development of tailored interventions to enhance student well-being and performance.

Keywords: Stress; Fatigue; Trainees; Well-Being; Performance

Mentor(s):

Sudip Vhaduri (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1047**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Child Automated Speech-To-Text (CAST): Audio Processing for Child speech transcription

Innovative Technology/Entrepreneurship/Design

Author(s):

Son Ha† (Science); Jonah Nichols† (Engineering); Vinay Gupta† (Science); Aaditya Doiphode† (Science)

Abstract:

[Abstract Redacted]

Keywords: Audio Processing; Machine Learning; ASR; NLP; Linguistics

Mentor(s):

David Purpura (HHS); Avery Closser (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1048**

*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## The Exploration of Autonomous Navigation of Unmanned Aerial Vehicles Within a Maze

Mathematical/Computation Sciences

Author(s):

Jaya Hari† (Engineering, JMHC); Alice Dragnea† (Engineering); Dheepa Hari† (Engineering, JMHC); Yash Ashtekar† (Engineering); Aryan Srivastava† (Engineering); Nikhil Saxena† (Science); Shuangding He† (Engineering); Nikitha Suraj† (Engineering); Geervan Bhattacharjee† (Engineering)

Abstract:

Unmanned Aerial Vehicles (UAVs) are useful in environments inaccessible to humans or where extensive data collection is necessary, however they have limitations as a system, particularly in memory. The purpose of our research is to explore memory-efficient solutions for path-planning and collision-avoidance by UAVs, specifically for two-dimensional navigation and mapping within unknown environments. To encourage the exploration of this field, we are organizing a UAV maze competition in Summer 2024, to be held in the Purdue UAS Research and Test Facility which challenges contestants to develop control software for UAVs to autonomously solve a physical maze. The most efficient solutions from a preliminary (virtual simulator) round will be invited to test their solutions at the Purdue UAS Research and Test Facility. Our team will design and build a maze using cubes made of PVC pipes, and paper to mark the walls of the maze and will test functionality of the structure by flying the drone in the maze. We will test the current solution for how quickly it is able to solve the maze, and analyze the algorithm used for maze traversal to determine its speed, utilizing Gazebo and ROS2 for virtual simulated testing before real-world testing in the hangar and streamlining the optimization of UAV navigation and functionality within unknown environments. This competition provides a controlled environment for recognizing limitations drones face for path-planning and object detection problems. Our next steps will be to build upon the baseline solution by improving the drone's memory efficiency, collision-avoidance, and maze-completion speed.

Keywords: Unmanned Aerial Vehicles; Memory-Efficient; Path-Planning; Collision-Avoidance; Open-Source

Mentor(s):

Yung-Hsiang Lu (Engineering); Kylie Sommer-Kohrt (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1049**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Infant Mouthing Behaviors During Naturalistic Play

Life Sciences


Author(s):

Ashley Hartman† (HHS, JMHC); Madeline Douglas† (HHS)



Abstract:

We have been taught from an early age to never put objects from the floor into our mouths, but this rule does not seem to apply to infants. Young infants frequently use oral exploration to inspect objects, yet research investigating hand-to-mouth and object-to-mouth behavior is limited. Typically, when studying object exploration, infants are handed a specific set of toys and are observed in a controlled laboratory setting. Our study is valuable because it gives us naturalistic data on the emergence of mouthing behavior in infants. To capture the naturalistic emergence of this behavior in infancy, we observed how mouthing frequency changes with age and motor stage for infants in their home environment. Our current study used 1-hour home videos of 9- 12- 18- and 24-month-olds and their caregivers' natural activity as they went about their daily routine. Trained undergraduate researcher assistants used Datavyu, a video coding software, to annotate the behavioral video data. We created detailed video coding of infant mouthing behaviors, including the onset and offset of each mouthing event, the object mouthed, whether the hand/object touched the floor 10 seconds prior to mouthing, infants' posture, and who initiated the mouthing event. Our findings contribute to understanding the frequency of mouthing events in infants as they gain new motor skills, the variety of objects they orally explore, and the prevalence of objects on the floor prior to infants mouthing them.



Keywords: Oral Exploration; Naturalistic Study; Behavioral Video Data



Mentor(s):

Laura Claxton (HHS); Paige Thompson (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1050**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**ASMprofiler**

Mathematical/Computation Sciences

Author(s):

Kyle Harvey† (Science); Nicholas Bogan† (Science)

Abstract:

The purpose of this research project was to create a user-friendly and relatively simple profiler that aids students in the optimization of x86_64 Assembly and C. This research project utilizes the profil() system call inside a shared library to create a “histogram” of time spent at each address within the text section of the target program. This data is then read from a file by a Python3 program and combined with data from objdump, addr2line, and the source code of the target program. The source code information allows for compiler-generated Assembly code to be associated with its C source code. This data is then displayed to the user in their browser via a locally hosted anonymous web server. This program successfully determined where the target program was spending its time and displayed it to the user in an easy-to-read format. This program assisted 500+ CS250 students in optimizing a hashtable written in Assembly. Computer Science educators may consider utilizing this program to aid students in optimizing C and Assembly code. Programmers may consider utilizing this program to aid themselves in optimizing C with inline Assembly code.

Keywords: Assembly; Profiling; Tools; Software Engineering Computer Science

Mentor(s):

Gustavo Rodriguez-Rivera (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1051**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Integration of paper-based wearable sensors on quadrupeds for precision agriculture**

Innovative Technology/Entrepreneurship/Design

Author(s):

Khaleel Ibrahim Hassan† (Engineering)

Abstract:

Accessorizing quadrupeds with payloads for autonomous inspections and assessments in various environments such as construction worksites, industrial plants, and warehouses is contributing to more efficient practices within industries. However, these payloads, which consist of high-resolution cameras, infrared thermal imaging capabilities, and complex sensors, are bulky and expensive. As a result, there is a pressing need for alternatives. This research pioneers the development of wearable paper-based sensors for quadrupeds. Since paper-based sensors are made from recyclable and easy-to-obtain materials such as paper, aluminum foil, and double-sided tape, this makes them cheap and easy to make. Therefore, instead of relying on expensive payloads for various applications, our approach leverages on the integration of cost-effective paper-based devices as wearable sensors for quadrupeds. This study will focus on the feasibility, improvements, and cost-savings wearable paper-based sensors offer in farming and agriculture. Particularly, tests on various microclimatic conditions such as humidity, pH, moisture, etc. will be conducted using these sensors and compared to actual readings from calibrated devices. The level of accuracy and reliability of the wearable paper-based sensors will then be determined. While acknowledging that paper sensors may not match the precision of traditional payloads, their cost-effectiveness positions them as a viable alternative. It is expected that the outcome of this study will have the potential to disrupt data collection and decision-making in precision agriculture, providing a balance between cost-effectiveness and accuracy.

Keywords: Precision Agriculture; Paper Electronics; Quadruped; Wearable Sensors; Cost-Effective

Mentor(s):

Muhammad Hussain (Engineering); Andres Castillo (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1052**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Application of a Combination of Commercially Available Sanitizers in the Post-Harvest Control of Salmonella enterica serovar Typhimurium, E. coli O157:H7, and Listeria monocytogenes on Cantaloupe Rinds.

Life Sciences

Author(s):

Amirah Haweit† (Agriculture); Isabela Ramirez Ortiz* (Graduate School)

Abstract:

Despite efforts aimed at mitigating pathogenic bacterial contamination in cantaloupes, foodborne illness outbreaks have persisted over the past decade. Since cantaloupes are grown on the ground, water used for irrigation, runoff from animal farms near orchards and fields, manure, rodent and ruminant excrement, wash water, worker handling, and contact with contaminated surfaces are all potential sources of contamination. Contamination is mitigated by the application of post-harvest sanitizers such as chlorine dioxide, peracetic acid, sodium hypochlorite, and hydrogen peroxide. While post-harvest sanitizers like chlorine dioxide, peracetic acid, sodium hypochlorite, and hydrogen peroxide help mitigate contamination, there is a pressing need for research to enhance their efficacy in reducing outbreaks. However, limited information exists regarding the effectiveness of combining peracetic acid (PAA) or sodium hypochlorite during post-harvest applications to reduce pathogenic bacteria on cantaloupes. This study evaluated three different sanitizers alone and in combination and measured the reduction of bacteria load of Salmonella enterica serovar Typhimurium, E. coli O157:H7, and Listeria monocytogenes on cantaloupe rinds. The results showed that the combination of different sanitizers applied inline resulted in a greater bacteria reduction when compared with the application of chlorine dioxide and sodium hypochlorite alone.

Keywords: Cantaloupe; Commercially Available Sanitizers; Salmonella enterica serovar Typhimurium; E. coli O157:H7; Listeria monocytogenes

Mentor(s):

Amanda Deering (Agriculture); Hansel Mina (Agriculture); Adriana Vanegas Torres (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1053**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Analyzing bacteriophage protein structural motifs utilizing a variety of novel software

Life Sciences


Author(s):

Zachery Heppner† (Engineering); Drake Strait† (Agriculture, JMHC); Hudson Schneider† (Engineering, JMHC); Michael Perrin† (Engineering, JMHC); Derek Temple† (Engineering); Katherine DeMarco† (Engineering)



Abstract:

Bioinformatic auto-annotation software can identify gene presence and function and is crucial for genome characterization in various biological fields. However, these software may introduce a level of bias for fringe type genomes, such as those found in bacteriophages. This is in large part due to the fact that bacteriophage DNA segments are very compact and may be structured differently than the sequences these software are commonly trained on. This study will address different predictions in a single protein coding region that is highly conserved across many bacteria and bacteriophages. This coding sequence is a theoretical protein found within the bacteriophage MellowYellow genome. HHpred, a software that compares genomic sequences, has over 40 hits on this conserved region with at least a 95% probability. To better understand gene function and shape, motif analysis will be performed utilizing many models to obtain a holistic view of the protein. To find the structure of the protein, algorithms such as AlphaFold and I-TASSER were used. Dali was used to identify similar structures and pyMOL was used to compare the motifs. This study is expected to find the function of the theoretical protein as well as provide a better understanding of bacteriophage protein motifs. Analysis of protein motifs from different software will be compared to determine similarities and outliers among software outputs. The findings related to this specific protein can lead to wider genetic applications in bioinformatic software and protein motif prediction in bacteriophages.



Keywords: Bacteriophage Protein Functions; Genetic Annotation; Bioinformatic Algorithms; Protein Structures; Structural Motif



Mentor(s):

Adam Quinn (Agriculture); Harry Ashbaugh (Engineering); AJ Gin (Engineering); Daphne Fauber (Engineering); Kari Clase (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1054**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Race 2 Zero: Decarbonization of the Galapagos

Innovative Technology/Entrepreneurship/Design


Author(s):

Brogan Holt† (DSB, JMHC); Daniel Wu* (DSB); Tristan Darby* (Engineering); Dylan Hall* (Engineering); Zach Tan* (Engineering); Carl Chandra* (Engineering); Ayan Hossain* (Engineering); Apoorva Bahl* (Engineering); Kexin Han* (DSB); Grant Goldsmith* (Engineering)



Abstract:

Race to Zero introduces electric motors and hydrogen combustion marine engines as a sustainable alternative to traditional combustion engines. The motivation behind this initiative is to address the negative environmental impact of conventional marine propulsion systems currently in use in the Galapagos islands. We aim to decarbonize the marine tourism industry while also providing a more enjoyable tourism experience for tourists through the introduction of electric and hydrogen-combustion marine engines. By providing a more environmentally friendly offering, we aim to differentiate ourselves from competitors by having a more efficient and cost-effective solution that will better appeal to the next generation of environmentally conscious tourists. The implementation plan includes research, development, collaboration with manufacturers, and a pilot program, with funding sourced from investors, grants, and government initiatives, that will hopefully facilitate a smooth and rapid transition from legacy engine technologies to newer electric hydrogen combustion marine engines. By leveraging hydrogen combustion technology as well as electric motors, we are also providing the available charging and fueling network at the marina for ease of use and accessibility. This infrastructure development will ensure that the transition to our innovative propulsion systems is convenient for marine operators as a marine tourism solution. Race to Zero is dedicated to shaping a greener and more advanced future for marine transportation.



Keywords: Hydrogen; Green Energy; Galapagos; Electric Motor; Decarbonization



Mentor(s):

John Sheffield (Polytechnic)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1055**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Exploring the needs of maternal Tdap vaccine among pregnant women: An Analysis of Reddit postings.

Life Sciences


Author(s):

Jon Hurley† (Science)



Abstract:

[Abstract Redacted]



Keywords: Tdap; Pertussis; Whooping Cough; Pregnant; Reddit



Mentor(s):

Soojung Jo (HHS); Tatiana Ringenberg (Polytechnic)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1056**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## How can GIS be used to calculate and inform wildlife corridor creation to facilitate dispersal of extirpated species to their historic habitat?

Life Sciences

Author(s):

Luca Iacobucci† (Agriculture); Sierra Hunnicutt‡ (Science, JMHC); Hannah Reyes Charles‡ (Agriculture, JMHC); Katie Hong‡ (Agriculture); Zhixin Cai‡ (Science, JMHC); Ryan Feller‡ (Science, JMHC); Anthony Tan‡ (Science)

Abstract:

Many species rely on forest interior habitat to thrive, reproduce, and disperse. Wildlife corridors are a way to encourage the dispersal of species into previously unavailable habitat. Corridors have become a necessity for certain species because of urbanization. The bobcat (Lynx rufus) is one of these species. With the historic overexploitation of bobcats by European settlers in the Midwest, the species has yet to return to areas like northern Indiana. By using remote acoustic monitors, AI-CNN technology, and camera traps, we aim to locate dispersing bobcats to Tippecanoe County. We deployed camera traps (n = 14) as well as acoustic monitors (n = 9) in locations on the southern and northern sides of the Wabash River to gather data on potential barriers to dispersal for bobcats. With this data, we will generate a Least Cost Path Analysis – a geospatial tool that calculates the optimal path from point A to point B – and use it as a guideline for the formation of a wildlife corridor. In the past, we have looked at the relationship between bobcat presence and other mesocarnivore (fox, possum, coyote, raccoon) presence, and we can use those findings in the Least Cost Path as well as acoustic data of anthropogenic sounds and the distance of our sites from human structures (roads, farms, cities, towns, etc.) Our aim for this project is to work with conservation agencies to identify potential wildlife corridor areas that facilitate intra- and interstate dispersal of locally extirpated species like bobcats.

Keywords: Bobcat; Wildlife Corridor; GIS

Mentor(s):

Kristen Bellisario (JMHC)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1057**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Automated Identification Method of Tissue Layer Boundary Lines in Images

Mathematical/Computation Sciences

Author(s):

Lourdes Ignacio† (Science); Selina Lin† (Science, JMHC); Shreeya Ettireddy† (Science)

Abstract:

Histological image analysis of tissue structure provides information about the dermis and subcutaneous layer composition with potential applications in the medical field, including transdermal drug delivery and cancer diagnosis. However, the conventional analysis approach involves manual identification by readers to study tissue layers and their structures, which is time-consuming, inefficient, and heuristic. In a prior study, an automated histological image analysis algorithm for identifying the tissue layers was proposed. The limitations of the previous work involved erroneously identifying collagen strands as tissue layer boundary lines and relying on a preprocessing technique dependent on the blue channel. This project aims to enhance the prior algorithm by incorporating a new color scale preprocessing method to further accentuate brightness differences between layers and a hierarchical spectral clustering approach to reduce noise sensitivity during identification processing. We hypothesize that these developments will reduce the false identification of collagen strands within the subcutaneous layer as boundary lines while eliminating the need for user input of the number of layers. In addition, the revised preprocessing method will allow the model to be more generalizable for tissues with different histology stains. Our model is tested with eight porcine tissue samples extracted from various anatomical locations from the breast to the belly. Outputs will be compared against the current results from the previous image analysis software to quantify performance improvements.

Keywords: Histology Imaging; Clustering; Machine Learning; Tissue Layer Identification

Mentor(s):

Brett Meyers (Engineering); Pavlos Vlachos (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1058**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Person, Object, and Coordinated Joint Engagement Profiles in Toddlers with Angelman Syndrome

Social Sciences/Humanities/Education

Author(s):

Rachel Isaac† (Science, JMHC); Maria Armenta† (HHS)

Abstract:

Angelman syndrome (AS) is a neurogenetic disorder caused by UBE3A gene disruptions and associated with developmental delays, motor issues, and limited speech. However, little is known about engagement states in young children with AS. This study aimed to characterize engagement in AS toddlers, focusing on person, object, and coordinated joint engagement. Participants included 17 children with AS who are mostly female (82.4%) and aged around 20 months (SD = 4.7, range: 11.6–29.9). Caregiver-child interactions were observed during free play and child engagement states were coded every three seconds. Results showed that children with AS spent time in all three engagement states; distributions were consistent with the behavioral phenotype of AS, with object engagement being most common (33.2%, SD = 14.7) and coordinated joint engagement being least frequent (6.2%, SD = 6.5). Notably, children with AS exhibited significantly greater object engagement than coordinated joint engagement (t = 7.74, p <.001). Exploratory analyses suggested that children with the deletion genotype exhibited less coordinated joint engagement compared to those with the mutation genotype (t = 2.64, p = .019). These findings highlight the potential for leveraging object play in promoting developmental skills as well as hint at broader genotype-phenotype associations, warranting further basic genotyping and clinical translational research. Broadly, our study lays the groundwork for understanding child engagement in AS compared to neurotypical development and other developmental conditions.

Keywords: Engagement States; Angelman Syndrome; Behavioral Coding; Development

Mentor(s):

Bridgette Kelleher (HHS); Wei Siong Neo (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1059**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Measuring Hydraulic Conductivity of Permeable Pavement

Innovative Technology/Entrepreneurship/Design

Author(s):

Clayton Jarosinski† (Engineering); Claire Middendorf‡ (Engineering)

Abstract:

The purpose of this study was to evaluate the effectiveness of the air permeability test (APT) in its ability to measure the hydraulic conductivity (k) of a material when compared to the more traditional falling head test. This study involved using an APT device on a control material and then taking cores of that control material to test using the falling head test. The control material included both a 2’x2’ and 1.4’x1.4’ pad of permeable pavement about 8 cm thick. APT measurements were taken at the centers of both pads as well as the corners to investigate variability of k within a “homogenous” material representing soil. This study can be applied to further research in geotechnical engineering as utilizing the APT is much faster and easier to do compared to the falling head test. The data from these tests can be used to estimate ground infiltration from rainwater near roads, which would allow transportation engineers to make more educated decisions when designing roads.

Keywords: Air Permeability Test (APT); Hydraulic Conductivity; Permeable Pavement; Geotechnical Engineering; Falling Head Test

Mentor(s):

Marika Santagata (Engineering); Luis-Enrique Garzon-Sabogal (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1060**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Determination if populations of immune cells change between colostrum and mature milk of dairy cows**

Life Sciences


Author(s):

Lauren Jones† (Agriculture); Addison Hill‡ (Agriculture); Brianna Gast‡ (Agriculture, JMHC); Ellie Ketcham‡ (Agriculture, JMHC)



Abstract:

Macrophage foam cells are present in milk and consumed by neonates. The presence of foam cells in milk suggests they play a functional role; however, little is known regarding their function. The study objective was to determine the somatic cell count (SCC) and the types of cells with lipid vacuoles in colostrum and mature milk (MM). We hypothesized the percentage of immune cells with lipid vacuoles is greater in colostrum versus MM. Multiparous Holstein dairy cows (n=12) were enrolled in the study in late gestation. Cows were examined for signs of impending birth every 6 h, and within 4 h of parturition, colostrum was collected. On day 14 of lactation, MM samples were collected. Milk production data was collected from the automatic milking system, and MM was analyzed for components at a commercial lab. Fresh colostrum or milk was transferred to the lab and centrifuged to pellet milk cells. Cell pellets were washed with phosphate buffered saline (PBS), resuspended in 100 µL of PBS, and 10 µL of resuspension was smeared on slides, and dried cells stained with Hema 3. Slides were scanned at 20x using an Echo Revolution scope. Colostrum yield was 7.98 kg and the average daily milk production over 14 days was 35.6 kg. MM average total solids were 13.7%, average protein was 3.34%, average milk urea nitrogen was 11.08 mg/dl, and average SCC was 296000±481363, with two cows showing signs of clinical mastitis (SCC ≥ 200,000). Analysis of distributions of cellular populations is ongoing.



Keywords: Colostrum; Foam Cells; Somatic Cell Count


Mentor(s):

Theresa Casey (Agriculture); Linda Beckett (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1061**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Public Adoption of New versus Pre-owned Electric Vehicles

Innovative Technology/Entrepreneurship/Design

Author(s):

Christina Joslin† (Science, JMHC)

Abstract:

The transportation sector is the leading contributor to greenhouse gas emissions, accounting for nearly 30% of total emissions. To address this problem, a transition to electric vehicles (EVs) has been proposed as one of the most viable options for widespread public adoption. As more people start to adopt EVs, the number of new as well as used (pre-owned) EVs is expected to rapidly increase. Given the expanding pre-owned EV market, it is critical to understand the factors that affect a consumer's choice between a new and pre-owned EV. A literature review of over a dozen studies from the United States, published between 2018 and 2024, was conducted on the public acceptance and preferences for purchasing a new versus a pre-owned EV.  Although there was no consensus, the majority of the extant literature indicated that the most cited factors were environmental impact, technological state, purchasing price, age, and income.  This study will explain some of the reasons for these influences. Other factors that were mentioned were ethnicity, neighborhood effect, and geographic distribution. The findings from this literature review will support a broader study analyzing survey data about the perception of EVs by the Indiana public, which can be used to inform government policymaking and the automotive industry in identifying considerations for educational campaigns promoting EVs.

Keywords: Pre-Owned; Electric Vehicles; Factors; Environmental Impact; Purchasing Price

Mentor(s):

Nadia Gkritza (Engineering); Bruno Cesar Krause (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1062**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Revitalizing Fort Wayne's Riverfront: A Nature-Based Approach

Innovative Technology/Entrepreneurship/Design

Author(s):

Elisabeth Justice† (Agriculture)

Abstract:

In collaboration with the City of Fort Wayne, Phase 3 of the Downtown Fort Wayne Riverfront Park is undergoing revitalization, with a specific emphasis on environmental remediation and education. Positioned along the Saint Mary’s River, the project site currently features a playground and boat ramp, but faces challenges due to the river's recurrent flooding and the lack of accessibility. This design and research initiative transforms the area into a naturalized urban park serving as compensatory storage during flood events, and also serves as a destination and connecting point for local residents and visitors.

Utilizing Esri’s ArcGIS Pro for site analysis and field survey, I explored data layers including soil conditions, water flow, river depth, and historical flood events which affect the site programming. Through this analysis and subsequent design ideation, I strategically identified optimal locations for compensatory flood storage and a redesigned levee, increasing floodable land to accommodate 37,500 yd3 of compensatory storage. The assessment considered factors such as soil conditions, existing vegetation, and topography.

This comprehensive site analysis informed three primary design goals: flood mitigation, stormwater education, and the creation of a naturalized urban park. By examining the demographics and culture of the surrounding community, I identified the dual need for recreational spaces and educational opportunities. This research contributes to a sustainable and resilient urban development that addresses both environmental challenges and community needs, ensuring the Downtown Fort Wayne Riverfront becomes an integral asset in the city's landscape.

Keywords: Compensatory Storage; Nature-Based Education; Environmental Design; Flood Management; Riverfront Revitalization

Mentor(s):

Aaron Thompson (Agriculture); Yiwei Huang (Agriculture); Erin Percevault (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1063**

*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Power Limitation Based on Supercapacitor

Innovative Technology/Entrepreneurship/Design


Author(s):

Connie Kang† (Engineering); Rongbo Hu† (Engineering); Nicholas Martel† (Engineering); Qinjia Xu‡ (Engineering); Jessica Lyng‡ (Engineering); Jiaming Fang‡ (Polytechnic)



Abstract:

Supercapacitors, also known as ultracapacitors or electrochemical capacitors, are energy storage devices that store electrical energy via electrostatic charge separation. Supercapacitors offer several advantages over batteries, including high power density, fast charging and discharging rates, long cycle life, and wide operating temperature ranges. They are commonly used in applications requiring bursts of power, such as regenerative braking systems in vehicles, renewable energy systems, and electronic devices requiring quick energy delivery. This mechanism allows them to achieve much higher energy densities compared to conventional capacitor. In RoboMaster competition, each robot has a constraint on power consumption throughout the game. Supercapacitors, with their exceptional power handling capabilities, offer a promising solution for mitigating power limitations in various systems. In this conference, we introduce a supercapacitor controller board designed for such robots, featuring a bidirectional DC-DC converter which facilitates direct current voltage conversion without requiring an inverter. With this innovative supercapacitor controller, the battery delivers a consistent power output while charging the robot. When the robot power consumption exceeds the limitation, the supercapacitor is responsible for providing a constant voltage output compensating the output from the battery.



Keywords: Supercapacitor; Robotics; Power Limitation


Mentor(s):

Abolfazl Hashemi (Engineering); Shivam Bhat (Science); Zijian He (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1064**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Artificial Intelligence Technology for Future Music Performers "Companion"

Innovative Technology/Entrepreneurship/Design

Author(s):

Temirlan Karataev† (Engineering); Tim Nadolsky† (Science); Calvin Tseng† (Engineering); Caasi Boakye† (Science); Shrish Senthilkumar† (Engineering); Ping-Hung Ko† (Engineering); Rixin Chen† (Liberal Arts); Minsoo Oh† (Science)

Abstract:

Historically, machine learning has been used in creative applications such as music generation, but its impact on musician-computer interaction has been limited. We have been developing an AI-assisted tool called Companion to aid string players in overcoming the challenges of coordinating remote ensemble rehearsals. Companion aims to play along with other humans in a chamber music ensemble, just like another human player would.

In our work developing Companion's audio processing capabilities, we investigated various time-domain effects for editing accompaniments. We adopted a technique called Differentiable Digital Signal Processing (DDSP) for resynthesizing the audio in its entirety. To detect beats in real-time input audio, we leveraged empirical cumulative distribution functions and beat signal estimation algorithms.

For synchronization across remote sessions, we implemented algorithms such as wave-similarity overlap-add (WSOLA) to synchronize audio streams in real time. Beat detection provides tempo reference, while proportional-integral-derivative control minimizes tempo timing errors. Large language models parse natural language commands and translate them into system instructions, mimicking human-like understanding.

Methods were also developed to calculate maximum-likelihood mappings of score positions to recorded audio timestamps. Techniques drawing from algorithms like Crepe frequency detection and Music21 score analysis were employed to correlate score measures with performance time points.

While further augmenting voice command capabilities and accompaniment variation remain ongoing work, these advances move us closer to realizing AI's potential to enhance collaborative music-making experiences through solutions like Companion. Continued development could broaden access to musical training opportunities even when ensembles are geographically dispersed.

Keywords: AI-assisted tool; Remote Ensemble Rehearsals; Collaborative Music-Making; Real-Time Synchronization; Differentiable Digital Signal Processing (DDSP)

Mentor(s):

Yung-Hsiang Lu (Engineering); Kristen Yeon-Ji Yun (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1065**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**User perspectives to inform the development of a rapid test for early detection of HIV.**

Innovative Technology/Entrepreneurship/Design

Author(s):

Ishita Kataki† (HHS, JMHC)

Abstract:

Rapid HIV tests have been proven to be effective in slowing down the spread HIV by providing results in as little as one minute, allowing quick and early treatment. This approach is particularly important in high-risk populations where transmission rates are elevated. No current iteration of test can detect HIV immediately after infection in the acute HIV phase (AHI), when the virus is most infectious, and instead take up to 90 days after exposure to detect. To ensure successful adoption of a novel rapid HIV test to detect AHI that is currently under development, investigation of user perspectives and context-specific factors are needed. As such, we engaged clients and staff of syringe service programs and HIV organizations to: 1) understand current experiences with and barriers to HIV testing in Indiana; 2) assess the acceptability of this novel AHI test, and 3) identify implementation considerations for such a device.

Semi-structured in-depth interviews were conducted with 14 staff and 5 clients. Interview guides were developed and tailored to each participant group, asking about experiences with HIV testing and thoughts on the AHI test in development. NVivo Coding Software was used for qualitative analysis to identify major themes. Identified themes included barriers to HIV testing and acceptability of the proposed AHI test. Overall acceptability was high. Key considerations for implementation emphasized accuracy, cost-effectiveness, ease of use, and ensuring access to counseling, education, and navigation to care. These findings will inform future iterations of the device and ensure adoption into target communities.

Keywords: Self Testing; Human Centered Design; HIV Rapid Testing; Technological Innovation; Smartphone-Based Diagnostic

Mentor(s):

Lara Balian (HHS); Jacqueline Linnes (Engineering); Natalia Rodriguez (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1066**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Influence of soil properties and land management on rainwater infiltration and soil water chemistry

Physical Sciences

Author(s):

Bethany Kettleborough† (Science)

Abstract:

Soil water dynamics influence vegetation health and soil geochemical reactions that affect stream chemistry. Water dynamics can be controlled by soil type and management. Water movement can be investigated using differences in water stable isotopes. It is important to understand water movement due to its influence on soil weathering, microbial activity, and nutrient transport. The purpose of this on-going study was to analyze soil water stable isotopes and dissolved ions in prairie and agricultural land management sites in Nebraska and Illinois. Prairies typically contain deep-rooted grasses, while agricultural lands typically contain shallow-rooted row crops. Root depth is considered a major control on rainwater infiltration depths. Soil type and structure also influence infiltration rates, with water moving more easily through coarse sand than fine-textured clays. We hypothesize that soil type influences water residence time, which leads to differences in stable isotope contents. Soil water at both Illinois sites showed reduced isotope variability than Nebraska, suggesting longer residence times in soil and more mixing of water from rain events. Ion analyses found that the Nebraska agricultural site contained higher $Mg^{2+}$, $Ca^{2+}$, $Na^{+}$, and $K^{+}$ concentrations than the prairie site. The Illinois agricultural site contained higher $Mg^{2+}$ and $Ca^{2+}$ concentrations, while the prairie site contained similar $Na^{+}$ and $K^{+}$ concentrations (Dere et al., 2019). Ion concentrations may be influenced by precipitation infiltration depths or evapoconcentration, which leave signals in the isotope values of the soil waters. Our results show that soil properties like clay content and root depth affect water movement through different soils.

Keywords: Water Stable Isotopes; Soil Properties; Soil Water Dynamics; Soil Chemistry

Mentor(s):

Lisa Welp (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1067**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Statistical Analysis of Wearable IMUs in Warehouse-like Environment

Innovative Technology/Entrepreneurship/Design

Author(s):

Julie Kim† (Engineering)

Abstract:

Almost half of all Amazon’s warehouse workers are injured just after 3 years. With more than two-thirds of workers that were surveyed to have taken unpaid time off to recover from pain or exhaustion, there is a prevalent task for computer vision domain to analyze human movement. Our team has focused on collecting the ergonomic data of participants in warehouse-like environments to analyze their movements when carrying loads of different weights. The weights varied between 0-15 pounds, and the participants were tasked with lifting cardboard boxes and setting it down in an organized fashion while wearing Inertia Measurement Units (IMUs) and motion capture sensors called Optitrack from Purdue’s envision center. More than 30 subjects’ data was collected, and we are currently analyzing each subject’s position, velocity, acceleration, etc for each body segment. Using this data, we hope to create a deep neural network (DNN) models capable of taking a 2D image containing multiple people as input and generating a 3D human body mimicking each person's body shapes and poses (i.e., the rotation of each body joint). Given the shapes and poses, the generated human body can be further described by the Skinned Multi-Person Linear (SMPL) model with a 3D mesh containing 6890 vertices and the 3D location of body joints. With proper model fine-tuning and adjustment, we expect that the performance of the DNN for 3D human reconstruction tasks can be used to find patterns and predict potential injuries to reduce warehouse incidents.

Keywords: IMU; Motion Capture; Statistical Analysis; SMPL; Accident Prevention

Mentor(s):

Denny Yu (Engineering); Guoyang Zhou (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1068**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## The Causal Effects of Parental Depression & Familial Arguments on Children Sleep Time

Social Sciences/Humanities/Education

Author(s):

Debora Kim† (HHS); Elliott Shi† (Science)

Abstract:

Research indicates that disturbance in family cohesion can largely impact the sleep patterns of individuals of a family unit. This study explores the potential causal effects of parental depression and parent-child conflict on children’s sleep duration. Data from Phase 8 & 9 of the Early Childhood Longitudinal Study-Kindergarten(ECLS-K) 2011 dataset were analyzed to examine changes in children's sleep patterns during Phase 9. Children's sleep duration was coded into minutes & familial argument change was coded to measure as follows: 1=arguing decreased from Phase 8 to 9, 2=arguing stayed the same in both phases and, 3=arguing increased from Phase 8 to 9. A survey-weighted logistic regression model was created to assess children’s sleep duration in Phase 9 with independent variables of child’s age, parent’s age, child’s sex, change in parental depression, change in familial arguments and children’s sleep duration in Phase 8. The analysis included 7,424 families. Results indicate changes in each variable to be statistically significant. Increases in severity of depression (none, mild, severe) show that severe depression largely affects a child's sleep duration. Increases in parent-child arguments also indicate that more arguments can affect a child’s sleep duration. Additionally, the model indicates a positive association between parent’s age with child’s sleep time. In female children, increases in depression & increases in arguments were negatively associated with sleep duration. These findings emphasize the significant impact of parental depression and familial arguments on children’s sleep duration, underscoring the critical role of family cohesion in shaping children’s sleep quality.

Keywords: Sleep Health; Children Sleep; Family Conflict; Family Systems Theory; Parental Depression

Mentor(s):

Michelle Garrison (HHS); Garrett Price (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1069**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**The Effects of Lead Exposure on Retinal Neurons in the Visual System**

Life Sciences

Author(s):

Caleb Klopfenstein† (HHS)

Abstract:

Lead (Pb) exposure can lead to decreased visual acuity and eventual blindness. The mechanisms of Pb-dependent vision loss are unknown. The purpose of this study was to analyze a mechanism by which Pb has its neurotoxic effect on vision; we hypothesized that Pb-dependent vision loss is caused by retinal ganglion cell axon degeneration and cell death. Three groups of mice were used in this test, being administered Na-Acetate (control), and two levels of Pb-Acetate via oral gavage daily for 4 weeks. After the 4-week Pb exposure, blood and retinal samples were collected. Pb concentrations in the blood and retina were assessed to confirm uptake of Pb into the visual system correlated to exposure levels. Using immunohistochemistry, retinal ganglion cell density and cell death were quantified by the immunomarkers RBPMS and cleaved caspase-3, respectively. We found no difference in retinal ganglion cell death. However, we did observe a small, but significant, decrease in retinal ganglion cell density. These results suggest a loss of retinal ganglion cells with Pb exposure, but apoptotic cell death is occurring earlier than 4 weeks during Pb exposure. Additional studies will investigate optic nerve pathologies during Pb exposure, such as glial cell survival and reactivity. This could have implications for an effect of Pb on neuronal function in the visual system.

Keywords: Heavy Metal Toxicity; Retina; Immunohistochemistry; Vision

Mentor(s):

Pat Kerstein (HHS); AJ Alqahtani (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1070**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Spin Correlation in Top Quark Pair Decay: An Approach with Machine Learning for Super Symmetric Exploration

Physical Sciences


Author(s):

Anna Klupshas† (Science); Jacob Strietelmeier† (Science)



Abstract:

This research delves into the search for evidence supporting the Supersymmetric model by leveraging data obtained from FastSim (Delphes) as a projection study for the HL-LHC upgrade. Centering on the spin correlation observables of top quark pair decay, we create a methodology involving the creation of histograms to identify patterns and deviations within the data. Additionally, we leverage machine learning techniques using PyTorch to enhance our ability to identify patterns and draw conclusions regarding the potential presence of the SUSY model. The investigation involves treating Standard Model data as background data, allowing for a comparative analysis that aims to reveal potential signatures of Supersymmetry. The study represents a significant contribution to the ongoing efforts to validate or refute the existence of Supersymmetry, providing valuable insights into the fundamental nature of particle interactions at the forefront of high-energy physics.



Keywords: Supersymmetric; Top Quark Pair Decay; Machine Learning; LHC; Spin Correlation


Mentor(s):

Andreas Jung (Science); Lingqiang He (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1071**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Characterization of Candidate Transcription Factors in Arabidopsis Leaf and Seed Development

Life Sciences


Author(s):

Rachel Kuhn† (Science); Kayleigh Jennings‡ (Science)



Abstract:

Transcription factors (TFs) are the key regulators of gene expression and control plant development and metabolism. Multiple TFs have been previously identified as regulators of biosynthesis pathways in Arabidopsis thaliana, a model organism for oilseed crops. This study aims to determine the correlation, if any exists, between the expression of certain transcription factors and seed phenotypes. After inducing constitutively high expression of these transcription factors, the seed weight, seed area, and leaf canopy were all measured and compared to the average WT measurements. Research is ongoing, but multiple TFs have proven to have significant relationships between level of expression and seed/plant phenotypes. This can lead to increase in overall oilseed yield, which has relevance for food and biofuel uses.



Keywords: Arabidopsis thaliana; Transcription Factors; Phenotype



Mentor(s):

Kranthi Varala (Agriculture); Rajeev Ranjan (Agriculture)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1072**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Dog Breed Detection Android Application

Mathematical/Computation Sciences


Author(s):

Andy Lam† (Engineering); Yu-Wei Chang† (Engineering); Yiyuan Zhang† (Science)



Abstract:

The purpose of this project is to create an Android application that classifies the breed of a dog in an image. The application will take a user’s captured image, send the image to an external server, pre-process the image, use a trained convolutional neural network to distinguish what breed the dog is in the image, and return the correct breed to the mobile device. The android application that analyzes images of dogs will distinguish if the image is of either a husky or a golden retriever. In our research, we analyzed different image processing techniques including grayscale conversion, Gaussian filter, and Sobel edge detection. We also compare and contrast different convolutional neural network architectures. In its developmental phase, this application has the potential to benefit both families seeking to identify their pets’ breeds and veterinarians requiring accurate breed confirmation for tailored treatments. Additionally, its development lays the groundwork for a versatile system capable of identifying various objects within images.



Keywords: Android Application; Convolutional Neural Network; Classification; Image Processing



Mentor(s):

Edward Delp (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1073**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**The interactive effects of temperature and salinity in Bd infection in bullfrog tadpoles**

Life Sciences

Author(s):

Megan Lawson† (Liberal Arts, Science)

Abstract:

As keystone species, amphibians are sensitive to changes in the environment and can be used to indicate the health of the surrounding environmental community. It is important to understand how environmental change impacts animal health. Amphibian populations currently face both biotic stressors, such as infection from Batrachochytrium dendrobatidis; “Bd”, and abiotic stressors like increased salinity pollution and varying temperatures attributed to climate change.

In this experiment, American bullfrog tadpoles, (Lithobates catesbeianus), were exposed to varying treatments of temperature, salinity, and infection with Bd. Tadpoles were exposed to one of two salt treatments, 0 and 1.5g/L NaCl, mimicking current polluted water sources, and one of two temperature treatments, constant 23□C and fluctuating temperatures from 20□C to 25□C reflecting current and predicted patterns. Additionally, individuals were either exposed to Bd or left unexposed. Following the treatment period, length, mass, and stage of development were measured along with infection intensity for each tadpole.

Length was higher for tadpoles that were exposed to Bd, regardless of temperature and salt treatments. With Bd infection, we found a significant interaction between our parasite and temperature treatments, where tadpoles exposed to the combination of Bd, stable temperatures, and no salt were infected significantly more than those exposed to sublethal salt or fluctuating temperatures. We found no effect of temperature, salt, or Bd treatments on developmental stage or mass. Broadly, these results suggest salt pollution in freshwater systems and variable temperatures can influence tadpole infection and health.

Keywords: Abiotic and Biotic Stressors; Salinity Pollution; Fluctuating Temperatures

Mentor(s):

Cat Searle (Science); Paradyse Blackwood (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1074**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Enhancing Conduction Band Analysis with Leveraging Eigenvectors and Mode Space for Efficient Matrix Operations in Coming Machine Learning

Mathematical/Computation Sciences

Author(s):

Sangjin Lee† (Engineering); Andrew Liu‡ (Science); Benjamin Miller‡ (Engineering); Ansh Gangapurkar‡ (Science); Hyun (Eric) Kang‡ (Science); Rahul Menon‡ (Science)

Abstract:

Modeling semiconductor nanodevices at the quantum mechanical and atomistic level is computationally intensive. To mitigate costs, semiconductor researchers and industry leaders apply low rank approximations. However, these approximations necessitate device-tailored basis representations. This leads to our project aims of compiling an extensive database of device-specific basis representations and training an AI to autonomously utilize the quantum code library tools and eventually forecast basis representations without tool intervention. In this research, we explore fundamental aspects critical to the design of semiconductor nanodevices, investigating the conduction band structure of silicon and various semiconductor materials using computational methods. The analysis focuses on E-k diagrams and conduction band data, which serve as primary input for the development of potential machine learning models. By investigating the eigenvalues and eigenvectors associated with the band structure, we aim to understand the modes through which electromagnetic wave functions propagate in materials and devices. The number of modes involved in transmission is usually very small compared to the total number of modes obtained by solving the Schrödinger equation for the original matrix. Therefore, our approach involves optimizing the computational code by reconstructing the “mode space” representation of the wave function using eigenvectors. This approximate baseline can be expressed using smaller matrices, which significantly speeds up the matrix operations performed in the code. These optimizations greatly accelerate matrix operations and are particularly useful for devices with extensive Hamiltonian matrices or complex orbital and spin properties. This research lays an essential foundation for advancing semiconductor nanodevice engineering and computational methodologies.

Keywords: Band Structure; E-K Diagrams; Eigenvector; Mode Space

Mentor(s):

Tillmann Kubis (Engineering); Logan Melican (Engineering); Daniel Lemus (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1075**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Internal Stress Relaxation and Geometry Simulation of Additively Manufactured Fiber Reinforced Thermoplastic Composite Through Heat Treatment

Innovative Technology/Entrepreneurship/Design

Author(s):

Harry Lee† (Engineering, JMHC)

Abstract:

Interest in additive manufacturing for large scale tooling has increased in the composites industry because of its cost and time advantages in large scale prototyping and small production runs compared to traditional metal tooling. However, a notable challenge for additive manufacturing is internal stress caused by sequential deposition of molten material. When exposed to elevated temperatures, such as a cure cycle, the internal stress is released, leading to shape changes. This study demonstrates the effectiveness of heat treating additively manufactured parts to alleviate internal stresses controllably and predictably. U-shape and closed U-shape geometries were printed using Polyetherimide (PEI) reinforced with 25% carbon fiber by weight. The closed U-shape included an additional wall between the ends of the U-shape to constrain them. Removing the wall before heat treatment showed greater spring-in compared to removing it after heat treatment, which indicated reduction in internal stress. Finally, the additive manufacturing process and heat treatment process were simulated for the normal U-shape to visualize the internal stress and compare the modeled and experimental shape change. The results of this study agreed on the importance of heat treatment to alleviate internal stress for purposes such as composite tooling and showcased the accuracy of physics-based models.

Keywords: Additive Manufacturing; Composite; Carbon Fiber; Simulation

Mentor(s):

Eduardo Barocio (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1076**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Critical assessment of corporate sustainability indexing methods

Social Sciences/Humanities/Education

Author(s):

Sarah LeFever† (Engineering)

Abstract:

As consumer interest in environmental protection grows, corporations have begun expanding their sustainability efforts. Consequently, eco-labels claiming environmental friendliness are becoming more widespread with over 450 in the Ecolabel Index alone. Concerns arise over the reliability of these labels, particularly those lacking third-party verification. This research seeks to investigate a set of eco-labels regarding carbon emissions that may make incorrect efficiency claims without the proper consideration of rebound effects. To do this, we developed a matrix of recognized eco-labels and gathered publicly available information about their calculation methodologies. To fill in gaps in the information, surveys were designed for completion by representatives of the respective corporations. We analyzed the data to find patterns regarding potential fallacies in the labeling schemes. Anticipated results include the identification of an economic misunderstanding among eco-labels making efficiency claims. Statistics and figures will highlight the patterns found in labels falsely advertising a minimal environmental impact. Our findings aim to encourage the proper integration of rebound effects in impact assessments and raise awareness about eco-label reliability.

Keywords: Eco-Label; Sustainability; Carbon Emissions; Efficiency

Mentor(s):

John Mulrow (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1077**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Activation of the Unfolded Protein Response by VceC

Life Sciences

Author(s):

Sydney Leohr† (Science)

Abstract:

The unfolded protein response (UPR) is a eukaryotic signaling network initiated within the endoplasmic reticulum (ER) that regulates proteostasis (ie. cell fate in response to cellular and ER stress caused by misfolded proteins). We have identified the ER-resident human FIC (filamentation induced by cyclic AMP) protein, HYPE (Huntingtin-yeast Partner E), as a crucial UPR control hub. HYPE regulates proteostasis by reversibly AMPylating (adding an AMP moiety to) the chaperone BiP, thereby regulating BiP's ATPase activity and protein folding capacity. Some pathogenic bacteria, like Brucella abortus, can manipulate UPR upon infection by secreting effector proteins that hijack host proteostatic pathways. B. abortus uses a Pro-rich secreted effector VceC (VirB Coregulated Effector C) to activate UPR potentially by interacting with BiP. Additionally, we found that HYPE AMPylates VceC. To determine the significance and structural mechanism for VceC function, here we describe our findings with a mutant lacking its Pro-rich domain that is critical for activity (ΔPR). Interestingly, we observed an unexpected cleavage of affinity-purified ΔPR VceC resulting in two bands totaling the expected weight. Using Western blotting and mass spectrometry, we will determine the site of VceC proteolysis and HYPE-mediated AMPylation. We hypothesize that VceC is autoproteolytic and that HYPE-mediated AMPylation alters its activity.

Keywords: Fic Protein; VceC; ER; UPR; AMPylation

Mentor(s):

Seema Mattoo (Science); Ben Watson (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1078**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Investigation of high energy radiation effects on electronic memory devices

Physical Sciences

Author(s):

Isabella Levine† (Engineering, JMHC)

Abstract:

Electrically Erasable Programmable Read-Only Memory devices (EEPROMs) store critical data in spacecraft; however, they face significant challenges in the harsh space environment, notably from radiation damage. While past research has explored the effects of certain radiation types like protons, electrons, and gamma rays, the impact of heavy ions from cosmic rays remains uncertain. This study aims to investigate the reliability and memory of EEPROMs under such radiation using Purdue University's Rare Isotope Measurement Laboratory (PRIME) and its accelerator mass spectrometer. An accelerator mass spectrometer aims to speed ions to highly high kinetic energies, creating a radiation field. By subjecting EEPROMs to diverging heavy ion beams at varying radiation doses, we seek to understand their response over time and identify critical dose thresholds. Through this analysis, we aim to determine which nuclei pose the greatest threat to EEPROM functionality aboard spacecraft, informing strategies for radiation protection. The outcomes of this research will contribute to a deeper understanding of EEPROM behavior in dynamic space environments and provide insights into mitigating radiation-induced damage in spacecraft systems. Ultimately, this knowledge will be crucial for ensuring the integrity and functionality of critical electronics during extended space missions.

Keywords: Radiation Hardening; EEPROM; Heavy Ions; Spacecraft; Radiation Effects

Mentor(s):

Peter Bermel (Engineering); Sayan Roy (Engineering); Stylianos Chatzidakis (Engineering); Allen Garner (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1079**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Validation of a Theoretical Model for Optimized Autoinjector Parameters Through Rapid Testing

Innovative Technology/Entrepreneurship/Design

Author(s):

Brianna Lewis† (Engineering, JMHC); Alexis Hawkins† (Engineering, JMHC); Claire Maurer† (Pharmacy)

Abstract:

Autoinjectors (AIs) are essential medical devices for self-administering subcutaneous injections of biopharmaceuticals, offering benefits such as ease of use, reduced anxiety, and precise dosing. Variation of controllable AI parameters (e.g. spring force, fluid viscosity, fluid volume, air gap in the syringe, etc.) can greatly impact the overall system performance and influence drug efficacy post-injection. Thus, identifying optimal design specifications is a crucial aspect for effective drug delivery. In a previous work a theoretical model was developed to optimize AI parameters for more robust delivery. This study focuses on validating the model outputs through rapid testing tunable parameters with a modular platform that allows these controllable AI variables to be adjusted test by test. The modular system utilizes a stabilizing loading dock and high-speed camera setup to capture and analyze the injection process by image processing with in-house developed software. We will use the optimization outputs from the theoretical model to adjust controllable parameters in a design of experiment. This will allow us to verify outputs and test if other configurations outside the model bounds may provide differing results that are more optimal. Our findings will help reveal if optimization of controllable AI parameters is feasible and may provide more efficient drug delivery.

Keywords: Autoinjector; Drug Delivery; Subcutaneous Injection; Image Processing

Mentor(s):

Pavlos Vlachos (Engineering); Brett Meyers (Centers & Institutes); Rozhin Derakhshandeh (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1080**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Emotions Surrounding Human Papillomavirus Vaccination Discussion on Reddit

Social Sciences/Humanities/Education

Author(s):

Selina Lin† (Science, JMHC); Chris Farber* (Science, JMHC); Neel Sarathy* (Science, JMHC)

Abstract:

Social media use has been steadily increasing, and more and more people have taken to the internet to express their thoughts and ideas. Information found online can play an important role in influencing one's opinions. With vaccination being a highly debated topic, the question of the state of the discussion on Human Papillomavirus (HPV) vaccinations needs to be explored. The aim of this project is to categorize emotions on HPV vaccination discussion on Reddit with machine-learning techniques. To achieve this, Reddit posts on HPV vaccination were collected from eight subreddits since December 2023. A pre-trained BERT (Bidirectional Encoder Representations from Transformers) model will be fine-tuned with the GoEmotions dataset from Google Research for the task of predicting the emotions conveyed by the Reddit posts. Then topic modeling will be applied to posts categorized under the top five most identified emotions. The results of this study will help reveal the general opinion on HPV vaccinations in online discussions, allowing one to see specific emotions often associated with the topic and common words and phrases linked to the top five emotions. With this information, professionals can determine whether there is a necessity to promote or educate the public on HPV vaccinations.

Keywords: Human Papillomavirus; Vaccination; Reddit; Machine Learning; Emotions

Mentor(s):

Soojung Jo (HHS); Min Sook Park (University of Wisconsin Milwaukee)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1081**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**A prediction model of antibiotic treatment success in dairy calves with bovine respiratory disease**

Life Sciences

Author(s):

Erica Long† (Agriculture)

Abstract:

Bovine respiratory disease (BRD) is a bacterial and viral disease which causes respiratory illness particularly common in beef and dairy calves in which microbes infect the lung cavity, leading to cattle morbidity and mortality. BRD has been identified as the leading cause of death in pre- weaned dairy calves, leading to significant economic impact in producers because of animal death, reduced feed efficiency, and treatment cost. BRD is typically diagnosed on-site based on visual signs including coughing, nasal discharge, fever, labored breathing, or decreased appetite or water intake. Due to the lack of specificity in diagnosing BRD and determining the microbe causing BRD, it can be difficult to determine which antibiotic would be most successful.

Many farms regularly collect animal data to document events such as weight, serum protein, movement, feed intake, weather, and pneumonia treatments. Treatment failure is defined through these data points based on need of retreatment and/or animal death. The goal of this experiment is to develop a machine-learning algorithm based on animal metadata which could predict antibiotic treatment success. A large five-year dataset from a local Indiana dairy was cleaned and translated into a format readable to a machine learning model. A random forest model was employed to determine correlation between many factors (such as weather, feed intake, or age) and treatment successes, which may be applied to use in farm settings as a rapid antibiotic prediction. If the model can predict successful treatment, then the frequency of chronic illness, re-treatments, and death are decreased.

Keywords: Bovine Respiratory Disease; Calves; Prediction Model

Mentor(s):

Tim Johnson (Agriculture); Isabela Garcia Mendes de Araujo Santos (Agriculture); Madison Simonds (Agriculture); Ruth Centeno Martinez (Agriculture); Jacquelyn Boerman (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1082**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Development of species-specific PCR primer sets for the detection of Sporobolomyces lactucae, a leafy vegetable-associated yeast

Life Sciences

Author(s):

Noah Lyon† (Agriculture)

Abstract:

The basidiomycetous yeast species Sporobolomyces lactucae represents more than a quarter of the mycobiome of commercially grown romaine lettuce in the United States. Romaine lettuce is also a leafy vegetable crop commonly implicated in foodborne pathogen outbreaks. Current detection methods of foodborne pathogens on leafy greens is often costly or time-consuming. Thus, the development of new molecular tools for such detection is needed. The yeast S. lactucae may be leveraged as a living biosensor, but its association with other leafy green vegetables is not known. Our work aims to develop a species-specific primer pair targeting S. lactucae for rapid detection of the yeast on various leafy green vegetables. The internal transcribed spacer region of S. lactucae was used as the source sequence for primer development. Primers were designed using the Primer3 software via the web interface. Gradient polymerase chain reaction was used to determine the optimal annealing temperature without cross-reactivity with closely related Sporobolomyces species. The optimal cycle number required to enable precise detection of S. lactucae was tested against the same related species. The optimal conditions for S. lactucae detection are an annealing temperature of XX and XX cycles. These primers were tested on lettuce slurries for targeted detection of S. lactucae. This work provides a valuable tool for future investigations into the ecological dynamics of this yeast in diverse environments, with implications for food safety and microbiome studies.

Keywords: Primer Development; Biosensors; Yeasts; Sporobolomyces

Mentor(s):

Cathie Aime (Agriculture); Samira Fatemi (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1083**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Career expectations of college students in Construction Management and related fields

Innovative Technology/Entrepreneurship/Design

Author(s):

Yashwanth Reddy Mahesh Kumar† (Polytechnic)

Abstract:

The construction industry faces a critical workforce shortage, undermining project timelines, efficiency, and overall sustainability. This research aims to explore the underlying factors that influence an individual's decision to enter the Construction Management field, aiming to provide a fine understanding of the motivations, educational pathways, and career ambitions that shape the industry's future workforce. Through a carefully designed survey questionnaire, this study engages with a broad spectrum of participants, including college entrants, and current students, to accumulate insights into their educational experiences, career objectives, and preferences regarding company size and sector within the construction management landscape. The questionnaire's diverse array of questions is crafted to resonate with respondent's varied experiences and perspectives, offering a comprehensive overview of the factors guiding career choices in Construction Management. The significance of this research lies in its potential to inform educators, industry leaders, and policymakers about the preferences and expectations of the next generation of construction managers. By identifying key trends and motivations, the study aims to contribute to the development of targeted strategies that address the workforce challenges in the construction industry, fostering a strong foundation of skilled professionals ready to meet the demands of the future.

Keywords: Construction; Education; Career

Mentor(s):

Deniz Besiktepe (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1084**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Spatially Fractionated Radiation Therapy (SFRT): Quality Assurance of a Pre-clinical Radiation Therapy Modality

Physical Sciences

Author(s):

Carson Mann† (HHS)

Abstract:

Spatially fractionated radiation therapy (SFRT) is an innovative modality utilized in the treatment of cancerous tumors with numerous preclinical studies employed to facilitate its difficult translation into clinical applications. The translation has been difficult because, while scientists have shown its efficacy, the responsible mechanisms resulting in superior tumor control in specific cases remain unclear. One such project conducted at Purdue utilizes a grid-like arrangement of tungsten ball bearings to selectively shield X-rays. My project involved the development of a quality assurance plan for the irradiator that will be used along with the GRID. This quality assurance protocol is designed to mimic the standards of a clinical environment. For the first phase of this project, we conducted a review of current literature to analyze the relevant methods for assuring quality outcomes. The second phase of the project involved compiling data using an ion chamber and electrometer to measure radiation exposure. The outcome of these two phases was a comprehensive protocol that will be used to verify the integrity of this type of irradiator and future data for studying the biological effects of SFRT.

Keywords: Spatially Fractionated Radiation Therapy; GRID

Mentor(s):

Matthew Scarpelli (HHS); Mackenzie Coon (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1085**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Traffic Sign Detection Android Application**

Mathematical/Computation Sciences


Author(s):

Gabe Martinez† (Engineering); Abhilash Saravana† (Engineering); Christopher Lee† (Science); Nandini Pande† (Science)



Abstract:

The goal for our project is to create an Android app that will take a user input image and classify it to one of four types of traffic signs: stop sign, crosswalk sign, speed limit sign, or yield sign. Our application will ask the user to take a picture of a traffic sign and give the user the option to crop the image. The app will then send the image to our back-end servers to be preprocessed and run the image through our fully connected neural network built from scratch. Once this trained network classifies the type of traffic sign, it will display the correct traffic sign type to the user in the android app. Our model will be trained to identify the type of traffic sign based on its defined shape or text. We have researched many different image processing techniques, both in the preprocessing stages and the training neural network stages. We believe that the fully connected neural network along with edge detectors like the sobel edge detector will best help us accomplish our goals of accurate image classification. Our hope is that this app will help young or new drivers to memorize the many traffic signs they might see on the road, so that they can more efficiently learn the rules of driving.



Keywords: Android Application; Fully Connected Neural Network; Image Classification; Image Processing



Mentor(s):

Edward Delp (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1086**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Purdue Students' Perception of Exercise**

Physical Sciences

Author(s):

Annie McCarthy† (HHS)

Abstract:

Research indicates that exercise has numerous positive effects for college students, going beyond physical fitness. The National Institute of Health informs us that hese benefits include improved mental health as well as increased cognitive performance. These findings led me to wonder how college students, Purdue students in particular, perceive exercise and what their motivating factors are or what reasons they may have for not regularly working out. Through the next stage of my research I collected data and information that lead me to the things that play a role in our student's general activity and routines.

I collected information through interviews and a survey. I interviewed CoRec directors to get data on the populations that are most frequently at the CoRec as well as information on their facilities. I also created and distributed a survey to gather information about peoples' individual habits. This was taken by any Purdue student and asked about their status as a student, but remains confidential, and their general exercise and activity habits along with their reasons for them.

From this research I believe that I will discover that many members of our student body refrain from working out regularly due to a lack of time in their busy schedules or a general lack of interest. These findings do not call for a change of action from our university or our student body, but give researchers more insight on how Purdue students perceive the relevance of physical activity.

Keywords: Factors; Motivation; Physical Activity; Exercise

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1087**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Predicting Teamwork Performance in a Cooperative Virtual Reality Simulator through Physiological and Communication Analysis

Innovative Technology/Entrepreneurship/Design

Author(s):

Aidan McDonough† (Engineering)

Abstract:

The assessment of teamwork has traditionally been completed by expert observation and self-assessment, which is subject to bias, does not provide real-time feedback, and can be costly. A physiological sensing approach may allow for the determination of teamwork quality, which is objective, measured in real-time, and has a lower cost. Virtual reality (VR) based simulators have also been shown to be an effective team skills training tool. Therefore, this study aims to predict team performance in a cooperative VR task using verbal communication and individual heart rate metrics. Heart rate, task performance, and verbal communication data were synchronously collected while participants worked together to address visual prompts at regular and rapid intervals by pushing relevant buttons in the VR environment. Verbal communication was analyzed to extract metrics including overlap and frequency of interaction. A classification machine learning model was trained on all heart rate and verbal communication metrics to predict team task performance. Preliminary data shows that communication overlap is predictive of task difficulty and team performance. Data collection is ongoing, and we expect further analysis to show strong links between task difficulty and team performance. Findings suggest it may be possible to predict team performance with physiological and verbal communication metrics in simulated environments. These metrics can be implemented to allow real-time analysis of teamwork quality, which may boost the effectiveness of VR-based training used in various domains.

Keywords: Team Performance Prediction; Physiological Sensing; Verbal Communication Analysis; Machine Learning Classification; Virtual Reality (VR) Simulation

Mentor(s):

Denny Yu (Engineering); Ryan Villarreal (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1088**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Finding the Sensitivity of Detecting Toponium at the LHC

Physical Sciences

Author(s):

Karrick McGinty† (Science); Mason Giacchetti* (Science, JMHC); Travis Hastreiter* (Science)

Abstract:

The standard model predicts the existence of Toponium which is a particle defined as the bound state of a top quark and an antitop quark. Toponium has not been observed since anti top quarks have an extremely short lifetime and it decays almost instantly before it is able to bind with another quark.  Methods: We select events that contain 2 reconstructed leptons and 2 reconstructed b quarks which are potentially the decay products of a pair of top quarks from proton-proton collisions at a center of mass of 13 TeV at the Large Hadron Collider. The data were collected at the CERN LHC in 2016 with an integrated luminosity of 35.9 fb-1.  This study aims to test the sensitivity at finding toponium in the CMS detector and it takes into consideration the systematic uncertainties of the measurements.  Results:  Hypotheses with and without the existence of toponium are tested by fitting on systematic uncertainties as nuisance parameters. Impact plots of systematic uncertainties were generated using the Higgs Combine Tool (HCT). Likelihood plots are presented to scan for discontinuities in the fits provided by the HCT.  Conclusion:  Further work needs to be done to create a signal strength on our experiment using a Monte Carlo simulation of pseudo experiments utilizing Barlow beesten statistics.  This will aid in proving the existence of toponium.

Keywords: Toponium; Particle Physics; Large Hadron Collider; Higgs Combine Tool

Mentor(s):

Andreas Jung (Science); Andrew Wildridge (Science); Yao Yao (Science); Ethan Colbert (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1089**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Developing an Algorithm to Identify Potential Programmed Ribosomal Frameshifts in Arthrobacteriophage Genomes

Life Sciences


Author(s):

Stan Melkumian† (Polytechnic); Elizaveta Filippova† (Engineering); Prakhar Saxena† (Engineering); Adam Weber† (Agriculture, Engineering); Ethan Shatz‡ (Engineering); Dean Stornello‡ (Engineering, Science)



Abstract:

Bacteriophages (phages) are viruses that infect and replicate inside bacterial hosts. The rise of antibiotic resistance is a threat to global health due to the widespread use of antibiotics, pressuring bacterial pathogens to mutate. Researching how phages utilize multiple reading frames to translate proteins from small, tightly-packed genomes is critical to better understanding phage genome mechanisms. This knowledge can contribute to developing alternative medical therapeutics for antibiotic-resistant bacterial infections, such as phage therapy. Programmed ribosomal frameshifting (PRF) is a genetic phenomenon conserved across phages in which genes are encoded across more than one reading frame, resulting in overlapping genes. We developed an algorithm in Python to identify and visualize the locations of potential slippery sequences in phage genomes, and the accuracy of the algorithm was validated using the annotated genomes of AP2 subcluster arthrobacteriophages Beagle, Odyssey395, and Pureglobe5. Applying the algorithm to the unannotated phage genome of MellowYellow resulted in the identification of multiple slippery sequences. Identifying and confirming PRFs is a challenge, although this tool allows for future exploration of synteny and genomic conservation of ribosomal frameshifting across bacteriophage clusters, which in turn will allow researchers to advance technologies for antiviral treatments, virus-mediated genetic engineering, and antibiotic resistance treatments.



Keywords: Bacteriophages; Programmed Ribosomal Frameshifting; Slippery Sequences; Algorithm; Genome Annotation



Mentor(s):

Adam Quinn (Agriculture); Daphne Fauber (Engineering); Harry Ashbaugh (Engineering); AJ Gin (Engineering); Kari Clase (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1090**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Effect of Developmental Manganese Exposure on the Locomotor Behavior of Zebrafish Larvae

Life Sciences


Author(s):

Breeann Mild† (HHS, JMHC)



Abstract:

Manganese is a trace mineral essential for living organisms. There is a great concern for high manganese exposures during the developmental period due to the vulnerability of the developing central nervous system. To investigate these impacts, the zebrafish, a whole organism biomedical model system, is used to evaluate chemicals for their potential developmental neurotoxicity and relate them to humans due to their shared similarities in physiological system development. This study tested the hypothesis that exposure to manganese (as manganese chloride) during the early developmental period results in changes in locomotor behavior in a dose-dependent manner. Zebrafish embryos (at 1-2 hours post fertilization, hpf) were exposed via immersion to five different concentrations of manganese (0, 0.01, 0.05, 0.1 or 0.5 mmol). At 120 hpf, larvae were rinsed, and the visual motor response assay was completed, including five alternating phases of dark and light, each measuring total distance moved, velocity, and time spent moving. A repeated measures ANOVA test completed to determine significant differences ($\alpha$=0.05). Additionally spontaneous movement at 24 hpf, heart rate at 48 hpf, and daily measurements of survival and hatching rates, were recorded. While consistent hypoactivity occurred in the higher treatment groups, hyperactivity specific to the light phases in the lowest treatment group was detected. There was also a rise in spontaneous movement at 0.05 mmol, a decrease in heart rate at 0.5 mmol, and quicker hatching time at 0.1 and 0.5 mmol at 24 hpf. These findings support a connection between manganese exposure and locomotor behavioral alterations.



Keywords: Toxicology; Manganese; Zebrafish; Neurodevelopment


Mentor(s):

Jennifer Freeman (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1091**

*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Calling sites of frogs are not optimal for signal transmission

Life Sciences


Author(s):

Mickayla Miller† (Science)



Abstract:

[Abstract Redacted]



Keywords: Signal Transmission; Frogs; Acoustic; Habitat; Sound Attenuation



Mentor(s):

Ximena Bernal (Science); Katherine González (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1092**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Analysis on the Efficacy of Auto-Annotators in Bacteriophage Genomes

Life Sciences

Author(s):

Giovanni Minghetti† (Agriculture, Engineering); Seth Jimenez† (Agriculture, Engineering); Adelaide Bullard† (Agriculture, Engineering); Lillian Woolley† (Agriculture, Engineering)

Abstract:

Bacteriophages are viruses which infect a specific host bacterium, and they can be used to fight antibiotic resistant bacteria. The bacteriophage DoctorPepper infects the bacteria Arthrobacter globiformis, a bacterium commonly found in soil. A case study on the bacteriophage DoctorPepper's gene five concluded that it was likely the site of a transmembrane protein, a protein which spans the entire width of the membrane. The auto annotator had difficulties calling the correct reading frame for this gene, calling it a reverse gene, despite all genes surrounding it being called in the forward direction. Upon inspection of similar phages within DoctorPepper's cluster AW, the associated gene fives of these phages are also seemingly transmembrane proteins. The softwares PyMol, AlphaFold, and Phamerator were used to observe the structure of the transmembrane proteins and determine visible similarities across numerous phage genomes. Investigation was done into whether auto annotators such as Glimmer and GeneMark have inherent difficulties calling the reading frame of transmembrane proteins, or if DoctorPepper_5 was an isolated case. Auto annotators seem to have difficulties identifying the correct reading frames of transmembrane proteins. Understanding how auto annotators make conclusions can inform decisions while making manual annotations and can inform future programs to improve auto annotation algorithms. As phage therapies are increasingly studied and implemented, it is necessary for their genome to be known. Having auto annotators that can be trusted to make gene calls is vital to having large databases of phage genomes, when manual annotation is labor and time-consuming.

Keywords: Auto-Annotator Analysis; Transmembrane Proteins in Bacteriophages; Membrane Complexes; Open Reading Frame Analysis; Annotation Algorithms

Mentor(s):

AJ Gin (Engineering); Harry Ashbaugh (Engineering); Daphne Fauber (Engineering); Adam Quinn (Agriculture); Kari Clase (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1093**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Adolescent schooling experience during the covid-19 pandemic, anxiety, and cortisol levels: the mediating role of media use

Social Sciences/Humanities/Education

Author(s):

Hannah Murawski† (HHS)

Abstract:

The COVID-19 pandemic drastically impacted almost every population throughout the world. In adolescents specifically, the rapid closure of schools forced many to adapt to virtual schooling, which posed many challenges. This study aimed to explore how this shift to virtual schooling was associated with changes in anxiety and cortisol levels in adolescents during the pandemic, and how adolescents' media use mediated this association. Data were collected from 230 adolescents (Mage = 14.73; 45.2% female) who were enrolled in the Early Growth and Development Study (EGDS) COVID Light Touch Assessment. Using data collected from 11/2020 to 02/2022, structural equation models were run using SAS 9.4 and STATA 18.0 to examine the association between virtual schooling, anxiety, and cortisol, as well as the mediating role of media use (i.e., watching TV, using social media, and playing video games). The results indicate that there was stability in cortisol levels across the pandemic. In addition, more social media use during Fall 2020 predicted higher anxiety in Summer 2021. Despite any challenges that occurred from the shift to virtual schooling, it was not found to be associated with changes in anxiety and cortisol. Adolescents may have used social media during the pandemic as an escape from their anxiety. Excessive social media use is not a mechanism to improve anxiety and thus is associated with more anxiety post pandemic. The motives of social media use and anxiety during Fall 2020 were not explored in this study so further research should examine this association.

Keywords: COVID-19 Pandemic; Virtual Schooling; Media Use; Anxiety; Cortisol

Mentor(s):

Kristine Marceau (HHS); Li Yu (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1094**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Closely related species of frogs experience different levels of signal degradation in a tropical forest**

Life Sciences

Author(s):

Kathryn Myers† (Science)

Abstract:

[Abstract Redacted]

Keywords: Signaling; Signal Degradation; Anurans; Acoustic Signals; Ecology

Mentor(s):

Ximena Bernal (Science); Katherine González (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1095**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Development of Neocarzilin A Derivatives as Antimetastasis Agents Targeting VAT1

Life Sciences

Author(s):

Andrew Nelson† (HHS); Noor Owayni† (Pharmacy)

Abstract:

[Abstract Redacted]

Keywords: Drug-Discovery; Cancer Therapeutics; Organic Synthesis; Natural Products

Mentor(s):

Betsy Parkinson (Science); Noah Moriarty (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1096**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Implementing Machine Learning in Child Speech Transcription

Innovative Technology/Entrepreneurship/Design

Author(s):

Aarohi Panzade† (Science, JMHC); Akhil Kasturi† (Science); Rahul Ghosh† (Science)

Abstract:

[Abstract Redacted]

Keywords: Deep Learning; Machine Learning; Automatics Speech Recognition; Speech Recognition; Linguistics

Mentor(s):

David Purpura (HHS); Avery Closser (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1097**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Impact of RAGE Inhibitor Administration on Tendon Biomechanical Properties in Mouse Model of Type 2 Diabetes

Life Sciences

Author(s):

Karina Paone† (HHS, JMHC)

Abstract:

Disruption of tendon extracellular matrix homeostasis and altered biomechanical properties result in substantial clinical challenges for millions of individuals with diabetes. We explored the possible connection between serum advanced glycation end-products (AGEs) and activation of the receptor for AGEs (RAGE) and altered tendon properties with diabetes. AGEs accumulate in the serum with the intake of AGE-rich foods (foods cooked at high temperatures, highly processed foods) or chronically elevated serum glucose levels (diabetes). We determined the effect of RAGE inhibition on tendon biomechanical properties in a translational mouse model of type 2 diabetes. Nineteen db/db mice with naturally elevated serum AGEs and impaired tendon function were treated daily with a RAGE inhibitor [Azeliragon (AZ), n=9] or vehicle (n=10) for three weeks. After three weeks, mice were euthanized, and limbs were tested for various biomechanical characteristics. Stiffness and modulus were calculated from the linear portion of the load-displacement and stress-strain curves, respectively. Patellar tendon stiffness, modulus, and maximum stress tended to be greater in AZ-treated Db/Db mice. Using an established RAGE inhibitor, we demonstrate that administering a RAGE inhibitor improves tendon properties in an established mouse model for type 2 diabetes. The Purdue University Animal Care and Use Committee approved this study (Protocol #: 1905001903).

Keywords: AGE; Tendon; Biomechanical; Mouse; Diabetes

Mentor(s):

Chad Carroll (HHS); Eric Gutierrez (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1098**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Limitation of deep learning approach to automatic sleep phase scoring. Application of Otsu's method to multitaper spectrogram as alternative strategy to future implementation of a decision tree algorithm.

Life Sciences

Author(s):

Mitul Patel† (Engineering)

Abstract:

Sleep phase scoring is the crucial initial stage of sleep analysis, involving dividing electroencephalogram (EEG) recordings into wakefulness, non-rapid eye movement sleep (NREM), and rapid eye movement sleep (REM). Typically performed manually by trained experts like neurologists and sleep researchers, this process relies on identifying distinct phases based on changes in EEG wave frequency and amplitude corresponding to the subject’s behavior, often monitored via video and/or electromyogram (EMG) recordings. Due to its time-intensive nature, various automatic scoring methods have been developed to expedite data processing. Deep learning algorithms offer high accuracy but require extensive initial manual scoring for training. We evaluated the performance of AccuSleep, a validated, freely available deep learning sleep scoring software, on 18 days of EEG data (3 days per 6 mice) recorded and manually scored in our laboratory. Following thorough training (1 full day per animal used as a training set), the average correct recognition rates were 96%, 95%, and 76% for wake, NREM, and REM, respectively, with 20% of REM epochs mislabeled as wake. The training time can be avoided with automatic algorithms employing classification decision trees with predefined thresholds, but accuracy tends to suffer when thresholds are based on manual decisions or deviation from mean, neglecting inter-subject variability. To establish deterministic thresholds for creating a more accurate and fast sleep phase scoring algorithm, we will analyze the EEG spectrogram, estimated with the multitaper method, as successfully employed in human sleep analysis, and apply Otsu’s method to identify distinct differences between sleep phases.

Keywords: EEG Quantitative Analysis; Otsu's Method; Deep Learning; Sleep Phase Scoring

Mentor(s):

Riyi Shi (Veterinary Medicine); Martina Dalolio (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1099**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Unraveling the Impact of Generative AI in the Classroom and Education Research**

Innovative Technology/Entrepreneurship/Design

Author(s):

Vidhi Patel† (Liberal Arts)

Abstract:

Introduction: The emergence of generative AI has introduced a paradigm shift in education and educational research. With its profound capabilities in generating human-like results, it has both intrigued and concerned educators and researchers alike. This study aims to provide insights and recommendations for the effective and ethical use of generative AI in the education setting.

Contribution: Generative AI, pioneered by entities like ChatGPT and Gemini (formally, Bard), entered the scene respectively, November 2022 and March 2023. However, its implications have been profound, swift, and raising concerns around the efficient and ethical use of generative AI in educational settings. Despite efforts to develop AI detectors, such as GPTZero and Copyleaks , their accuracy remains questionable in the face of evolving AI capabilities.

Methods: This review paper employs a systematic thematic analysis aimed to explore new literature with respect to challenges, benefits, and general implications for the use of generative AI in higher education. existing literature concerning the integration of generative AI in higher education. By examining a wide range of sources, it aims to provide a comprehensive understanding of this new technology.

Results: Thematic analysis of the literature reveals many benefits, challenges, and avenues for future research. Benefits include enhanced personalized learning experiences, streamlined content creation, and innovative assessment methods. However, challenges encompass ethical concerns, the authenticity of generated content, and the need for effective regulation. Future research should focus on addressing these issues while harnessing the potential of generative AI.

Conclusion: In light of the findings, this paper offers insights, implications, and recommendations for effectively and ethically using generative AI in the classroom setting and research setting. Educators are encouraged to stay informed about AI advancements, integrate generative AI responsibly into their teaching practices, and prioritize critical thinking and creativity in education. Researchers are urged to explore the ethical implications of generative AI, develop robust detection mechanisms, and collaborate across disciplines to shape the future of AI in education positively. Through collective efforts, we can navigate the complexities of generative AI and harness its transformative potential in education and research.

Keywords: Teaching; Learning; Technology; ChatGPT; Undergraduate

Mentor(s):

Lisa Bosman (Polytechnic)

**Poster Presentation Abstract Number: 1100**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Characterizing Photonic Devices using Dual-Comb Spectroscopy

Innovative Technology/Entrepreneurship/Design

Author(s):

Stanislav Pelipad† (Engineering)

Abstract:

Integrated photonics has been a widely researched area in the past few decades, due to the strong potential of optical signals as an information carrier: optical signals travel at the speed of light, have large instantaneous bandwidths, and are not easily susceptible to electrical interference, among other reasons. On the silicon photonics platform in particular, commercial foundries offer a wide range of optical functionality such as waveguiding, modulation, and photodetection. It is often necessary for the designer to iterate designs depending on fabrication tolerances and device performance. For this reason, accurately characterizing the optical response at the device and system-level is crucial to realize efficient integrated photonic circuits. This research explores a method of swept-wavelength dual-comb interferometry (SWDCI) to rapidly acquire the complex transfer function of optical circuits. We use the commercial software Ansys Lumerical Interconnect to run circuit-level simulations of a SWDCI experiment and show that it can be used to accurately measure the optical transfer function. This work will guide the experimental setup of a SWDCI system, with feedback aiding in the understanding of the experiment.

Keywords: Photonics; Engineering; Simulation; Nanotechnology; Integrated Chips

Mentor(s):

Lucas Cohen (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1101**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**The effects of total nitrogen and total phosphorus on amphibian disease**

Life Sciences

Author(s):

Emileo Peralta† (Agriculture, Science, JMHC)

Abstract:

Global amphibian populations are in a sharp decline, partially as a result of habitat degradation and disease. Chytridiomycosis, caused by the fungus Batrachochytrium dendrobatidis (Bd), is an infection that targets the skin of frogs and often results in mortality. To prevent further amphibian population declines it is important to understand how habitat degradation in the form of water pollution can impact amphibian disease. Our goal is to address the conflicting findings in existing literature on the relationship between two measures of water quality, total nitrogen (TN) and total phosphorus (TP), and Bd prevalence and intensity. We hypothesize that if amphibian immune systems are impaired by increased TN and TP concentrations, then Bd prevalence will increase with TN and TP concentrations. Therefore we predict that field sites with higher total nitrogen and phosphorus concentrations will have increased Bd prevalence and intensity. We performed sampling for amphibian disease and water quality across 12 water bodies in the West Lafayette area. We processed pathogen samples using DNA extraction and qPCR techniques. We processed water samples using vacuum filtration and mercuric sulfate digestion. We analyzed 113 water samples, with TN ranging from 0.28 to 7.66 mg/L and TP ranging from 0.03 to 2.64 mg/L. We plan to correlate TN and TP concentrations with Bd prevalence and intensity. These findings can help inform the conservation of amphibians in both the Midwest and across the globe.

Keywords: Disease Ecology; Freshwater Ecology; Conservation Biology; Water Pollution

Mentor(s):

Cat Searle (Science); Kurt Lutz (Science); Mark Williams (U.S. Department of Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1102**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Differences in Academic Performance Between Morning and Night People

Social Sciences/Humanities/Education


Author(s):

Megan Perr† (Science)



Abstract:

The gap in knowledge that my study aims to address is whether morning or night people perform better academically. The significance of this topic is that on a college campus such as Purdue University, the difference in what time a person goes to sleep and wakes up may drastically determine their academic performance. The main objective of my preliminary research project is to investigate the difference in academic performance between morning and night people at Purdue University. The method that I employed to conduct my research is a questionnaire. I collected data through a nine-question survey, with questions relating to sleep patterns and academic performance, administered to second-year students at Purdue University. The significance of my research is that with my findings, students may change their sleep patterns to improve their academic performance. This study contributes to helping understand whether morning or night people perform better academically by using real data from college students at Purdue University. The questionnaire aims to gather information from college students about their sleep patterns and academic performance, this can then be used to help understand whether morning or night people perform better academically.



Keywords: Academic Performance; Sleep Pattern; Early Bird; Night Owl; Purdue University



Mentor(s):

Michael Johnson (Liberal Arts)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1103**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Microbial Growth in Point-of-Use Water Filtration Systems

Physical Sciences


Author(s):

Giulio Pettenati† (Engineering)



Abstract:

Point-of-use water filtration systems are effective at removing emerging contaminants in drinking water that are often unregulated, but microbial growth may affect their performance. The objective of this study was to analyze the effects of microbial growth on contaminant removal in point-of-use water filtration systems. The impact of microbial growth on the removal efficiencies of contaminants by both activated carbon and reverse osmosis point-of-use water filtration systems was evaluated. Different levels of assimilable organic carbon were spiked into drinking water to evaluate their effect on microbial growth. Emerging contaminants, including perfluoroalkyl and polyfluoroalkyl substances (PFAS) and heavy metals, were spiked into drinking water, and their removal efficiencies by the activated carbon filters and reverse osmosis membranes were measured. The results showed that PFAS and metal removal for both filters were not significantly affected by microbial growth, except that PFAS removal efficiency was significantly correlated with bacterial concentration, which may be attributed to the increased cell hydrophobicity in mature biofilm on the active carbon filter. The results indicated that microbial growth may affect the removal performance of point-of-use water filtration systems and should be regularly monitored to maintain removal efficiencies of emerging contaminants.



Keywords: Point-of-Use Water Treatment Systems; Microbial Growth; Emerging Contaminant Removal; PFAS



Mentor(s):

Zhi Zhou (Engineering); Ejike Ken-Opurum (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1104**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Towards Secure Data Communication in Internet of Things using Attribute-Based Access and Communication Control (ABAC-CC)

Mathematical/Computation Sciences

Author(s):

Vinh Pham Ngoc Thanh† (Science, Polytechnic)

Abstract:

Internet of Things (IoT) is revolutionizing the capabilities of the Internet with billions of connected devices in the cyberspace. These devices are commonly referred to as smart things enabling smart environments, such as Smart Home, Smart Health, Smart Transportation, and overall Smart Communities, together with key enabling technologies like Cloud Computing, Artificial Intelligence (AI) and Machine Learning (ML). Security and privacy are major concerns for today's diverse autonomous IoT ecosystem. These IoT devices, smart health devices, smart home devices, such as smart TVs, sensors, thermostats, cameras, alarms and Amazon Alexa, Google Home, Apple HomeKit. They collect, share, and transmit huge amount of data to the cloud and/or other IoT devices and applications. This data may include sensitive and private information, such as user health or personal data. However, users have limited control on managing access to their data and are not able to do so since most of these devices send all the data to the cloud. In this research, our goal is to provide a mechanism to control access and data flow to sensitive user information by utilizing Attribute-Based Access Control and Communication Control (ABAC-CC) approach. ABAC-CC allows to extract data attributes from IoT data and include them in access control policies using ABAC model which includes user attributes, resource attributes, or environmental attributes. We implement this approach in a edge computing gateway. This gateway allows users to set which kinds of information can be sent to the cloud, how often to send/receive data, and also which kind of information their smart system may receive (e.g., blocking advertisement). This approach not only improves data privacy but also reduces the strain on end devices. To demonstrate the applicability of our approach, we conduct rigorous statistical tests on our implementation to confirm and highlight advantages of the ABAC-CC model.

Keywords: Internet of Things; Privacy and Security; Smart Home, Smart Health, Smart Transportation; Cloud Computing; Data Transmission

Mentor(s):

Smriti Bhatt (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1105**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Pangenome Exploration of the Genomic Similarities Between AW Cluster Bacteriophages

Life Sciences


Author(s):

Enos Pray‡ (Engineering); Armand Destin‡ (Engineering); Adalene Stangeland‡ (Engineering); Amy Murdock‡ (Engineering); Anagha Gaitonde‡ (Engineering); Megan Painter‡ (Engineering)



Abstract:

Bacteriophages (phages) are host-specific bacterial viruses with diverse, mosaic genomes. Phages can be used to combat antibiotic-resistant bacteria and to assist in food production due to their host specificity. Because phages are less researched compared to other microorganisms, determining groupings of similar phages remains a challenge. Currently, phages are sorted into genomic clusters that consist of phages with similar genomic sequences and partially or fully conserved genomic regions. A pangenome analysis was used to provide insight into the unique characteristics of a phage genomic cluster by defining the core genes shared among phage genomes in that group. Using both visualization tools such as PyMOL and Phamerator alongside protein BLAST software like NCBI and HHPred, this analysis of the actinobacteriophage cluster AW explores which genes are conserved across these phage genomes. The phage cluster AW demonstrates approximately 15 conserved gene regions throughout the 13 genomes. Genes of unknown functions were examined using the above software tools to identify potential functional domains. Once a reliable core genome is established, a true set of criteria for AW cluster phages can be defined. This research will continue to expand the current understanding of phages and their genetic diversity, allowing for greater control while utilizing them in various microbiological applications.



Keywords: Bacteriophages; Pangenome Analysis; Phage Genomic Clusters; Conserved Genes; Bioinformatics



Mentor(s):

AJ Gin (Engineering); Adam Quinn (Agriculture); Harry Ashbaugh (Engineering); Daphne Fauber (Engineering); Kari Clase (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1106**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Meteorological Case Study of QLCS Tornado in Southern Indiana on New Year's Eve 2018

Physical Sciences

Author(s):

Owen Rahman† (Science)

Abstract:

Quasi-Linear Convective Systems (QLCSs) are a category of severe weather in which a line of storms translates across an area, typically responsible for heavy rain, hail, and occasionally tornadoes. These events can be a frequent occurrence, especially in Indiana. Past studies have shown that 50% of all days in which a tornado occurs in Indiana results from a QLCS. On 31 December 2018, a line of severe storms passed through Northern Spencer County, Indiana, producing an EF-1 tornado. Comparing this Northern Spencer County tornado with other QLCS tornado cases in the literature, and to QLCS tornado statistics more broadly, it is shown that the responsible QLCS exhibited multiple characteristics outside of the expected ranges. These characteristics included time of day, month of the year, location given the month of occurrence, abnormally warm air temperature and dew point, low Convective Available Potential Energy (CAPE), and high wind shear. Initial weather conditions from Automated Surface Observing Systems, severe weather parameters derived from Rapid Refresh model data, storm damage observations from the National Weather Service's Damage Assessment Toolkit, and radar signatures from NOAA's WSR-88D radars were examined to determine how the event unfolded. This case study contributes to the growing body of literature over QLCS tornadoes. Heightened knowledge of tornadic QLCS events can improve forecasting and detection, leading to increased lead time to protect life and property.

Keywords: Meteorology; Tornado; Severe Storms; Radar; Case Study

Mentor(s):

Robin Tanamachi (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1107**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Assessing the Resilience of the Semiconductor Supply Chain

Mathematical/Computation Sciences


Author(s):

Zachary Ramirez† (Engineering, JMHC)



Abstract:

Resilience has been a growing area of interest within supply chain research. This has been driven by the increasing frequency of disruptive events within the globalized supply chain such as pandemics, geopolitical conflicts, and extreme weather events. Furthermore, rising demand for advanced electronics places semiconductors in a critical position for ensuring global security and promoting innovation.

This study seeks to assess current resilience levels in the semiconductor supply chain by analyzing historical disruptions and their impacts, identifying critical vulnerabilities and bottlenecks in the supply chain, and developing a comprehensive understanding of the factors contributing to supply chain disruptions through literature review of research on supply chain resilience in the semiconductor industry. It also proposes a framework for interpreting resilience and assessing the effectiveness of risk management options to provide actionable recommendations for manufacturers, suppliers, and policymakers. The study's findings suggest that the largest threats to the supply chain stem from a lack of supply chain coordination, vulnerability to hardware tampering, and shortage effects. As such, resilience depends on the ability of the semiconductor supply chain to adopt incentive alignment and information-sharing measures to increase coordination and communication, implement robust hardware security practices while maintaining low overhead, and optimize capacity decision-making to mitigate long-term shortage effects.



Keywords: Resilience; Risk Management; Semiconductor; Supply Chain Management



Mentor(s):

Tho Le (Polytechnic)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1109**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Maternal Mortality Rates in the United States: Exploring the Determinants and Implications

Social Sciences/Humanities/Education

Author(s):

Harini Ravichandran† (Liberal Arts)

Abstract:

The United States has the highest maternal mortality rate among any other industrialized nation. This issue is characterized by significant racial and socioeconomic disparities. Women of color, notably African American women, and individuals with lower socioeconomic status are disproportionately impacted. African American women are 2.6 times more likely to be affected by maternal mortality rates than their white counterparts. Additionally, women in low-income, Health Professional Shortage Areas (HPSA) are twice as likely to experience mortality from pregnancy-related complications than their wealthier counterparts. This research aims to analyze the determinants of maternal mortality rates in the United States, focusing on three lenses: racial biases in pain assessment, barriers to healthcare related to socioeconomic status, and the influence of hospital monopolies on the state of maternal healthcare in Indiana. In this study, the employed methods included a comprehensive literature review to explore scholarly works on racial bias in pain assessment. Subsequently, data analysis was conducted to synthesize relevant information, allowing for the identification of determinants that contribute to maternal mortality rates. As the research progressed, I examined existing solutions to maternal mortality rate issues and created my own strategies for reducing maternal mortality rates in the United States. This involved analyzing both domestic and international efforts, as well as public health policies, directed towards resolving this issue. The results indicate that racial bias in pain assessment has a significant effect on the quality of healthcare. Additionally, African American women experience higher rates of maternal mortality regardless of their socioeconomic status.

Keywords: Maternal Mortality Rates; State of Indiana; Racial Biases; Hospital Monopolies; Maternal Healthcare

Mentor(s):

Lynn Parrish (Liberal Arts); Alfred Lopez (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1110**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Elementary Teachers' Mathematics Curricular Reasoning: Connecting Instructional Decisions to Curricular Knowledge, Vision, and Trust

Social Sciences/Humanities/Education

Author(s):

Bronwyn Rigsby† (Education)

Abstract:

To better understand how elementary teachers use their curricular materials to plan and teach mathematics, we conducted a study focused on: (1) How and why do teachers select or evaluate and adapt curricular materials to teach mathematics?, and (2) How are teachers creating coherence across their curricular resources? In spring 2020, we surveyed 524 teachers from 46 states to first gain a broad understanding of their curricular use. In spring 2022, we conducted individual interviews (two per teacher) followed by group interviews with teachers from the same school. The findings discussed in this presentation are preliminary, based on our completed survey with 524 teachers and the first sample of interviews with 5 teachers. We focused on two of the teachers: Kasie (4th grade) and Jamie (3rd grade)-- from a mid-western elementary school. We explored their curricular decision-making through the lens of curricular reasoning. We transcribed all the interview data and used a top-down and bottom-up interactive data analysis to identify the complex relationship between teachers' curricular knowledge, vision, and trust. Using a collective case study design, we identified similarities and differences in Kasie and Jamie's curricular reasonings. Overall, our findings support the framework presented by Breyfogle (2010), in that our teachers' curricular knowledge is foundational to their curricular reasoning, which generates their curricular vision, which influences their curricular trust. Teacher educators need to better understand the complexities surrounding the development of curricular reasoning as they work to prepare pre-service teachers to effectively interact with a variety of curricular resources.

Keywords: Curricular Decision Making; Curricular Reasoning; Elementary Mathematics; Mathematics Curriculum; Curricular Use

Mentor(s):

Jill Newton (Education); Doris Fulwider (Education); Bima Sapkota (University of Texas Rio Grande Valley)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1111**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Antimicrobial Resistance: Navigating Ongoing Challenges and Future Implications**

Social Sciences/Humanities/Education

Author(s):

Ben Roberts† (HHS)

Abstract:

This paper serves as an in depth discussion on the major actions that Purdue is taking to combat the ever increasing problem of antibiotic resistance. Antibiotic resistant bacteria, a formidable challenge in modern society, threatens public health because of their constant evolving resistance to the very drugs we have created to eliminate them. With over 2.8 million cases of antibiotic resistant bacterial infections a year and this number only set to increase, the problem of antibiotic resistance is one that demands urgent attention. Using many resources and literature including scholarly articles, government websites, and Purdue's very own databases I have conducted very diverse research on this topic to discover how Purdue is facing these demands. Purdue is currently solving through the OneHealth solution, Hosting international conferences, antibiotic research, and through their public engagement initiatives. Purdue University serves as a model for other universities in providing a great deal of hope in combating the issues most often associated with antibiotic resistance. By addressing the problem of antibiotic resistant bacteria and actively participating in global initiatives, Purdue shows a comprehensive and effective approach to alleviating the challenges most often associated with antibiotic resistance. Moreover, Purdue’s dedication extends beyond the immediate solutions and emphasizes the importance of fostering collaborative efforts and shared responsibility among global actors that are currently working on this issue.

Keywords: Antimicrobial Resistance; Antibiotic Resistance; Infection; Antibiotic

Mentor(s):

Sidney Ducleroir (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1112**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Synthesis and characterization of CoIII complexes supported by a tetra-imine macrocycle (TEIM)

Physical Sciences


Author(s):

Jeremy Roos† (Science)



Abstract:

Light-driven catalysis enables the efficient formation of new carbon-carbon bonds by using visible light instead of sacrificial agents—which can be expensive and toxic—allowing for new developments in drug discovery, materials synthesis, along with various other industrial applications. Recently, earth-abundant 3d metal photocatalysts have emerged as sustainable alternatives to expensive 4d and 5d metal complexes through novel reaction pathways. In nature, the cobalt-carbon bond in vitamin B12 is known to undergo photolytic cleavage to mediate radical-induced organic transformations. However, the corrin ligand of vitamin B12 is difficult to synthesize, complicating its use in future industrial applications. The CoIII(TEIM) (TEIM = 2,3,9,10-tetraethyl-1,4,8,11-tetraazacylcotetradeca-1,3,8,10-tetraene) complexes discussed in this poster serve as precursors to model complexes for vitamin B12, which can be readily synthesized while maintaining photolytic activity. The synthetic methods and characterization, including spectroscopic data and crystal structures, of these complexes are presented in this poster.



Keywords: Inorganic Chemistry; Inorganic Synthesis; Photolysis; Spectroscopy; 3D Metal


Mentor(s):

Tong Ren (Science); Leobardo Rodriguez Segura (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1113**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## 2D Topology Optimization with Genetic Algorithms

Mathematical/Computation Sciences


Author(s):

Jonathan Ryan† (Engineering)



Abstract:

[Abstract Redacted]



Keywords: Topology Optimization; Heat Sink; Genetic Algorithm



Mentor(s):

Justin Weibel (Engineering); Boyu Duan (Engineering); Liang Pan (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1114**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Purdue Aerial Robotics Team

Innovative Technology/Entrepreneurship/Design

Author(s):

Joao Paulo Schott Ymayo† (Engineering); Mateo Llerna* (Engineering, JMHC); Corey Auerbach* (Engineering)

Abstract:

The Purdue Aerial Robotics Team Competition Division is developing an aircraft for the 2024 AVUSI SUAS competition. The team is composed of five subteams: Airframe, GNC, Mechanisms, Integration and testing, and Software. The Airframe team aims to further develop the existing competition platform by shedding weight from the fuselage by removing core material from the composite layup, removing weight from the wings by using tapered wings and more efficient rib spacing, and by improving the interface between the rear landing gear and the fuselage. The objectives of the Guidance, Navigation, and Control team include developing an efficient waypoint algorithm and a precise airdrop system to drop payloads on their respective targets accurately. The Airdrop Algorithm aims to ensure payload accuracy by employing differential equations and integration while accounting for uncertainty using Monte Carlo Simulations. Dubins Path Planning is employed for 3D path optimization. GNC is also developing a streamlined UI for waypoint Entry. The Mechanisms team's objectives are threefold. First, to improve the parachute deployment system by eliminating springs and harnessing the air to eject the parachute. Second is designing a simple,accurate, and consistent payload dropping mechanism. Third, Mechanisms is improving the aircraft's suspension and taxi steering capabilities. The Integration and testing team works directly alongside other subteams to prepare flying test platforms like the “Anaconda” and the “Ranger” RC aircraft for testing different components. The software is divided into core and external divisions. The external division is in charge of object detection, localization, and classification of targets and the core team is in charge of integrating systems.

Keywords: Autonomous; 3D Path Optimization; Composite Manufacturing; Object Detection

Mentor(s):

Shreyas Sundaram (Engineering); Charles D'Onofrio (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1115**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Something Inside So Strong the Freedom

Social Sciences/Humanities/Education

Author(s):

Chris Selig† (Education)

Abstract:

Music is essential to various cultures for various reasons related to, for example, celebrations, encouragement, religious purposes, etc. Within the Children's Defense Fund Freedom Schools summer literacy program, music is a major part of the daily operations. The Freedom Schools program is rooted historically in the Freedom Summer of 1964 movement. Within this movement, music was instrumental for those Civil Rights activists who were involved. Music can bring people together, especially when it's catchy and easy to learn. This paper overviews the role of music within the Freedom Summer movement and specifically within the context of the present-day Freedom School program. Additionally, we will analyze the song entitled, Something Inside So Strong by Labi Siffre (1987) which has been adapted and sung within the national CDF Freedom School Program during its daily Harambee morning celebration for over 30 years. Through literary and song analysis, this paper will highlight themes within popular Civil Rights songs and show the impact that music has had on the Freedom movement overall.

Keywords: Music; Civil Rights; Freedom; Literacy; Unity

Mentor(s):

Breanya Hogue (Education)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1116**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Interventions to Support Wellbeing of Rural Family Caregivers of Older Adults: A Systematic Review

Life Sciences


Author(s):

Shatakshi Shelar† (Science); Yu Lu† (Liberal Arts)



Abstract:

The rapid aging of the population and limited access to healthcare in rural communities pose significant challenges for caregivers caring for older family members suffering from serious chronic illnesses. The heavy burden of care and multiple responsibilities cause poor coping, self-care and wellbeing outcomes and therefore need interventions to promote their resilience and overall quality of life. Our systematic review aims to explore interventions available in the existing literature to promote the self-care and well-being of family caregivers of frail older adults residing in rural underserved areas. Arksey & O'Malley's methodological framework of scoping studies was employed for the analysis. Databases such as PubMed and Scopus were used to search the articles. PRISMA and Covidence tools were followed to review and analyze the study. CASP tool was used to examine the quality of the study and consensus was established among three research assistants and the advisor in the team. Our findings include 24 selected articles, with the majority of studies conducted in the U.S. (63%). Interventions were categorized into four groups as digital-web-based interventions (7), telehealth interventions (6), psychoeducational interventions (9), and other interventions (2). The most common outcomes observed across these interventions were increasing caregiver knowledge, self efficacy and reducing caregiver burden. Our review emphasizes the need for more research using community-engaged and culturally based approaches to promote the wellbeing and resilience of rural caregivers.



Keywords: Rural Caregivers; Wellbeing Interventions; Caregiver Resilience; Older Adults; Caregiver Burden



Mentor(s):

Nasreen Lalani (HHS); Bhagyashree Katare (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1117**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## The emergence of Fire for Cooking in Human Evolution

Life Sciences


Author(s):

William Shumway† (Liberal Arts); Zachary Ryan* (Polytechnic)



Abstract:

Fire is one of the most impactful human discoveries. Human control of fire sparked a cascade of socio-cultural and bio-evolutionary benefits over time. Evolutionary biologists argue that using fire for cooking may have triggered humans to adopt an energy-rich diet causing the evolution of a specialized metabolism and increased brain size. Cooking increases the nutrient extraction rate of foods by approximately 50%. This efficiency significantly enhances energy availability, even if cooked meat contributes only a small percentage of the overall diet. Wrangham proposed humans were likely able to control fire as early as approximately 1.8 million years ago. This development coincides with the increasing brain size trend seen in fossil hominins, the proliferation of the genus Homo, and the appearance of Homo ergaster/erectus, along with their sophisticated Acheulean stone-tool industry. However, although several archaeological sites have yielded evidence associating H. ergaster and erectus with significant increases in brain size, more human-like anatomy, and Acheulean tools, very little evidence exists to support their use of fire for cooking. This may be because although cooking practices like direct-roasting leave a clear charring signature on fossil bones, others like boiling, braising, or indirect-roasting are not detectable through current analytical methods. Consequently, to develop methodologies that reliably detect the use of different cooking methods, our project applies randomized controlled experiments to evaluate whether butchery marks may be used as evidence of cooking. If successful, This experiment will allow evolutionary biologists to make inferences about why we are the way we are today.



Keywords: Cooking; Bone Surface Modifications; Fire; Human Evolution; Socio-Cultural



Mentor(s):

Erik Otarola-Castillo (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1118**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Speech recognition in Aphasia Patients through Self-Powered Wearable Sensors

Mathematical/Computation Sciences


Author(s):

Richard Silvester† (Science, JMHC); Aadi Jangid† (Science, JMHC); Alejandra De la Torre Garcia† (Engineering); Aarohi Panzade‡ (Agriculture, Science, JMHC); Philip Liu‡ (Science, JMHC); Pavan Sathengeri‡ (Engineering, JMHC); Katelin Mcalli Rainey‡ (HHS); Ji Yeon Lee‡ (HHS)



Abstract:

[Abstract Redacted]



Keywords: Aphasia Patients; Speech Recognition; Machine Learning; Wearable Sensors; Mispronounced Words



Mentor(s):

Wenzhuo Wu (Engineering); Robert Ccorahua-Santo (Engineering); Jing Jiang (Engineering); Katelin Mcalli Rainey (HHS); Ji Yeon Lee (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1119**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Mus2Vid

Innovative Technology/Entrepreneurship/Design


Author(s):

Chiho Song† (Science); Vir Toshniwal† (Engineering); Ruby Woudneh† (Engineering); Kareena Patel‡ (Liberal Arts); Haichang Lu‡ (Polytechnic); Tim Nadolsky‡ (Science)



Abstract:

While music is a universally cherished form of communication and entertainment, its is often limited to individuals with hearing abilities. This study explores the potential use of generative artificial intelligence (AI) to create real-time visual representations for music, offering an inclusive approach to inspire user imagination and enhance the overall music enjoyment experience, including those with hearing disabilities. The methodology involves a multi-step process: (a) Analyzing and classifying music into various dimensions, including instruments, emotion, tempo, pitch range, harmony, and dynamics, to extract key features of the music such as emotion and genre. (b) Utilizing these features as inputs for machine models to generate an appropriate prompt that matches the music. (c) Employing stable diffusion models with prompts derived from textual descriptions to create visual representations. These steps are repeated throughout the music to dynamically reflect musical changes during real-time playback.



Keywords: Music; Artificial Intelligence; Visual; Real Time; Generative



Mentor(s):

Kristen Yeon-Ji Yun (Liberal Arts); Yung-Hsiang Lu (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1120**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Longitudinal Assessment of Gait Dynamics in Mice**

Life Sciences

Author(s):

Aavya Srivastava† (Engineering)

Abstract:

Gait is affected and hindered in various conditions, such as injuries and arthritis. Characterizing gait is crucial for identifying deviations from normal, understanding the temporal development of coordination, and obtaining an organismal-level measurement of biomechanical function. Despite extensive research into human movement biomechanics, there exists a notable deficiency in translational gait research involving commonly utilized animal models, notably mice. There is currently a lack of data up to when mice reach skeletal maturity at 16 weeks and a limited scope of studies examining gait changes over more extended periods. This study aims to characterize the gait of wild-type mice over an 11-week period, spanning from early development to skeletal maturity at 16 weeks, using the DigiGait system. Video recordings of five mice walking at 20 cm/s were analyzed using DigiGait Analysis software to assess paw placement on a transparent treadmill belt. 42 different gait parameters, such as stride length or stride frequency, were then assessed via DigiGait Analysis. We will analyze this data for any potential trends linked to development. These findings will underscore the dynamic nature of mouse gait throughout development. Investigating gait paves the way for better informed studies, offering a nuanced comprehension of the temporal development of organismal biomechanics. Future directions involve investigating sex-specific differences in gait.

Keywords: Gait Development

Mentor(s):

Deva Chan (Engineering); Cameron Villarreal (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1121**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Lessons Learned and Recommendations from Practitioners in Equine-Assisted Services Following the Death of an Equine

Social Sciences/Humanities/Education

Author(s):

Sophie Stahl† (Science)

Abstract:

Mental health is a global health crisis: around 1 billion people are living with a mental illness. One way to support mental health is with animal-assisted services (AAS). Equine-assisted services (EAS) are a popular type of AAS. While there is growing research surrounding death of a companion animal, there is still limited research regarding the death of an animal in AAS, specifically EAS. The death of an animal may involve feelings of grief which have their own mental health implications furthering the mental health concerns that brought the participants to AAS in the first place. The goal of this study was to identify best practice recommendations from practitioners in EAS following the death of a horse in their program. A total of 77 practitioners filled out an online survey that collected demographics, the cause of the horse's death, information about their EAS program, and open-ended questions to gather their lived experiences. A grounded theory and a constant comparative qualitative approach were used to identify common themes among the open-ended responses. The common themes found were preparation for the death of an equine, variation in grief processes, communication, and memorialization. This study is important as the death of an equine in EAS may affect many people: as a loss of a companion animal, coworker, friend, or family member. Findings can help identify new ways to better prepare and process the grief and resulting mental health challenges surrounding a horse's death and ultimately aid in bettering EAS.

Keywords: Grief; Animal-Assisted Services; Equine-Assisted Services; Mental Health; Horse

Mentor(s):

Leanne Nieforth (Veterinary Medicine); Sara Kaufman (Manchester University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1122**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## The Social Life of Letters: Growing the Print Bay

Social Sciences/Humanities/Education


Author(s):

Emma Summers† (Liberal Arts, JMHC)



Abstract:

The purpose of this research is to lay a foundation for the historical background and evolution of the printing press so that one may better understand the functionality of its contemporary applications, specifically in the context of cultivating outreach on campus. This process has involved deep research resulting in the production of a myriad of learning modules, each focused on a different area of letter pressing, to be used to initiate new students into the Print Bay. The process has also involved the development of posters in shop to be used as branding for the space, hand carving a linoleum block with the Print Bay logo on it so there will be an identifying mark on all future creations, and outreach and collaboration with other students interested in the space. Through the learning of how to use a printing press, as well as the development of a series of learning modules and dedicating weeks to the restructuring of the space's organization, a more coherent and recognizable branding has emerged out of the Print Bay. This goes along with a social media presence as well as the anticipation of upcoming workshops and events to shed light on the space. The growth in the Print Bay leads to a hope that the learning module series will be preserved and used to train new prospective students, and that there will be more workshops in and products coming out of the Print Bay so that we may further study how the art of letter press acts as an outlet for creative expression and community.



Keywords: Historical Background; Contemporary Application; Campus Outreach; Brand Establishment; Process of Printing



Mentor(s):

J. Peter Moore (JMHC)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1123**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## The Effect of Collaboration on Exercise-Induced Change in Cognitive Performance

Life Sciences


Author(s):

Eva Taylor† (HHS); Ashlita Lodha‡ (HHS); Mark Naguib‡ (HHS); Isabella Wilson‡ (HHS)



Abstract:

Previous research indicates that when exercise is more cognitively engaging, exercise-induced cognitive gains increase. However, there is a gap in literature as to whether collaboration during exercise is a viable form of cognitive engagement to maximize exercise-induced cognitive gains. Determining such benefits could have implications for exercise programing practices. Thus, this study compared the acute effect of collaborative with non-collaborative exercise on subsequent cognitive performance. Sixty-two adults (20.4 ±0.8 yr, 36 females) formed 31 sex-and performance-matched pairs. Using a within-subject design, these pairs completed a 15-min collaborative high-intensity interval training (C-HITT) and a HIIT session on two separate counterbalanced days. After each session, pairs completed a visual search task that required the identification of varying numbers (0, 1, 2) of targets under two counterbalanced testing conditions in which participants performed the task collaboratively (CO) and non-collaboratively (NC). Analysis of visual search performance showed subjects had a faster reaction time and were more efficient at identifying two targets compared to zero or one target. Furthermore, subjects had higher accuracy finding one and two targets in the CO condition than the NC condition. No significant effect involving the difference in cognitive measures between exercise conditions was observed. The findings indicate that integrating collaboration into HIIT did not significantly alter cognitive performance following exercise. This may be attributed to difficulty in quantifying collaboration, which may not have been sufficient to induce changes in cognitive performance. Further exploration and refinement of the integration of collaboration in exercise is needed to determine the potential impact.



Keywords: Collaborative Exercise; High Intensity Interval Training; Cognitive Engagement; Visual Search Task; Acute Exercise


Mentor(s):

Alvin Kao (HHS); Salim Onbasi (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1124**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Bayesian Optimization for Resilient Space Habitat Design in Limited Simulation Environments

Innovative Technology/Entrepreneurship/Design


Author(s):

Krish Thakkar† (Engineering); Taylor Vicente† (Engineering)



Abstract:

Extraterrestrial habitation is a crucial steppingstone for human interplanetary travel, and to achieve this goal we must design a space habitat with resilience and optimal design. However, the selection of the best safety controls for realizing the mission goal is challenging. In this study, we introduce the Bayesian optimization-based method to identify the optimal configuration of a space habitat under the constraints of limited computational resources. This limits the number of simulations that can be run to inform habitat design. Hereby, a Gaussian process-based surrogate model is constructed to represent the space habitat system, which is approached as a black-box function. Then the model is iteratively refined using strategically chosen updated information. Eventually, we obtain a model form where the optimal results can be extracted to approximate the desired outcomes. A case study is demonstrated using a notional space habitat under fire disruption. The model includes various safety control components: prevention, detection, and mitigation. For each component, multiple technological options can be selected. Overall, this study will direct the efficient design of space habitats while reducing the time it takes to pinpoint the optimal configurations.



Keywords: Bayesian; Optimization; Resilience; Space Habitat



Mentor(s):

Xiaoyu Liu (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1125**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Plate of possibilities: Purdue's vision for inclusive nutrition**

Social Sciences/Humanities/Education

Author(s):

Ameera Trady† (Science)

Abstract:

There is an overwhelming abundance of people who require unique dietary accommodations, and in more recent years many universities have set the standard for nutritional knowledge and allergenic acclimations. Purdue University is one of many American Institutions that has taken steps towards ensuring the inclusivity of every student in dining halls. My exploratory research aims to inform future directions in college dining practices. Throughout my extensive research, I have explored Purdue University's efforts to establish inclusive and informative nutrition and allergen practices in its dining halls. This research was predominantly written utilizing tools from academic journals found through platforms such as Litmaps and JSTOR. Other sources were discovered through navigating the Purdue Dining and Culinary webpage, and a handful of news articles. Utilizing the opinions of first-year students who experience food allergens and a long-serving dining hall employee, I will grasp an understanding of dining hall practices and how that directly correlates to the satisfaction of conscientious students. I will use in-person interviews to connect with the speakers and create a fruitful discussion to generate logos for my research. Through conducting this study, I expect to inspire Purdue Dining Facilities to provide physical labeling informing students of the allergens and nutrition in their food.

Keywords: Accommodations; Dietary-Restrictions; Nutritional Knowledge; Dining Halls; Inclusivity

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1126**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Understanding PS-PEG-OH Polymer Spreading Dynamics at the Air-Water Interface

Physical Sciences

Author(s):

Calla Tucker† (Engineering)

Abstract:

The purpose of this study was to contribute to developing a synthetic polymer lung surfactant to treat adult respiratory distress syndrome (ARDS). Previously developed lipid surfactants do not work for treatment of ARDS due to inflammation and blood present in the lungs that inhibit the spreading. This study focuses on varying concentrations, chemical properties, and nanostructure particle morphology for PS-PEG-OH to understand what controls the rate of spreading. This was accomplished by measuring the spreading rate of an 8 uL drop of a micelle solution on the air-water interface of a trough. The spreading dynamics of the surfactant were observed by measuring the radius of the Marangoni ridge (visualized using PTFE powder) over a specific period. Altering the micelle solution formulations has been shown to change the spreading kinetics. As the subphase height decreased, the PS-PEG-OH polymer spreading exponent decreased and the rate of spreading decreased due to higher shear stress at the lower heights. The PS-PEG-OH spreading exponent appeared to depend on the concentration of the micelle solution while the PB-PEG-OH spreading exponent stayed constant across concentrations. The varying physical and chemical properties of PS-PEG-OH influence its spreading behavior in the pulmonary air-water interface, which can treat ARDS through lubrication of the alveoli. Additional experiments and analysis include comparing the spreading dynamics of cylindrical versus spherical micelles and understanding the pattern that the PS-PEG-OH and PB-PEG-OH follow at different concentrations. Current analysis is being conducted using previously collected isotherm data.

Keywords: Polymer Micelle Solution; Lung Surfactant; Pulmonary Surfactant; Adult Respiratory Distress Syndrome

Mentor(s):

You-Yeon Won (Engineering); Seyoung Kim (Dankook University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1127**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Analyizing the Effect of Rising Water Levels in Lake Huron using High Resolution Multispectral imagery

Physical Sciences


Author(s):

Sophia Ung† (Engineering, JMHC)



Abstract:

Extreme water level fluctuations in the Great Lakes have caused irreparable damage to infrastructure, roads, and the shoreline. There is an absence of data regarding the effects of these rapidly changing water levels on the Lake's coastal areas. In order to quantify the effects of rising water levels specifically in Lake Huron, the movement of shoreline position is tracked using high resolution multispectral imagery and a shoreline detection algorithm. Although the entire lake experiences the same water level increase, some areas erode more than others. The purpose of this research is to identify the most vulnerable areas to help policymakers, environmental agencies, and local communities make informed decisions regarding coastal area management, ecosystem conservation, and infrastructure planning in the Lake Huron region.



Keywords: Great Lakes; Coastal Erosion; Remote Sensing



Mentor(s):

Cary Troy (Engineering); Hazem Abdelhady (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1128**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Adult Separation Anxiety Disorder in College: Research and Prevention

Social Sciences/Humanities/Education

Author(s):

Nathaniel Veach† (Education)

Abstract:

Imagine being away from home and family for likely the first time, and this new place is hundreds, or even thousands of miles away, perhaps even in a different country. This paper will delve into the mental disorder known as Adult Separation Anxiety Disorder (ASAD). This overlooked disorder is constantly simply labeled as homesickness and isn't treated as the proper mental health disorder that it is. In college students, this disorder can lead to symptoms of depression, anxiety, and more. ASAD has influenced an increase in teen and college-aged suicide rates and will continue to rise if nothing is done. However, in my research, studies have shown that preparation for this massive step in life is the key factor to preventing ASAD during a student's first year of college. Now, what does that mean? I like to call this home integration, also known as just simply doing things that help you to prepare for being away from what you know and love. Another crucial step to better acclimate to college is attending colleges' orientation programs, such as Purdue's BGR. Orientation allows students to get to know all the popular spots and activities on campus, as well as make new friends who are in the same boat as them. In this paper, I will use articles from the Purdue Library Database and their citations, as well as a study of my peers to better understand how ASAD affects students and Purdue and how they prepared for it.

Keywords: Adult Separation Anxiety Disorder; Mental Health; College Preparation

Mentor(s):

Sidney Ducleroir (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1129**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Mechanistic features of Cationic Amphiphilic Polyproline Helix (CAPH) interactions with the biological membranes

Life Sciences

Author(s):

Andrew Walke† (Science); Emmaleigh Shinno‡ (Engineering)

Abstract:

Cationic Amphiphilic Polyproline Helices (CAPHs) are short, amphiphilic polypeptides. CAPHs are cell-penetrating molecules that can be used to deliver payloads to cells and have shown potent antimicrobial activities. Despite great potential as drug delivery carriers, CAPHs have not reached their full potential, likely due to an incomplete understanding of their mechanisms of membrane interaction and uptake. We measure the biophysical features of CAPH-membrane interactions using an in vitro reconstitution assay. We generate supported lipid bilayer membranes of controlled composition to measure kinetic features of fluorescently-tagged CAPH recruitment to the membrane in addition to their mobilities and interaction lifetimes. Using membrane-selective imaging in a TIRF configuration, we also have access to CAPH behaviors at the single-molecule level. We find that CAPHs are sensitive to cholesterol in the membrane with an increase in the binding on rate. We anticipate that these findings will lead to actionable opportunities to tune CAPH design and behaviors for more efficient and tolerable drug delivery.

Keywords: Cell-Penetrating Peptides; Single Molecule; Membrane Biophysics; Fluorescence Microscopy; Reconstitution

Mentor(s):

Shalini Low-Nam (Science); Kevin Scrudders (Science); Vinay Menon (Vanderbilt University); Jean Chmielewski (Science); Thomas Dietsche (Regeneron)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1130**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

# Development and Assessment of Potent and Selective GRK6 Inhibitors for Treatment of Multiple Myeloma

Life Sciences


Author(s):

Ellen Wei† (Science)



Abstract:

Each year, about 7 in 100,000 individuals are afflicted by multiple myeloma (MM), a cancer in plasma cells affecting the ability of the immune system to fight infections. In a kinome-wide siRNA lethality study in myeloma tumor cell lines, G protein-coupled receptor kinase 6 (GRK6) inhibition was revealed to be lethal to myeloma tumors, but tolerable in human cell lines, suggesting that GRK6 inhibition is a novel therapeutic strategy in the treatment of MM. The goal of this project is to develop potent and selective inhibitors of GRK6. Our lab and our collaborators are developing a series of inhibitors that are derivatives of the FDA approved drug sunitinib and contain a reversible covalent warhead that can react with a cysteine residue in the active site of GRK6 to enhance selectivity. Inhibition efficacy was measured using a radiometric assay. Several compounds were shown to have high potency and, in some cases, selectivity over other GRKs. These compounds also show efficacy in cellular assays against a multiple myeloma cell lines. When modeling our lead inhibitor with GRK6 using prior GRK5-inhibitor bound crystal structure data, we can identify potential residues that are important for binding the inhibitor to GRK6. This knowledge will refine the rational design process and will help yield optimized inhibitors with improved potency and selectivity.



Keywords: GRK6; Multiple Myeloma; GPCR; G-Protein



Mentor(s):

John Tesmer (Science); Mackenzie Imhoff (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1131**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Understanding Clinical Diagnosis: Does Race Influences Diagnostic Impressions?

Social Sciences/Humanities/Education

Author(s):

Jasmine White† (HHS)

Abstract:

Within real-world clinical settings black men are often diagnosed with schizophrenia at 2-3x higher rates than white men. One possible explanation for this difference is that it reflects diagnostic bias on the part of the clinicians who assign the diagnoses. We examined this possibility using a case vignette methodology. Specifically, we selected a case vignette presenting a client with clear negative symptoms of schizophrenia, but ambiguity for positive symptoms, and randomized the vignette to be either white or black. We hypothesized that if bias were present, the white vignette ratings would be higher for depression and the black vignette would be higher for schizophrenia. 185 clinicians across North America read the vignette and provided diagnostic ratings for common mental disorders. Contrary to our hypotheses, the ratings did not differ by the vignette's race. These results suggest that clinician bias does not account for observed racial discrepancies in psychotic disorder diagnoses.

Keywords: Health Equity; Assessment; Clinician Diagnosis; Symptom Presentation; Health Disparities

Mentor(s):

Doug Samuel (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1132**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Investigating the Role of Novel Type V-A Anti-CRISPR in Inhibiting CRISPR-Cas12a Bacterial Immune System

Life Sciences

Author(s):

Gwyneth Wong† (Science)

Abstract:

CRISPR-Cas is a highly sophisticated and adaptive immune system found in roughly 40% of bacterial genomes (Lan, 2022). It is designed to degrade phage DNA and keep a library in its genome of all foreign genetic elements that have invaded the cell, thereby preventing future infections. Today, CRISPR gene editing is being repurposed to tackle problems ranging from crop quality to human disease (Subica, 2023). CRISPR specificity – the mitigation of off-targets, unintentional gene cleavages made by the Cas protein, is of significant concern (Guo, 2023). Anti-CRISPRs (Acrs) are inhibitor proteins encoded by bacteriophages that can evade CRISPR-Cas systems through various mechanisms depending on the Acr; some can mimic, chemically inhibit, or block some component of the system (Zhang, 2019). It is crucial for us to study Acrs as they are natural off-switches for CRISPR-Cas proteins that are capable of editing genes. In this project, we investigate AcrVA3.1, a class V-A Acr whose molecular mechanism of inhibiting the CRISPR-Cas12a system has not yet been studied. Here we present preliminary data from in-vitro nicking activity assays which suggest that AcrVA3.1 is a non-sequence-specific nickase that can nick plasmid DNA from a supercoiled to open conformation. This property could provide us with some insight behind the AcrVA3.1-mediated inhibition of Cas12a.

Keywords: CRISPR; anti-CRISPR; CRISPR Off-Targets; Gene Editing; Bacteriophages

Mentor(s):

Leifu Chang (Science); Indranil Mukherjee (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1133**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Using Communication Patterns to Predict Team Performance

Social Sciences/Humanities/Education

Author(s):

George Youssef† (Engineering)

Abstract:

While individual performance has been extensively investigated, research on team performance is still in its exploratory stages. To address this gap, this study aims to develop a technique for objectively measuring team performance. Using the commercial game “Keep Talking and Nobody Explodes,” we replicated a team-based scenario. Two modes, categorized as easy and hard, were introduced to vary different task difficulty, with poorer performance expected in the harder task. Within a 5-minute timeframe, the easy mode involved defusing three modules, while the hard mode required four, increasing the game's difficulty through added time pressure. Effective communication was essential for bomb defusal, regardless of the task's complexity. Strikes were given for operational errors, with three strikes triggering a bomb explosion. To objectively measure task performance, communication data was collected during gameplay. They were analyzed by transcribing audio recordings into text and categorizing sentences according to speech actions afterward. Communication metrics, including speech action entropy, word count per sentence, and word count entropy, were computed to assess communication efficiency. Preliminary analysis of six participants revealed no significant performance difference between modes. However, it indicated a decrease in speech action entropy and word count per sentence, and an increase in word count entropy as the difficulty level rose. Further comprehensive analysis aims to uncover a significant link between communication efficiency and task performance, addressing the gap in objective team performance evaluation.

Keywords: Team Performance; Communication; Objective Measurements; Speech Coding

Mentor(s):

Denny Yu (Engineering); Pramiti Sarker (Engineering); Jingkun Wang (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1134**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

**Procedural Generation with Quantum Optimization**

Mathematical/Computation Sciences

Author(s):

Zirui Zhang† (Science); Priyam Gupta‡ (Science); Shannon Cheng‡ (Science); Lauren Britten‡ (Engineering); Sean Ruda‡ (Science); Kevin Xiao‡ (Science)

Abstract:

The project introduces a new wave function collapse algorithm for quantum computing devices, traditionally bound by classical computing constraints. The classical wave function collapse algorithm, often used in various procedural generation applications, faces significant challenges when encountering large-scale, high-dimensionality datasets. That is, its runtime increases exponentially with the complexity of the data set. This exponential increase presents a barrier in processing large-scale or intricate simulations, limiting its applicability in advanced computational tasks. Our research addresses this critical bottleneck by employing Quantum Unconstrained Binary Optimization (QUBO) and Quantum Approximate Optimization Algorithm (QAOA) within the quantum computing paradigm. Quantum computing, with its inherent ability to handle superpositions and entanglements, offers a substantial leap in processing capabilities compared to classical methods. The exact use of this algorithm can be applied to various fields that require generated data, such as simulation and computer graphics. By integrating these quantum algorithms, we demonstrate a considerable reduction in runtime for the wave function collapse algorithm, enhancing its efficiency and scalability. A significant contribution of our work is the practical applicability of our quantum algorithm, where while the majority of quantum algorithms remain primarily theoretical and await the advent of more advanced quantum computers, our algorithm is designed for near-term quantum computing platforms. This aspect makes it one of the few quantum algorithms that can be implemented and tested in the current state of quantum technology.

Keywords: Quantum Computing; Algorithms; Procedural Generation; Optimization

Mentor(s):

Mahdi Hosseini (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1135**
*Presentation Time: April 9 in Session 1: 9:00am-10:00am*

## Potential Incompatibilities between Admixtures and Nontraditional and Natural Pozzolans (NNPs) in Cementitious Systems

Innovative Technology/Entrepreneurship/Design

Author(s):

Anel Zhussupbekova† (Engineering)

Abstract:

Concrete is the most used construction material in the world and consists of cement, water, aggregates and, generally, admixtures. Admixtures, such as water reducing agents (WRAs) and air entraining agents (AEA), play a key role in concrete production as they can improve workability and modify the air void system. Conversely, studies have shown that potential incompatibilities may exist between components, WRAs and AEAs as they are chemically different. Furthermore, the chemical composition of cement and, when used, of supplementary cementitious materials (SCMs), may further increase the level of these incompatibilities. Traditional SCMs, such as fly ash, slag cement, or silica fume are typically used to improve the mechanical and durability properties of concrete. However, the availability of these traditional SCMs continues to decline and nontraditional and natural pozzolans (NNPs) are emerging as suitable alternatives. Currently, there is not enough information about how the incompatibility between the admixtures can affect cementitious systems if NNPs are incorporated. The purpose of this study was to evaluate the performance of mortar with two different NNPs: calcined clay (CC) and fluidized bed combustion ash (FBC). Mortar mixtures were designed and prepared in a laboratory to meet specific slump and air content requirements. To achieve the target slump and air content, this study involved adding two distinctive types of WRA and AEA in varying amounts to mortar mixes. These mixes were prepared at two different replacement percentages of NNPs (25% and 35% replacement by weight of cement). Additionally, three different types of cement, each with different chemical compositions were used. Mortar cubes measuring 2x2x2in were cast and tested for compressive strength at 3, 7, 28, and 56 days and mixtures with NNPs were benchmarked against mixtures with cement only. Results indicated that incompatibilities indeed exist between certain admixtures and NNPs and that they also influence the rate of strength development of a given mixture.

Keywords: Nontraditional and Natural Pozzolans; Admixture Incompatibility; WRA; AEA; SCM

Mentor(s):

Jan Olek (Engineering); Alberto Castillo (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1200**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Exploring the Impact of the Documentary Poisoned Through a Content Analysis of the YouTube Comments on the Documentary Trailer

Social Sciences/Humanities/Education

Author(s):

Shams Adigozalzade† (Agriculture)

Abstract:

Authors: Adigozalzade Shams, Autumn Stoll, Fanny Gozzi and Yaohua Feng

Abstract:

The 2023 Netflix documentary Poisoned: The Dirty Truth About Your Food garnered significant attention by shedding light on foodborne pathogen contamination in commercially processed foods. However, its impact on consumers' perceptions and trust in the U.S. food system remains largely unknown. In light of various methods used to deliver food safety information to consumers, this study aimed to evaluate the influence of food safety documentaries on consumer attitudes. Using a Google Chrome extension, we extracted and analyzed 1,288 YouTube comments from viewers who engaged with the documentary's trailer on October 31, 2023. Following screening with inclusion and exclusion criteria, 1,192 comments were coded for general characteristics, content, emotion, and trust in food safety stakeholders. Skepticism regarding the safety of the food supply chain emerged as a common concern (n=56, 4%). Additionally, distrust was expressed by 41% of the comments towards the U.S. food system, specifically distrust towards the U.S. 12% (n=159) and the U.S. government 9% (n=116). Furthermore, 14% of the comments expressed negative emotions concerning U.S. food system, for example feelings of “hopelessness” (n=63, 5%) and “fear” (n=58, 5%). These findings highlight the documentary's capacity to evoke negative emotions and distrust in the safety of the U.S food supply chain, thus challenging consumer engagement in food safety education. Further investigation is needed to better understand the impact of food safety documentaries on consumers’ behaviors.

Keywords: Food Safety Documentaries; Food Safety Attitudes; Trust in Food Systems; Documentaries Impact; Consumers’ Behavioral Change

Mentor(s):

Betty Feng (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1201**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Using machine learning to classify signal and background in the data from XENONnT Detector

Mathematical/Computation Sciences

Author(s):

Divij Agarwal† (Science); Vasileios Kalaitzidis† (Science); Liam Gallagher† (Science)

Abstract:

XENONnT detector is a dual-phase Xenon based instrument designed for the direct detection of WIMPS using nuclear recoil events. Since the nuclear recoil for neutron scattering and WIMP scattering is the same, we can tune our detector to study neutrons. Calibrating the detector is done using a radioactive source of Yttrium-Beryllium which emits neutrons at 152keV which are slowed down by water and reach the detector at lower energies. The data from each event consists of a small gaussian peak produced by a photon (emitted at the time of the nuclear recoil) and is followed by a larger peak caused by an electron produced by the previous recoil event. However, these peaks can also be separately produced and incorrectly paired due to background events in the detector. Hence, an algorithm is required to discern the signals from the background events.Our aim is to use a machine learning model like XGBoost or Random Forests to train a neural network on simulated data and ultimately try to classify events as background or signal.

Keywords: Signal Classification; XENONnT; Neutron Event Characterisation; Data Analysis; Machine Learning

Mentor(s):

Andreas Jung (Science); Husheng Guan (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1202**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Shielding Tomatoes from Pathogen Assault: Deciphering the Mysteries of the Detoxification Gene**

Life Sciences

Author(s):

Maggie Anderson† (Science)

Abstract:

[Abstract Redacted]

Keywords: Fungal Resistance; Tomato Ortholog Detoxification 9; Functional Conservation; Candidate Gene; Arabidopsis ADS1

Mentor(s):

Tesfaye Mengiste (Agriculture); Madylin Schaider (Agriculture); Chao-Jan Liao (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1203**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Ontogeny and Cell Proliferation in the Porcine Fetal Intestine

Life Sciences

Author(s):

Lillian Andis† (Agriculture)

Abstract:

There is a significant knowledge gap with regards to the ontogeny of the fetal intestine and the endocrine signals that regulate this developmental process. We sought to address this by characterizing intestinal development between mid to late gestation using a porcine model of fetal hypothyroidism. We hypothesize that overall diameter and luminal space of the intestine will increase from mid-to-late gestation, and that the corresponding increase in luminal surface area will be driven by proliferation of enterocytes near the base of the villi. Finally, we hypothesize that endocrine disruption, in the form of fetal hypothyroidism, will alter this normal developmental trajectory. To investigate this, intestinal samples were collected from N=24 fetuses each at days 55, 66, 76 and 86 of gestation. Half of the samples at each time point were derived from gilts treated with methimazole for 21 days prior to sampling to induce fetal hypothyroidism. All N=96 samples were formalin-fixed, paraffin-embedded in triplicate, and histologically sectioned using a microtome. Sections from all fetuses were chemically stained with alcian blue and nuclear fast red to evaluate changes in intestinal morphology. Additional sections from a subset of N=3 fetuses per treatment and time point were immunofluorescently stained with a monoclonal antibody against proliferating cell nuclear antigen (PCNA) to assess localization of epithelial mitosis. The resulting slides were examined microscopically, and at least 3 images captured per sample. Analysis of the resulting images is ongoing but is expected to reveal insights with regards to intestinal development in the fetus.

Keywords: Ontogeny; Porcine Fetal Intestine; Cell Proliferation; Hypothyroidism

Mentor(s):

Alex Pasternak (Agriculture); Alyssa Smith (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1204**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Structural Adaptation of the Porcine Placental from Mid to Late Gestation

Life Sciences


Author(s):

Megan Ashby† (Agriculture)



Abstract:

Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) infection in pregnant gilts severely impacts developing fetuses during late gestation. While fetuses exhibit immunity to PRRSV in early gestation, susceptibility to vertical transmission is known to increase as gestation progresses.

This study is founded on the hypothesis that alterations in placental architecture during gestation increase placental permeability, facilitating vertical transmission of PRRSV. Thus, the objective is to assess and quantify changes in the folding of the porcine placental epithelial bilayer and the reduction in placental layer width as gestation progresses.

Placental samples were collected at 10-day intervals between day 55 and day 85 of gestation. Histology sections were cut from formalin fixed paraffin embedded tissue using a microtome, then fluorescently stained with wheat germ agglutinin (WGA) and imaged at three locations along the maternal-fetal interface. Morphometric image analysis was then used to quantify the folding of the epithelial bilayer and width of placental layers.

Preliminary results from day 55 and day 85 samples indicate that increased nutrient transport is facilitated by a reduction in total placental layer depth, achieved through decreased stromal and allantoic endoderm depth. Further assessment of samples from day 65 and day 75 will chronologically track these changes throughout gestation.

This study's outcomes will enhance understanding of porcine placental development during gestation and its connection to PRRSV and fetal immunity. Results may increase understanding of the mechanisms influencing susceptibility to PRRSV infection during late gestation, aiding in the development of targeted intervention strategies.



Keywords: Swine; Reproduction; Placenta; Pathology; Histology


Mentor(s):

Alex Pasternak (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1205**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## The Black College Experience at Purdue University

Social Sciences/Humanities/Education

Author(s):

Kyala Augustin† (Science)

Abstract:

Background:

My research project's main focus highlights the experiences of black students on the Purdue campus, whether it be academically, socially, and also when it comes to mental health. This is significant because many individuals may not know how being at a PWI as a minority affects experiences.

Objective:

My main objective is to give light to my topic and also to try to spread awareness in hopes that the University becomes more diverse. In order to complete my objective, I will be doing first person research. My study aims to address the lack of knowledge of how some student experiences differ from others at Purdue University.

Methodology:

My preliminary,  primary research methods were questionnaires and surveys, and my secondary research were interviews that are semi-structured. Surveys and Questionnaires helped me have a greater outreach to the black community and to gather information quickly and efficiently. Interviews helped me get an insight on particular students and their specific experiences.

Expected Results (Optional):

Value-Added: Significance, Implications, and/or contributions

Bringing these things to light can help with diversity and inclusion and the overall well being on campus. Many students on Purdue campus have these struggles and I believe that this research will help them validate their experiences.

Keywords:

-PWI

- Imposter syndrome

Keywords: PWI; Imposter Syndrome; Mental Health; College Experience

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1206**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Exploration of the intersection of Mental Health & Demographic Factors in Hartford City, IN

Life Sciences

Author(s):

Tamia Austin† (HHS)

Abstract:

Mental health is the state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their communities. Mental health was identified as a concern among the citizens in Hartford City, IN through a community public health survey. The objective of my research was to compare mental health with demographic factors among Hartford City residents. We recruited Blackford County residents who were 18 years or older. An online questionnaire collected data on demographics, lifestyle, and self-reported health. With these questionnaires, I abstracted age, gender, ethnicity/race, education, household income, height, weight, substance/drug use, and mental health data. Data analysis including descriptive statistics and determination of the association between mental health and other variables was performed in Excel. A total of 284 participants participated in the survey; the majority were female (N=169, 60%). Average age was 56 (standard deviation= 17.55). A total of 80 persons (28%) had been told at any time they had a mental health condition and 34 (12%) reported seeing a mental health professional within the past 12 months. Specific mental health conditions reported included PTSD, ADHD, bipolar disorder, anxiety, and depression. Among females, N=54 (31.95%) reported ever having a mental health condition and N=25 (14.79%) reported seeing a mental health professional in the past year, suggesting there were no major differences in mental health based on gender in this population. My next steps are to explore other demographic variables of self-reported mental health.

Keywords: Mental Health; Self-Reported; Concern Among the Citizens in Hartford City, IN; Demographic Factors; Mental Health Professional/Condition

Mentor(s):

Ellen Wells (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1207**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Predicting Cycling Drivetrain Performance from Sound: Auto-Encoder Analysis for Predictive Maintenance

Mathematical/Computation Sciences

Author(s):

Aaron Banks† (Science)

Abstract:

In the past decade, the cycling industry has seen significant technological advancements aimed at improving both bicycle and rider performance. One area that has received little attention is the development of chain lubricants. Recent studies have demonstrated the effectiveness of machine learning models for use in machine tool predictive maintenance and replacement using analysis of audio data. A comprehensive study was conducted to facilitate a better understanding of the relationship between a chain's efficiency and its audio characteristics. By modifying an existing chain testing rig with audio gathering equipment, over 300GB of audio data was collected. An autoencoder machine learning model was trained to analyze the Mel-Frequency Cepstral Coefficients (MFCCs) of the collected data. The model suggests there may be a correlation between time elapsed since lubrication and acoustic characteristics. Further analyses aim to assess chain efficiency from the analysis of audio samples. The findings may also present more factors that influence a chain's performance, and the predictive nature may prove useful in re-lubricating chains at more efficient time intervals.

Keywords: Machine Learning; Predictive Maintenance; Auto-Encoder

Mentor(s):

Jan-Anders Mansson (Engineering); Patrick Cavanaugh (Engineering); Teal Dowd (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1208**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Hybrid Lithiation Mechanism in Hard Carbon Enables Ultrasafe Semisolid Fire Retarding Electrolyte in Lithium-ion Batteries

Innovative Technology/Entrepreneurship/Design


Author(s):

Shawn Belongia† (Engineering)



Abstract:

Lithium-ion batteries (LIBs) have recently been at the forefront of energy storage research but have serious downsides such as lack of material availability and unsafe operating conditions that commonly result in thermal runaway. Flame-retardant electrolytes that contain organophosphorus compounds have spurred great interest in LIB development, yet still require additional strategies for improving electrochemical stability with reductive anodes. The phosphate compounds are particularly incompatible with commercially used graphite anodes due to exfoliation of the graphite's layered structure from co-intercalation of solvent molecules. Alternatively, hard carbon provides a form of disordered carbon with enhanced interlayer spacing yielding reversible Li-ion storage even after applying fire retarding solvent through a hybrid mechanism of intercalation within graphitic regions and absorption into micropores and particle surfaces. We adapted a solid-state fire-retardant electrolyte system utilizing a hard carbon anode that displays greatly improved electrochemical cycling capacity of 211 mAhg-1 and stability (74% capacity retention over 90 cycles). Interfacial studies over varying cycles and state of charge over a singular cycle was completed via electrochemical impedance spectroscopy, along with cyclic voltammetry to demonstrate the improved stability of the redox reactions. Raman Spectroscopy was used to analyze structural changes in the characteristic disordered and crystalline bands of the carbonaceous materials pre- and post-mortem. High resolution transmission electron microscopy visualized graphite's thick solid-electrolyte interface and morphological degradation while the hard carbon showed little impact beyond surface absorption. These findings suggest a feasible alternative to traditional graphite anodes in solid-state flame-retardant electrolyte systems to improve functionality and safety of LIBs.



Keywords: Lithium-Ion Batteries; Energy Storage; Hard Carbon; Solid-State; Battery Safety


Mentor(s):

Vilas Pol (Engineering); Annie Sun (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1209**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Phenotyping Behavioral Changes of sorl1 Gene Downregulation as a Model for Alzheimer's Disease in Zebrafish

Life Sciences

Author(s):

Saraf Bhuiya† (HHS, JMHC)

Abstract:

The SORL1 gene has been linked to the development of Alzheimer's disease (AD). SORL1 is involved in amyloid-beta precursor protein (APP) processing, and secretion of amyloid-beta peptides which, when aggregated, triggers AD pathophysiological processes. AD is associated with certain behavioral characteristics related to social interaction, cognitive function, anxiety, and other outcomes. The aim of this study was to elucidate behavioral functions related to downregulation of SORL1 in a CRISPR mutant zebrafish. This model, selected for its homology to humans and ease of handling, is seen across studies today for its practical uses. It was hypothesized that zebrafish with the gene mutation would show behaviors characteristic of AD. A series of sex-specific behavioral tests were completed in wild-type and sorl1 fish aged at 5 months or 1 year. Assays focused on the cognitive/memory function using the new object recognition test (NORT) and spatial memory test (SPT). Additionally, two versions of the NORT were conducted as a result of previous literature showing color preferences with less time spent near the novel object when it was orange compared to purple. This preference influenced the mutant response in a sex- and age-dependent manner, but overall mutants spent less time near the novel object. In the SPT, 5-month mutant males spent less time in a new arm, while 1 year mutants of both sexes spent more time in the new arm. Overall data from these tests support behavioral differences in mutants that are sex- and age-dependent in response to newly presented objects/environments.

Keywords: Behavior; Alzheimer's Disease; Zebrafish; Memory; Preference

Mentor(s):

Jennifer Freeman (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1210**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Determining Predictive Biomarkers for Breast Cancer Subtype Differentiation using Machine Learning**

Life Sciences


Author(s):

Rachit Bisht† (Engineering); Aiyan Alam† (Engineering)



Abstract:

Labeling predictive diagnostic markers for tumor heterogeneity for breast cancer has been a difficult but rewarding task for the past decade. Breast cancer tumors have been categorized into sub-categories (Triple-Negative, luminal A/B, and HER2) based on the presence or absence of hormone receptors and the HER2 protein. Different categories demand a more personalized approach to treatment. This study pioneers a non-invasive approach by collecting plasma samples and leverages post-translationally modified (PTM) proteins within plasma extracellular vesicles (EVs). EVs are recognized as crucial regulators of immune responses and mediators of intercellular communication, representing a potential goldmine for unraveling the complexities of breast cancer subtypes. Using PTMs holds promise for delineating cellular physiology status, offering a nuanced perspective on breast cancer dynamics. A comprehensive array of peptides in plasma extracellular vesicles (EVs) was found in the discovery experiment, and over hundreds of overexpressed peptides were targeted using the parallel reaction monitoring technique in the validation experiment. For this validation experiment, a robust machine-learning pipeline was created, including careful exploratory data analysis, strategic feature engineering and selection, deliberate hyperparameter tuning, and model comparison. This pipeline was used to attain an accurate predictive model for breast cancer subtypes from peptides selected based on importance, which allows us to gain valuable and promising insights on which peptides could potentially serve as diagnostic biomarkers for the different categories of breast cancer and contribute to a deeper understanding of the molecular landscape.



Keywords: Breast Cancer; Mass Spectrometry; Machine Learning; Extracellular Vesicles; Predictive Modeling



Mentor(s):

Marco Hadisurya (Agriculture)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1211**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Remote Sensing of Water Quality

Mathematical/Computation Sciences


Author(s):

Alexandra Britto† (Engineering); Kayla Osen‡ (Engineering)



Abstract:

In the North-Central U.S., thousands of inland lakes and reservoirs provide critical ecosystem services. These systems' health is under stress from increased usage and increasingly dramatic shifts in precipitation and water availability. Developing tools and methodologies to predict the occurrence and intensity of algal blooms more accurately in Midwestern inland lakes is a priority. This project focuses on quantifying how sediment, temperature, and nutrients relate to the potential formation of harmful algal blooms in Indiana lakes and reservoirs. The project scope involves analyzing sediment, nutrients, chlorophyll-a, and microcystin from lab analysis of water samples collected in the Summer of 2023 and correlating those samples with antecedent environmental conditions including precipitation, temperature, and solar radiation. The process starts with tracking water samples through lab analysis using an established database and checking that lab results are associated with the correct water sample. Next, statistical analysis of the samples is conducted to identify correlations with time, location, and other environmental variables including, but not limited to, antecedent precipitation, air, and water temperature. And using GIS to map the results of the analysis and statistics to the sample locations within the sampled water bodies. During my time with this project, I have learned how to complete laboratory analysis, manage samples, utilize laboratory equipment, report findings for a subset of parameters, track sample analysis, and utilize laboratory equipment. With these results compared to satellite data, it could be possible to generate an algorithm that can be used by satellites to determine specific elements of water quality.



Keywords: Algal Bloom; Water Quality; Environmental Conditions; Analysis of Water; Satellite Data



Mentor(s):

Keith Cherkauer (Agriculture); Zhi Zhou (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1212**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Water vapor stable isotope interactions with common air sampling tubing materials

Physical Sciences

Author(s):

Meghan Brown† (Science)

Abstract:

Around 99% of the water content found on Earth is H2O made up of 1H and 16O, but there is also a small amount of stable isotopes that have heavier atomic masses, like 2H or deuterium and 18O, which are measurable. Studying the ratios of each stable isotope variation in atmospheric water vapor can provide insights into several research topics that measurements of water vapor mixing ratios alone would have difficulty with. These include sources of atmospheric moisture and mixing of air masses. Due to the cohesive and adhesive properties of water molecules, stable isotope movement through air sampling tubing varies based on the makeup of different tubing. This influences how quickly molecules move and reach an isotopic equilibrium. There is not a standard tubing used to study stable isotopes nor a published study on the different types of tubing used. Using a wide range of known tubing materials, HDPE, Dekabon, and Bevaline were all tested in this experiment. We found that HDPE reached equilibrium within 5 minutes for H2O concentration, δD, and δ18O. Considering Dekabon tubing, the δD isotopic values took more than an hour to reach an equilibrium while the H2O concentration and the δ18O took less time.  Bevaline also had issues with reaching equilibrium in 5-minute tests, needing 6 hours to reach equilibrium. Our results demonstrate that tubing type does impact water vapor movement, influencing stable isotope concentration measurements. We anticipate that these results can help define which tubing should be used in atmospheric hydrometeorological research.

Keywords: Stable Water Isotopes; Water Molecule Interactions With Analyzer Tubing; Timing of Isotopic Equilibrium

Mentor(s):

Lisa Welp (Science); Alexandra Meyer (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1213**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Microplastics in precipitation in the Greater Lafayette area

Physical Sciences

Author(s):

Sydney Brown† (Science)

Abstract:

Over the past century, plastics have become a ubiquitous influence in our daily lives. The effects on the environment are not yet widely understood, there is an increasing interest in how these plastics break down, get lofted into the atmosphere, and impact precipitation as it falls to the surface. Plastics can also have significant impacts on our ecosystem and lives as they make their way into soils and water basins. These impacts raise a complex, multi-disciplinary question to conquer.

In this presentation, I will discuss the work that I've done to identify and quantify microplastics in precipitation. No prior studies of microplastics in our region have been conducted, however, previous studies in remote regions have shown that the presence of plastics involves transportation via natural processes. In the past year, precipitation was sampled from convective thunderstorms at three West Lafayette locations, including the Purdue ACRES site. Snow samples were collected at one of the West Lafayette locations. Samples were scanned for microplastics and organic material through optical analysis. Current research involves treating natural samples to remove organic material and comparing this sample to prior natural sample analyses.

Plastics are a major component of a globalized, rapid manufacturing-based society and the goal of this research is to uncover the implications of these plastics in precipitation and/or clouds. These implications include the possibility of microplastics acting as cloud condensation nuclei (CCN) or ice nuclei (IN), and thus, affecting cloud and precipitation formation with increasing effects over time.

Keywords: Plastics; Precipitation; Weather; Climate Change; Manufacturing

Mentor(s):

Alexandria Johnson (Science); Gouri Prabhakar (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1214**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Mechanosensing in Aplysia californica neuronal growth cones

Life Sciences

Author(s):

Alexa Burke† (Science)

Abstract:

Axonal growth is a critical step during the development of the nervous system. The neuronal growth cone is a highly motile structure at the end of axons, that responds to chemical, electrical, topological, and mechanical cues, thereby guiding axons. The effect of chemical cues on axonal pathfinding has been well described; however, how growth cones sense mechanical cues is not well understood. Different types of neurons have shown different responses to substrate stiffness. Based on computational modeling, we expect that Aplysia growth cones respond faster to soft vs stiff substrates; however, how these neurites respond to stiffness over longer periods of growth is not known. Therefore, we cultured Aplysia californica bag cell neurons on uniform polyacrylamide gels of 0.3 kPa, 3 kPa, and 30 kPa. These animals have larger growth cones than other animal models making them more suitable to quantify cytoskeleton dynamics. Our preliminary results so far indicate that Aplysia neurites growth faster on soft substrates compared to stiff substrates, whereas the number of neurites per cell body is higher on stiff substrates compared to soft substrates. These findings suggest that different aspects of neurite growth can be regulated by substrate stiffness in distinct ways.

Keywords: Neuronal Growth Cones; Aplysia Bag Cells; Mechanosensing of Neurons; Substrate Stiffness; Cytoskeleton Dynamics

Mentor(s):

Daniel Suter (Science); Laura Pulido Cifuentes (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1215**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Earth Remote Sensing utilizing Signals of Opportunity

Innovative Technology/Entrepreneurship/Design

Author(s):

Joseph Carrig† (Engineering); Jingyu Xiao† (Engineering, JMHC); Massimo Lapina† (Engineering, JMHC)

Abstract:

Signals of Opportunity (SoOp) is an emerging remote sensing technique that harnesses existing satellite signals to study Earth features. Scientific applications of remote sensing are limited by competition with communications satellites for band allocations. By using a bistatic radar to receive reflected signals from existing satellites, SoOp expands the range of frequencies available for scientific research.

Our research works toward optimizing the function of the Purdue Radionavigation Lab's Soil Moisture Tower, which is installed in a field at the Agronomy Research Center and Education (ACRE) and infers soil moisture from reflected communications signals. The NUC (Next Unit of Computing) computer at the tower can only collect and transfer a limited amount of data due to storage restrictions. We present a solution for automating the transfer of tower data to Fortress, the file storage system for Purdue research. Files are securely transferred using secure copy protocol. In the field, HydraProbes are installed at various depths beneath the surface to collect in-situ soil moisture measurements and cross-correlate with data from the tower. Lastly, we address elemental challenges to the tower system, such as precipitation damaging circuitry components within the box. We present a solution to this by installing a drip pan at the location of the breach in the box and draining this through a one-way tube.

The results of our research can give direction to agricultural experts to maximize their harvest and learn more about the targeted environment. Farmers can use the correlation of data between the signals captured by the tower, and the moisture levels below the earth to adjust and schedule accordingly.

Keywords: Signals of Opportunity; Earth Remote Sensing; Engineering Agriculture

Mentor(s):

James Garrison (Engineering); Archana Choudhari (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1216**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## IOT Machine Learning Environmental Detection

Mathematical/Computation Sciences

Author(s):

Jacob Carroll† (Engineering); David Lender† (Engineering); William Jiang† (Science, JMHC); Dogyu Ryu† (Engineering); Mihika Sharma† (Science); Anthony Petrescu† (Science, DSB)

Abstract:

Our project, based at the Bechtel Innovation and Design Center, is focused on enhancing safety within high-risk environments through the strategic use of Internet of Things (IoT) devices. We're leveraging these devices to collect a diverse range of data from multiple sensors that measure variables such as light intensity, temperature levels, particulate count, and various gas concentrations. Applying advanced machine learning algorithms to this collected data along with simulated hazard scenarios allows us to create a predictive system. This system is designed to identify potential safety incidents like fires or air contaminants before they actually occur.

The proof of concept for our project involves using a supervised learning approach which allows the computer to independently identify anomalies within the data stream. These models are trained to anticipate future sensor data values and then check whether these predicted values could indicate an impending safety incident. Our ultimate objective is not just about improving safety in workplaces with high-risk factors but also about demonstrating how cost-effective IoT systems can be used in this regard. We believe that efficiently collecting and harnessing information through these systems can play a significant role in promoting safer working conditions by enabling preventive measures before any potential hazards turn into real incidents.

Keywords: Research; Machine Learning; Algorithms; Anomaly Detection

Mentor(s):

Matthew Swabey (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1217**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Comparing Automated vs manual cell counts in Cytosmart in breast cancer cell lines

Physical Sciences

Author(s):

Kaubfar Changkanjana† (HHS)

Abstract:

The purpose of this study was to compare a manual count to an automated cell count using Cytosmart to identify the best method to accurately count our cells after exposure to radiation. We had the ability to utilize multiple breast cancer cell lines irradiating at different doses and time points to allow variation our studies. This study involved using cell lines from BT474 MG2, SKBR3 MGI, SKBR3 MG2, and MD MBA 231 irradiating them into separate wells at 0-8 Gy. This technique enables us to count our cell lines at different time periods in both manual and automated counting through multiple trials to ensure its accuracy. The percent differences in graphs proves their efficiency between manual and automated counts to reduce outliers in our data. A decay in the graph highlights how the number of cells decrease in both manual and automated counts while the exponential decay displays the accuracy between the two counts and their exposure to radiation overtime through periods up to 96 hours. Overall, our cells had to be confluent in each well before counting and each trial was adjusted accordingly to improve the visibility of the cell line which provides variability in our results.

Keywords: Breast Cancer; Cytosmart; Automated Count; Manual Count; Radiation

Mentor(s):

Matthew Scarpelli (HHS); Philip Durham (HHS); Mackenzie Coon (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1218**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## How can game development engines simulate sensory stimuli?

Innovative Technology/Entrepreneurship/Design

Author(s):

Leo Chen† (Engineering); Adarsh Veerapaneni* (Science); Amy Tong* (Engineering); Saandiya KPS Mohan* (Engineering); Jadden Picardal* (Engineering); Zilu (Johnny) Jin* (Science); Ata Ulas Guler* (Engineering); Alicia Zhou* (Science); Jin Hyun Kim* (Engineering)

Abstract:

This project aims to create artificial intelligence driven tools that can simulate human senses in realistic digital models. Using Unreal Engine's (UE) Environmental Query System (EQS), various environmental inputs can be processed to impact a simulated person's reaction to external stimuli. The EQS judges a set of points around the AI Non Player Character (NPC), choosing the point with the highest score as the next point that the AI will move to. By manipulating the scoring system and filtering out undesirable points, the engine can simulate the various senses accounting for distance, obstacles, wind, etc.

By labeling objects with certain tags, the engine recognizes the objects as sources for senses such as a trash can that smells bad or noises from people and activities. NPCs can then be set to prefer or avoid the sources at varying intensities, creating “Personas” that affect how they navigate environments. These “Personas” can then be adjusted on a case by case basis or set to random for testing purposes.

The simulation can be expanded by creating factors like wind and obstacles between the sources and NPCs, thus blocking, reducing, or enhancing the sources’ effect on the NPCs’ decisions. A simulation tool of this nature will be of service to those who would like to simulate movement flows and spatial usage through various spaces in the built environment. It could predict high traffic paths, providing design feedback that could prove invaluable in modern landscape and architectural design.

Keywords: Environmental Query System (EQS); Sensory Stimuli; AI Non Player Character (NPC); Unreal Engine (UE); Personas

Mentor(s):

Dave Barbarash (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1219**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Demonstration of a fabrication method of carbon-fiber-reinforced composite honeycomb core and investigation of its properties.**

Innovative Technology/Entrepreneurship/Design

Author(s):

Jingyu Chen† (Polytechnic)

Abstract:

Sandwich structure is well known for its great stiffness and strength while being lighter than solid material. Among various types of core structures, the honeycomb core has an outstanding stiffness-to-weight ratio and excellent fatigue resistance. It can be made of different kinds of materials such as aluminum and aramid fiber composite (Nomex®). The objective of this research is to demonstrate the manufacturing process of carbon-fiber-reinforced composite honeycomb cores and to compare their performance with those of traditional aluminum or Nomex® cores. In this study, the sandwich core was manufactured by bonding the corrugated carbon fiber strip that was compressed and cured on the aluminum mold. Two factsheets made of carbon fiber were also boned on the top and bottom of the honeycomb cores to form the sandwich structure. Following trimming the specimens into different sizes, multiple tests were conducted on three different types of honeycomb sandwich structures, including compression, flexural, and weight drop impact tests. The results of the tests showed the carbon fiber reinforced honeycomb core has a superior compressive strength and impact resistance than the Nomex® honeycomb core and aluminum core. Additionally, the carbon-fiber-reinforced honeycomb core also presents the highest strength-to-weight ratio among all three kinds of materials. Based on the characteristics of the carbon-fiber-reinforced honeycomb core, the application of this type of honeycomb core can be further investigated.

Keywords: Sandwich Structure; Honeycomb Core; Composite Material Manufacturing Technique

Mentor(s):

Garam Kim (Polytechnic); Waterloo Tsutsui (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1220**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Characterization of Cu-diamond Heat Spreaders for Embedded Chip Packages**

Social Sciences/Humanities/Education

Author(s):

Veronica Cheng† (Engineering)

Abstract:

As chip assemblies become smaller, their behavior under a variety of conditions is still unknown. The performance of these chips relies heavily on their interconnect dimensions and barrier layer, as well as on operating conditions such as elevated temperatures. Embedded packages allow a very high

degree of miniaturization, due to the possibility of sequentially stacking of multiple layers containing

embedded components. A further advantage is the beneficial electrical performance by short and geometrically well controlled interconnects. In addition, the embedding gives a homogeneous mechanical environment of the chips, resulting in good reliability. The current project works to characterize embedded packages in a Cu-diamond composite for heat dissipation.  The goal of this project is to measure the properties of Cu-diamond heat spreader. We are conducting a suite of measurements to characterize the microstructure, morphology, elastic modulus, and hardness of Cu-diamond composite.  Therefore, nanoindentation measurements are required to determine the mechanical characteristics of the copper composite heat spreader of the chips and relate it to its characteristics compared to the pure metal counterpart. Through the nanoindentation of several metal-embedded chip assemblies containing a copper/diamond composite, an increase hardness is expected compared to pure copper. If these measurements are significant, this could reveal the potential of future embedded chips to contain higher durability to thermal stress and are therefore more reliable under high temperature conditions.

Keywords:

Mentor(s):

Shubhra Bansal (Engineering); Faharia Hasan Bhuiyan (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1221**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## The mechanism of indirect PP2A suppression by mutant KRAS in PDAC

Life Sciences

Author(s):

Ella Rose Chianis† (Science)

Abstract:

Pancreatic ductal adenocarcinoma (PDAC) is the third and fourth leading cause of cancer-related deaths in the United States in women and men respectively, and it has the lowest five-year survival rate of all major cancers at only 13%. In over 90% of PDAC cases, there is an activating mutation in the GTPase KRAS. Protein phosphatase 2A (PP2A), a major serine-threonine phosphatase, negatively regulates many of the downstream factors of KRAS, but its activity has been shown to be suppressed in PDAC. This suppression is likely through the upregulation of endogenous inhibitors, namely Cancerous Inhibitor of PP2A (CIP2A). Preliminary data from our lab shows that CIP2A protein decreases in the cell as KRAS signaling is lost, suggesting that CIP2A protein overexpression is dependent on mutant KRAS signaling. However, the mechanism of this upregulation is unknown. To elucidate the role of oncogenic KRAS driving PP2A suppression through CIP2A upregulation, we used a cell line with an inducible KRAS mutation that is addicted to KRAS signaling. After starving the cells of KRAS, we found that markers of autophagic degradation increase as CIP2A protein decreases. Confirming that dysregulated autophagy is the mechanism through which KRAS indirectly deactivates PP2A is critical for leveraging PP2A reactivation as a therapeutic strategy in PDAC.

Keywords: KRAS; PP2A; CIP2A; Autophagy

Mentor(s):

Brittany Allen-Petersen (Science); Samantha Tinsley (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1222**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Discordance between preferred and actual complementary foods among rural Quechua mothers**

Social Sciences/Humanities/Education

Author(s):

Yu Chung† (HHS, Liberal Arts); Sophie Mbongo‡ (Liberal Arts)

Abstract:

Infant feeding practices are associated with health outcomes, and simultaneously linked to cultural histories and novel modernizing influences in South American indigenous communities. However, mothers may be limited in their ability to provide preferred foods, especially when they are low-income and/or geographically isolated. This project analyzes the ideals and realities of infant feeding among rural Quechua mothers in Peru. 94 mothers were interviewed regarding infant feeding practices. This included free listing of 1) the first ("actual") non-breastmilk foods provided to their youngest infant, and 2) preferred or "ideal" infant foods. Using food lists and frequencies, each food was ranked for "cultural salience" using Smith's index (S). "Salience" was determined using the standard cut-off (≥0.10). S indices were then compared for "actual" and "ideal" foods. Mothers were a median of 37 (IQR=18, range=21-84) years. The ever-breastfed rate was 100%; the ever-formula fed rate was 20% (n=94). 80 mothers reported a list of 28 "actual" complementary foods. Commercial baby foods, potato, blue corn "mazamorra," and eggs had the highest salience scores (0.37, 0.27, 0.24, and 0.15, respectively). 87 mothers reported a list of 38 "ideal" complementary foods. Egg, liver, blood sausage, and milk had the highest salience scores (0.32, 0.22, 0.18, and 0.14). Egg was the only food ranked in the top four of the "actual" and "ideal" foods lists. "Ideal" complementary foods were locally-derived and rich in protein and iron. However, reported "actual" infant foods were commercial and/or carbohydrate-based, suggesting that the Quechua mothers face constraints when feeding their infants.

Keywords: Infant Feeding; Peru; Quechua

Mentor(s):

Amanda Veile (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1223**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

### Advancing Space Habitat Safety: A Simulation-based Analysis of Safety Control Strategies

Innovative Technology/Entrepreneurship/Design

Author(s):

Meredith Clark† (Engineering); Benjamin Krugman† (Engineering)

Abstract:

With the newfound boom of the space tourism industry and impending human presence on the Moon and Mars, certifying the safety and efficiency of habitat designs is paramount in ensuring the success of extraterrestrial missions. Manned extraterrestrial missions pose numerous safety risks under disruptions that must be carefully studied, planned for, and mitigated efficiently. This study presents a simulation-based investigation into safety control strategies within lunar habitats. Building upon previous research on residential houses on Earth, this study focuses on modeling of disturbance prevention, detection, and mitigation in a space environment. Transitioning to deep space setting requires the consideration of extraterrestrial disturbances and their related consequences in microgravity condition. We also utilize advanced simulation techniques to simulate the conditions of lunar habitats in specific scenarios. With each iteration of the simulation, a set of habitat safety control strategies is simulated and analyzed to deliver comprehensive results based on the given configuration input. This study's findings provide valuable insight into the evaluation and decision making regarding different safety configurations for extraterrestrial habitation, aiding in the development of robust and economical lunar habitats for future space exploration missions.

Keywords: Simulation; Lunar; Habitat Design; Safety; Space Exploration

Mentor(s):

Xiaoyu Liu (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1224**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Mental Health, Polygenic Risk Scores, and their affect on White Matter Integrity**

Life Sciences

Author(s):

Quinn Clemenz† (Science); Lauren Voss* (HHS); Olivia Richter* (HHS, JMHC); Samantha Maari* (Science)

Abstract:

Diverse aspects of mental health are known to be partially influenced by genetic factors. Multiple aspects of brain structure and function are also associated with mental health. This study brought together these two lines of research to examine the extent to which genetic propensities relate to three different aspects of mental health: subjective well-being, depression, and anxiety, were related to integrity of the uncinate fasciculus, a major white matter tract that serves brain areas related to emotion regulation and other functions. Data was from the neuroscience sub-study of the national Mid-Life in the United States (MIDUS) study's Refresher cohort (N = 71). Data from diffusion-weighted images were used to estimate four metrics of white matter tract integrity: factional anisotropy, mean diffusivity, radial diffusivity, and axial diffusivity. Polygenic risk scores (PRS) were determined from DNA extracted from tissue samples and genotyped using Illumina Omni Express array. Linear regression models adjusting for multiple demographic characteristics were used to estimate the associations between mental health PRS and tract integrity. The results showed that there was no association between the measures of white matter integrity and any of these specific PRS. There are at least two potential explanations for this finding. This was a relatively small, demographically diverse, non-clinical (i.e., largely mentally healthy) sample, and this diversity may have masked potential associations in specific sub-populations. Moreover, liner regression models assume linear relationships between PRS and white matter integrity, however, associations may be non-linear, only emerging above some level of genetic risk.

Keywords: Polygenic Risk Scores; Mental Health; Subjective Well-Being; Depression; Anxiety

Mentor(s):

Elliot Friedman (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1225**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## An analysis of batteries and their functionality and practicality within the field of autonomous motorsports in application to the competitive Autonomous Karting Series.

Innovative Technology/Entrepreneurship/Design

Author(s):

Alexander Collins† (DSB); Adrian Romo-Loomis* (Engineering); Doren Cohen* (Engineering); Jackson Thompson* (DSB); Prahlad Shelvapille* (DSB)

Abstract:

The purpose of this investigation was to identify the best battery for future mechanical projects within the Autonomous Motorsports Purdue (AMP) club through Vertically Integrated Projects (VIP). This was done by contrasting capabilities of various lithium and lead acid batteries, and how they each respectively function within the context of an autonomous go-kart. These specific battery types cover the primary batteries found powering karts commonly competing in the Autonomous Karting Series. The chemical and physical characteristics of the batteries were stringently compared alongside each other, and it was identified that lead acid provided the most advantages in application to projects within an autonomous kart. It was also identified that, whilst expensive, lead acid batteries posed the highest value out of the investigated battery archetypes, and therefore was the best purchase prospect for AMP on a macroeconomic level. It was, however, also identified that lithium iron, lithium polymer, and lithium ion batteries did pose their respective benefits.

The demonstration of the theoretical, chemical and physical characteristics of each battery archetype will now begin to be analyzed in limited physical samples. With the application of this research, usage of lead acid batteries will now be utilized within projects conducted in the Autonomous Motorsports Purdue organization. Any research will be noted and professionally presented in order to act as a reference for any future projects within AMP.

Keywords: Battery; AMP

Mentor(s):

Shreya Ghosh (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1226**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Evaluating the Synergistic Relationship between CBX2 and CDK4/6 Inhibitors

Life Sciences

Author(s):

Gabby Conjelko† (Science); Sam King‡ (Pharmacy)

Abstract:

Despite new treatments, Breast Cancer remains responsible for one-fifth of all cancer mortalities in women. Initial and acquired drug resistance is a prevalent issue preventing current therapy regimens from being effective. Synergistic interactions between drugs to treat breast cancer are a mechanism to overcome therapy resistance. CDK4/6 Inhibitors are a recently introduced first-line therapy for specific breast cancer subtypes. Proteomic studies of cancer cell lines revealed that cells with increased expression of CBX2, an epigenetic reader protein, were more likely to resist Palbociclib.  Therefore, we were interested in determining the potential synergy of the CBX2 inhibitor SW2_152F and the CDK4/6 inhibitor Palbociclib in human breast cancer cell lines. We used a triple-negative breast cancer model, MDA-MD-231, and a HER-2 positive model, SK-BR-3. We then measured cell survival using Cell-Titer-Glo and evaluated synergy using Bliss Synergy Analysis. In addition, we created CBX2 knock-down and knock-out MDA-MD-231 lines due to poor drug solubility. These results determined the relationship between CBX2 and CK4/6 inhibitors. Further work will determine the mechanism of the effectiveness of dual inhibition.

Keywords: Synergistic; CBX2 Inhibitor; CDK4/6 Inhibitor; Breast Cancer; CBX2 Knock-Down

Mentor(s):

Emily Dykhuizen (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1227**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Investigation of hydrogel composition effect on chemical and material properties of a three-dimensional articular cartilage model

Life Sciences

Author(s):

Aaron Coppeta† (Engineering)

Abstract:

This study evaluates the effect of hydrogel components on chondrocyte production of sulphated glycosaminoglycans (sGAG) and viscoelastic material properties of the extracellular matrix. Glycosaminoglycans are negatively charged polysaccharides bound to proteoglycans that make up the cartilage extracellular matrix. sGAG concentration correlates with the concentration of proteoglycans produced by the chondrocytes and modulates the viscoelastic properties of the articular cartilage in vivo. In this study, we will evaluate the effects of agarose and composite agarose and collagen gels. The combination of these components mimics the chondrocytes' extracellular environment, with agarose contributing stiffness and viscoelastic properties similar to the pericellular matrix, while collagen type I provides cell adhesion sites. In this study, chondrocytes are isolated from murine neonates and are seeded into either a monolayer on a standard well plate (n = 3) or a three-dimensional hydrogel (n = 6). We will compare two hydrogel formulations: 4% agarose (n = 3) or 4% agarose with 2 mg/mL type I collagen type I (n = 3). We will determine the relationship between the viscoelastic properties of the hydrogel, as measured by a stress relaxation protocol, and the sGAG concentration, as measured via dimethyl methylene blue (DMMB) assay in both hydrogel types over the time points. The chondrocytes cultures will be assessed at 0, 1, 3, or 7 days. Successful completion of this study will enhance understanding of chondrocyte behavior in combined agarose and collagen hydrogel environments and move towards developing a more physiologically relevant model of articular cartilage.

Keywords: Hydrogel; Murine Model; Articular Cartilage; sGAG; Chondrocytes

Mentor(s):

Deva Chan (Engineering); Alex Nguyen (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1228**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Validation of the neuromelanin-forming rats to model Parkinson's Disease and their implication in HAA-induced dopaminergic neurotoxicity

Life Sciences

Author(s):

Matthew Corson† (HHS, JMHC); Sofia Schumann‡ (HHS)

Abstract:

Dopaminergic neurodegeneration is the fundamental hallmark of Parkinson's Disease (PD). Currently, there are major gaps in understanding the effects of dietary exposures on PD mechanisms and the specific cellular mechanisms leading to its onset. One of these dietary exposures, a group of chemicals known as heterocyclic aromatic amines (HAAs) [commonly found in cooked red meats], have been previously identified by our lab to target mitochondria, causing oxidative damage, protein aggregation, autophagy disruption, and DNA adduct formation within dopaminergic neurons. Neuromelanin (NM), a dark brown pigment, found exclusively in the nigral dopaminergic neurons in humans and other primates, is vital to HAA intracellular accumulation and neurotoxicity. Since rodents lack NM, there is a critical need for developing NM-forming models in the study of HAAs. We aim to overcome the current animal model weaknesses by implementing NM-forming rat models. In preliminary findings, we have identified NM-forming rats through molecular biology techniques and use the same to distinguish between homozygous vs heterozygous transgenic animals. Validating these in vivo models will serve as a foundational step in investigating HAA-mediated neurotoxicity. This includes studying the biochemical interactions between NM and mitochondrial dysfunction, which contribute to the initiation of a neurotoxic cascade. Additionally, it will also be vital to determine if NM-forming rats are sensitive to HAA-induced DAnergic neurotoxicity, to identify mitochondrial structures that support HAA-induced neurotoxicity, and to better understand the connections between HAA, NM, mitochondrial dysfunction, and protein aggregation, ultimately leading to PD pathology.

Keywords: Dopaminergic Neurons; Parkinson's Disease; Neuromelanin; Heterocyclic Aromatic Amines; Neurotoxicity

Mentor(s):

Jason Cannon (HHS); Fatema Currim (HHS); Josephine Brown-Leung (HHS); Reeya Tanwar (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1229**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Covalent Approximation for Dissociation Energies in Density Functional Theory**

Mathematical/Computation Sciences

Author(s):

Wyatt Crain† (Science)

Abstract:

Kohn-Sham Density Functional Theory (KS-DFT) stands out as a computationally efficient and accurate method to calculate the electronic structure of atoms, molecules, and materials. Nonetheless, it grapples with the "symmetry dilemma," an issue in KS-DFT where chemical accuracy is lost when preservation of the correct charge and/or spin symmetries is needed. Partition Density Functional Theory (PDFT) emerges as a promising approach to address this dilemma. In PDFT, the energy is obtained through coupled self-consistent fragment calculations, but the accuracy of these calculations depends on the quality of approximations for the inter-fragment interaction energies. This study aims to test a Covalent Approximation (CA) designed to refine the binding energies of covalently-bound molecules. Employing established exchange correlation functionals such as LDA, PBE, and SCAN, we undertake a comparative analysis of dissociation energies using the CA.

Keywords: Kohn-Sham Density Functional Theory; Partition Density Functional Theory; Approximation; Quantum Mechanics

Mentor(s):

Adam Wasserman (Science); Yuming Shi (Science); Alvin Uppgård (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1230**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## CAPS in the Eyes of Others

Social Sciences/Humanities/Education

Author(s):

Lauryn Crumbley† (DSB); Ryan Mason* (DSB); Kinaya Hines* (DSB)

Abstract:

Mental health is a very serious issue, especially among college students. It is important that students know and get proper treatment. Purdue provides these treatments through their Counseling and Psychological Services, or CAPS. The objective of this exploratory research project is to examine CAPS, specifically the overall state of CAPS, the outreach efforts of CAPS, and if students enjoy CAPS. This research will be conducted two ways. The first way will be through interviews with two people who utilize the CAPS services and a person that works at CAPS. The second way will be a questionnaire with a mixed group of students. It is important for students with mental health issues to know the services that are available to them. Knowing their resources around them can increase their help-seeking habits, which will increase their mental health. This increase could help in many ways, including healthier habits and increase in grades.

Keywords: Mental Health; Services; College Students; Outreach Efforts; Enjoyability

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1231**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Investigation of Occupational Exposure to Heavy Metals and Pesticides, Potential Risk Factors for Parkinson’s Disease

Life Sciences

Author(s):

Perry Curtis† (HHS); Hannah Bard* (HHS); Tamia Austin* (HHS)

Abstract:

Parkinson’s disease (PD) is a neurological disease that has become increasingly prevalent; meanwhile, environmental risk factors for PD have been understudied. Previous literature demonstrated that occupational heavy metal and pesticide exposure are linked to PD. The goal of this analysis is to calculate and compare cumulative occupational metal exposure to metal concentrations from current toenail, urine, soil, and dust samples. This cross-sectional study included adults (18+ years) from Hartford City, Indiana. Participants collected soil and dust from their residence, completed surveys, and provided biomarkers at a study visit. A total of 80 people completed the study. Analysis focused on occupations with known exposure to metals which have been linked to neurological toxicity including lead, arsenic, and manganese. Participants provided their occupational history; this was used to create an exposure estimate in the form of a cumulative exposure index (CEI). Previous literature was used to create categories of occupations with high, medium, or low likelihood of exposure to heavy metals. The CEI was calculated by using exposure likelihood and adjusting for years spent in each occupation. The correlation of metal concentrations in environmental and biological samples with CEI will be calculated. Initial results showed that N=26 (32.5%) of participants have had an occupation linked to high heavy metal exposure in previous literature. Additionally, N=68 (85%) of participants’ latest occupation fell into the low-exposure category. Ultimately, this will inform further work on heavy metals as potential risk factors of PD and other health issues in Hartford City.

Keywords: Heavy Metals; Occupation; Parkinson's Disease; Pesticides; Hartford City, Indiana

Mentor(s):

Ellen Wells (HHS); Edem Sededji (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1232**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Phrenology and Slavery: 19th Century Pseudoscience in the Antebellum South

Social Sciences/Humanities/Education

Author(s):

Arianna Dejoie† (HHS, Liberal Arts)

Abstract:

The United States Antebellum Era is a period of history of the Southern United States that extended from the conclusion of the War of 1812 to the start of the Civil War in 1861. This project examines the historical connection between phrenology and the justification of slavery in the United States Antebellum South. Phrenology is a 19th century pseudoscience that claimed to link the shape and size of cranial bumps to specific mental capacities and character traits. (Greenblatt 1995) This pseudoscientific belief played a significant role in conserving racist ideologies during this period. This research explores how in the 19th century pseudoscience and racism became intertwined as medical fact and used to ideologically justify and economically support African enslavement. Medical experts such as Samuel Cartwright built reputations on claiming knowledge and authority over Black bodies at a time when the medical profession was not well regulated. (Willoughby 2018) This research focus will pertain to pseudoscientific documents and primary sources written during the United States Antebellum Era. This study explores how medical professionals in the Antebellum South employed phrenological principles to validate their arguments, creating a false narrative of the scientific legitimacy to this practice of enslavement. Through the analysis of primary sources, such as phrenological diagrams and published work found through various data bases and archives, this research will reveal how this pseudoscience circulated and had major impact on public opinion contributing to the maltreatment of enslaved peoples in the United States.

Keywords: Pseudoscience; Scientific Racism; Antebellum Era; Slavery; Phrenology

Mentor(s):

Yvonne Pitts (Liberal Arts); Scotty Secrist (VP Diversity and Inclusion)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1233**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Expanding Therapeutic Potential: Engineered IL-27 Variants with Prolonged Half-Life for Enhanced Anti-Tumor Efficacy

Life Sciences

Author(s):

Aryaman Dewan† (Science)

Abstract:

Interleukin-27 (IL-27) presents a promising avenue to slow down tumor progression and induce regression across various cancer models. However, the clinical translation of cytokine-based therapeutics is hindered by their short half-lives, typically ranging from 1 to 5 hours. Numerous strategies have been devised to address this limitation, including PEGylation and lipidation. Yet, most of these strategies involve post-production modifications, escalating production costs, and complicating purification processes while potentially triggering immunogenic responses. In this project, our focus centers on the expression of proteins fused with a Pro-Ala-Ser (PAS) domain, which can be genetically encoded, offering a promising avenue for extending protein stability. To this end, we have designed an IL-27 variant featuring a PAS200 domain (addition of 200 repetitions of amino acid Pro-Ala-Ser sequence to the N-terminus) aimed at prolonging the protein's half-life alongside a non-PASylated version serving as a control. During this study, we successfully developed methods for expressing and purifying these protein variants. Notably, while IL-27 was expressed in Escherichia coli (E. coli), its expression was unattainable in mammalian cells. Conversely, the PAS200 IL-27 variant could only be expressed in mammalian cells, failing to express in E. coli. To ensure consistency in testing conditions, we elected to express the PASylated IL-27 in Expi 293FGnTI cells. This mammalian cell line lacks N-acetylglucosaminyltransferase I (GnTI) activity and, therefore, lacks complex N-glycans. Our expression and purification strategy revolved around affinity and size exclusion chromatography techniques. Subsequent animal studies are planned to understand these variants' therapeutic potential further.

Keywords: IL-27; Cytokine-Based Therapeutics; PASylation; Protein Engineering, Expression, Purification; Half-Life Extension

Mentor(s):

Raluca Ostafe (Discovery Park)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1234**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Distribution and Pattern Analysis of Osteoarthritis in an Ancient Tombos Population

Social Sciences/Humanities/Education

Author(s):

Sophia DeWitt† (Liberal Arts)

Abstract:

Osteoarthritis is the most common type of arthritis which affects millions of people each year. This degenerative joint disease is associated with many factors but can be difficult to diagnose in both living and non-living populations. For this study, remains from the ancient Egyptian/Nubian archaeological site of Tombos, Sudan (1400-750 BCE) were observed and analyzed to document the presence of osteoarthritis in discretely buried adult individuals. Data was collected on six joints in seventy-nine individuals for new bone growth, pitting, and eburnation; each joint surface was scored between zero and three based on severity. Individuals who had two or more conditions with a score of two or higher were diagnosed with osteoarthritis. Of the original seventy-nine, nine (11%) were considered osteoarthritic; only three (4%) individuals demonstrated moderate/severe osteoarthritis with the remaining having a mild severity. Osteoarthritis is a degenerative disease that involves some type of repetitive motion for an extended period for conditions to exist; 89% of the individuals presented mild or absent osteoarthritic conditions. This suggests that that most of the population was not engaged in heavy repetitive manual labor. Contextual information about these individuals based on demographic information and mortuary practices indicates that males and females affected by osteoarthritis range from young to old adult and come from different tomb types across the site. Variations in osteoarthritis status and mortuary practices provide an opportunity to explore possible socioeconomic and subgroup differences in the community.

Keywords: Anthropology; Osteoarthritis; Tombos; Pattern Analysis; Osteology

Mentor(s):

Michele Buzon (Liberal Arts); Sarah A Schrader (Leiden University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1235**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Analysis of Thermal Neutron-Induced Degradation in Commercial SOIC and TSSOP EEPROMs Across Varying Memory Capacities

Innovative Technology/Entrepreneurship/Design

Author(s):

Fraser Dougall† (Engineering); Brian Dodd‡ (Engineering)

Abstract:

The space industry requires robust and high performance devices for optimal performance in missions. A commonly used device is the electrically erasable programmable read-only memory (EEPROM). It is essential that these devices are able to hold up in the radiation environments present in space due to their importance in storing mission critical data. This research intends to explore the degradation of commercial EEPROMs in a thermal neutron environment so they can be better radiation-hardened for future space applications. The experiment is planned to use the Nuclear Engineering Department's Subcritical Pile, which emits thermal neutrons. A custom manufactured PCB will host the EEPROMs in the neutron ?ield, which will be externally monitored by an Arduino-based microcontroller and a Raspberry Pi. Each PCB, tested per ?lux level, will have all packages and storage capacities and the stored data on each device will be intervally dumped to the microcontroller to be relayed to the Raspberry Pi for storage and evaluation. Since TSSOP packages are by design more dense and thinner packed compared to SOIC, we expect that there will be a statistically signi?icant difference between the reliability and degradation rate between two chips of identical memory capacity and differing packaging type. We expect TSSOP-packaged chips will degrade faster and harsher than SOIC due to the higher density leading to higher probability of thermal neutron interaction. Additionally, since TSSOP packages are thinner, there is less material to attenuate or scatter incoming neutrons leading to a higher interaction rate and faster degradation.

Keywords: Neutron; EEPROM; PCB; Radiation Hardened Electronics; Space

Mentor(s):

Peter Bermel (Engineering); Stylianos Chatzidakis (Engineering); Allen Garner (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1236**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## SWARMS: Multi-Agent Control Simulation Platform

Innovative Technology/Entrepreneurship/Design

Author(s):

Avi Dube† (Engineering); Peter Zakariya† (Science); Sully Cisco* (Engineering); Justin Gan* (Engineering); Sahithi Gokavarapu* (Science); Josh Krohn* (Engineering); Derek Matthei* (Engineering); Anne Mitten* (Engineering); Pranati Patchigolla* (Science)

Abstract:

The SWARM Simulation platform is a user-friendly cloud-based application designed to advance drone development and autonomous research. By utilizing Unreal Engine's high-fidelity graphics in combination with AWS cloud services, it offers scalability and realism while significantly reducing computational demands. Researchers can efficiently design, implement, and evaluate multi-agent flight control algorithms using this platform. SWARM provides accessible data log files and visualizations for in-depth analysis of simulation results, including drone positions over time. The platform also offers realistic benchmarks and built-in libraries for common autonomous navigation functions, such as task allocation and obstacle avoidance utilizing LiDAR sensor data. SWARM RDS UI utilizes a native user interface application to simplify the simulation and system setup, which is particularly useful for testing custom algorithms.

Current efforts are primarily directed towards enhancing autonomous drone capabilities through the development and testing of custom algorithms, alongside building automation tools for comprehensive simulation analysis. A major focus is on developing a multi-sensor fusion-based mapping system that integrates semantics from various sources, including LiDAR data and cameras, to provide a complex awareness of drone navigation, especially for indoor search and rescue missions. This initiative aims to leverage machine learning-based object detection and LiDAR-based mapping to significantly improve the effectiveness of autonomous drones in critical scenarios.

Keywords: Autonomy; Simulation; Sensor Fusion; Machine Learning; Unreal Engine

Mentor(s):

Shreyas Sundaram (Engineering); Younggil Chang (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1237**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Examining the association between laboratory-induced stress and reward responsiveness in new mothers

Social Sciences/Humanities/Education

Author(s):

Elena Eberwine† (HHS, JMHC)

Abstract:

Current research indicates that laboratory-induced stressors are associated with blunted reward responsiveness, as assessed by the Reward Positivity (RewP), a neurophysiological event-related potential. However, few studies have examined this association within at-risk populations, such as new mothers, particularly utilizing an emotionally valanced picture viewing task as the laboratory stressor. For this reason, this study aims to explore the relationship between stress, induced by a picture viewing task, and the RewP in new mothers. It is hypothesized that elevated levels of stress will correlate with a reduced RewP response. A sample of 28 mothers were recruited to engage in a picture viewing task, followed by the collection of salivary cortisol to evaluate their current stress levels. Subsequently, participants underwent a simple gambling task while their EEG activity was continuously recorded to elicit the RewP. Correlation analyses will be conducted to investigate the proposed research question. Considering that new mothers represent an at-risk group due to recent significant life transitions, it is important to examine this relationship to further understand how these factors may contribute to negative mental health outcomes, including depression.

Keywords: Cortisol; Reward Positivity (RewP); Stress; New Mothers; Laboratory Tasks

Mentor(s):

Dan Foti (HHS); Kimberly Galvez-Ortega (HHS); Kaylin Hill (Purdue University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1238**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Wireless Debug Access Port**

Innovative Technology/Entrepreneurship/Design

Author(s):

Jiaming Fang† (Polytechnic); Qinjia Xu‡ (Engineering); Zay Linn Htet* (Engineering, JMHC); Drew Philhower* (Engineering); Rongbo Hu* (Engineering)

Abstract:

RoboMaster competitions rely heavily on the efficient coding of robots for optimal performance, with the Debug Access Port (DAP) playing a crucial role in facilitating this process. Acting as a bridge between a user's computer and the chip needed for coding, DAP enables seamless communication and debugging. Among DAP solutions, the CMSIS-DAP structure stands out, offering a wireless debugging interface that minimizes disruptions and risks associated with wired connections. Implementing wireless DAP streamlines debugging, enhancing the overall competition experience. The wireless DAP, based on the CH32V307 microcontroller, functions as a receiver and transmitter of data between the user's computer and designated devices like the STM 32 chip.

Before adopting wireless DAP, USB connections using STLINK were common, but limited by cable length. In contrast, wireless DAP allows for transmission within a 5-meter radius. Although wireless transmission slightly compromises speed compared to wired STLINK connections, with STLINK averaging 49.98 KB/s and wireless DAP averaging 48.17 KB/s in three test cases, the benefits of increased mobility and reduced risk of cable interference outweigh the minor speed reduction. Moreover, stability issues with wireless DAP connections can often be resolved by adjusting clock frequency or switching connection cables, further enhancing usability. Overall, wireless DAP emerges as a versatile solution, offering competitive advantages in RoboMaster's dynamic environment

Keywords: Wireless; Transmission; Debugger; Coding; Microcontroller

Mentor(s):

Abolfazl Hashemi (Engineering); Zijian He (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1239**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

### Analysis of Online HPV Vaccine Hesitancy

Mathematical/Computation Sciences


Author(s):

Chris Farber† (Science, JMHC); Neel Sarathy‡ (Science, JMHC); Selina Lin‡ (Science, JMHC)



Abstract:

Social media websites such as Reddit are prominent platforms for disseminating information and opinions on public health topics such as the Human Papillomavirus (HPV) vaccine. Analyzing the sentiment and subjectivity of Reddit posts related to the HPV vaccine across different subtopics can provide crucial insights into public opinions on the vaccine.

This study aims to analyze how the subjectivity and sentiment of posts concerning the HPV vaccine vary across different subtopics within online discussions.

Utilizing the Reddit API, a dataset of Reddit posts discussing the HPV vaccine will be collected and analyzed with Natural Language Processing (NLP) to assign sentiment and subjectivity scores to each post. From here, NLP will be used to categorize this data into subtopics, such as vaccine hesitancy and effectiveness. Mean, median, and range of sentiment and subjectivity scores across subtopics will be compared, and correlational analysis will be applied to see the relationship between subjectivity and sentiment scores within each subtopic.

Findings from this research can inform public health communication strategies by highlighting areas of concern or misinformation regarding the HPV vaccine. Understanding the attitudes within different subtopics can allow for targeted actions to address misinformation and promote acceptance of the HPV vaccine. Additionally, insights gained from this study can be put towards refining sentiment analysis techniques for analyzing health-related discussions on social media platforms in future studies.



Keywords: HPV Vaccine; Sentiment Analysis; Natural Language Processing; Public Health; Social Media



Mentor(s):

Soojung Jo (HHS); Min Sook Park (University of Wisconsin Milwaukee)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1240**

*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Research and Development in IoT and Edge Processing

Innovative Technology/Entrepreneurship/Design

Author(s):

Maximillian Farrell† (DSB); Jack Scarfo† (Engineering); Anish Asthi† (Engineering); Minh Vu† (Science); Vinh Tran† (Science); Mateo Hackett† (Engineering); Michael Piper† (Engineering); Anthony Wachowski† (DSB); Avinash Ignaczak† (DSB)

Abstract:

The Bechtel Innovation and Design Center (BIDC) is Purdue's central makerspace and a creative hub for makers across campus. With facilities ranging from machine shops to electronics labs, 3D design studios, and more, the BIDC provides essential resources for all engineering projects. With numerous students utilizing this shared space simultaneously, ensuring safety is the highest priority. However, the BIDC lacks a robust and intelligent automated system that monitors the environment and alerts occupants before an incident occurs. We address this critical gap and ensure the safe operation of tools and machinery by monitoring signs of danger by building an array of sensors and working with our ML team. Our team has created sensor nodes with a Wi-Fi-enabled microcontroller that allows us to centralize ML classification to one Orange Pi. These ESP32 microcontrollers use an ad hoc network called ESP-NOW. An Orange Pi 5 receives and will eventually process the data. Our project includes a robust data pipeline to manage insights from our sensor network, seamlessly integrating data into both local and offsite databases with multiple redundancies. Data will soon be accessible via a web server with GUI. Weekly updates will include predicted labels generated by our ML team’s prediction system. By combining sensor data with these labels, we will enhance our system's capabilities, enabling continuous model improvement through re-training.

Keywords: Air Quality; Monitor; Edge Processing; IoT; Safety

Mentor(s):

Matthew Swabey (Engineering); Jaeeun Kim (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1241**

*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

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

Life Sciences

Author(s):

Mia Fleisher-de Kozan† (Science, JMHC)

Abstract:

Eukaryotic initiation factor 2 (eIF2) plays a critical role in mRNA translation as the phosphorylation of the eIF2α subunit inhibits translational initiation. Commonly categorized as a stress response, phosphorylation of eIF2α is associated with changes in healthy aging, memory, behavior, and nervous system development making it critical to the understanding of neurodegenerative disease. We hypothesize that early life exposure to methylmercury will impact sensitivity to secondary exposure with sodium arsenite in the eIF2 pathway. 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 and ELISA. Investigation of MeHg developmental exposure has shown an effect on the regulation of the eIF2 pathway in mature neurons via western blot in addition to genome-wide gene expression changes in the eIF2 pathway. Cells exposed to 1 µM during development showed an increase in expression of phosphorylated eIF2α compared to controls. To further assess the long-lasting effects of the primary MeHg exposure, sodium arsenite ($NaAsO_2$), known to impact eIF2 regulation, was used as a secondary stressor. Preliminary results of $NaAsO_2$ secondary exposure show an increase in eIF2 activation in samples exposed to 200 µM $NaAsO_2$, including prior MeHg-exposed cells. Future experimentation with additional concentrations of $NaAsO_2$ is necessary to further evaluate the effects of a secondary stressor.

Keywords: Methylmercury; Sodium Arsenite; eIF2; iPSC

Mentor(s):

Aaron Bowman (HHS); Anke Tukker (HHS); Jennifer Schmitz (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1242**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Modelling Transistors in a Simulated Radiation Environment

Innovative Technology/Entrepreneurship/Design

Author(s):

Mason Fleming† (Engineering)

Abstract:

When transistors are exposed to radiation, the charge concentration within the transistor changes. This can impact the performance of a transistor. These charges affect the current and sometimes lead to a complete failure of the functionality of a transistor. Although research has been done on the effects of radiation on different transistors, the research is not up-to-date with modern transistors, such as Gate-All-Around (GAA) transistors. To analyze the effects, Dr. Peter Bermel, Hannah Pike and I have employed the Technology Computer-Aided Design (TCAD) modeling software called Sentaurus to produce and inflict radiation on the transistors. To simulate radiation we have changed the charge concentration running through the transistors at varied gate and drain voltages, then have analyzed the consequent output drain current. In order to model the more modern transistors, the dimensions of the previous Metal–Oxide–Semiconductor Field-Effect Transistors (MOSFET) and previous transistors have to be changed. Throughout the modern-shaped transistors, we have been able to see that an increased charge concentration can cause an increased drain current, which can lead to the dysfunctionality of all transistors, including modern transistors like GAAs. This study is the subsequent research project to the previous study of MOSFETs in the same environment, and based on both of these studies, we can determine that the addition of either a positive or negative charge concentration increases drain current in transistors causing potential damage to the transistor.

Keywords: Transistors; Radiation; Drain Current; Gate Voltage; Technology Computer-Aided Design

Mentor(s):

Peter Bermel (Engineering); Hannah Pike (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1243**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Evaluating the Effect of Placement of a Photolabile Backbone Amide Linker on the Yield of a Cyclic Pentapeptide

Physical Sciences


Author(s):

Madison Flowers† (Science)



Abstract:

Peptide drugs are an increasingly important component of drug discovery, especially cyclic peptides, whose lack of C and N termini makes them more bioavailable. Solid Phase Peptide Synthesis (SPPS) is the primary method for making these, however cyclic peptides are not possible to synthesize on resin because the C-terminus isn't free. To overcome this, the Backbone Amide Linker (BAL) approach is used. To this end, the Lipton Lab developed a photolabile BAL that not only has an extra dimension of orthogonality but also releases peptides with efficiency via photolytic cleavage. Another issue of the BAL method arises during the dipeptide stage, which is when diketopiperazine (DKP), an undesired byproduct, forms. To avoid DKP formation, peptide synthesis using this BAL has been optimized. One unanswered question is whether the position of placement of the linker on the growing peptide chain affects the efficiency of synthesis and, if so, whether rules can be worked out to guide future users. My research is to synthesize three versions of a cyclic penta-peptide but with different placement of the linker. Finally, these cyclic peptides will be analyzed using LC-MS to see which position results in the highest yield and purity.



Keywords: Solid Phase Peptide Synthesis; Photolabile Backbone Amide Linker; Cyclic Peptide; Drug Discovery; Diketopiperazine (DKP)



Mentor(s):

Mark Lipton (Science); Kaif Rashid Khan (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1244**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Does Adding Lean Red Meat to a Healthy Vegetarian Diet Affect the Gut-Derived Metabolite Trimethylamine Oxide?

Life Sciences

Author(s):

Madyson Foster† (HHS)

Abstract:

Objectives: Research suggests associations between greater meat consumption and cardiometabolic disease may mechanistically attribute to higher plasma Trimethylamine Oxide (TMAO), a gut-microbiota-dependent metabolite. We assessed the effects of adding unprocessed, lean red meat (URM) to a lacto-ovo vegetarian dietary pattern (LOV) on TMAO concentrations in healthy, young adults. We hypothesized adding URM would blunt a reduction in TMAO.

Methods: For this randomized-controlled, cross-over trial, 19 participants (42% females; ages 26 +/- 4y; BMI 23 +/- 3kg/m2, mean +/- SD) without diagnosed disease consumed the LOV diet (control) and the LOV plus 3 ounces of cooked URM (experimental) during 3-week dietary interventions separated by a 5-week dietary washout period. Fasting blood samples were collected before and during the last two weeks of each intervention and analyzed for plasma TMAO concentrations and its associated factors. TMAO data were transformed for normality.

Results: Adding red meat to the LOV diet did not influence short-term changes in TMAO (treatment-by-time, p=0.430). Post-intervention, TMAO was higher in URM vs. LOV (p=0.024). Plasma choline, betaine, and carnitine were not differentially affected by URM vs. LOV or changed after consuming the healthy dietary pattern (all p>0.05).

Conclusion: Inconsistent with our hypothesis, adding red meat to a LOV diet did not differentially affect changes in TMAO. However, the apparent differences in TMAO post-intervention suggest adding the red meat may have blunted a reduction in TMAO when these healthy, young adults switched from consuming their self-chosen, habitual diet to a healthy LOV diet.

Keywords: Beef; Pork; Randomized Controlled Trial; Healthy Dietary Pattern; Omnivorous Diet

Mentor(s):

Wayne Campbell (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1245**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**The Effects of Coal Ash on Wetland Aquatic Fungal Biodiversity**

Life Sciences

Author(s):

Ethan Fox† (Agriculture)

Abstract:

The US generates an estimated 140 million tons of coal ash annually, posing significant challenges due to the limited availability of storage space and the potential environmental ramifications, including contamination of surrounding areas and groundwater. This study endeavors to investigate the effects of coal ash on the biodiversity of fungi within wetland ecosystems. I hypothesized that coal ash will not only decrease the overall number of fungi but also lead to a reduction in fungal species diversity.

In November 2023, soil and water samples were meticulously collected from the Celery Bog. The experimental setup involved introducing varying quantities of coal ash to autoclaved soil within Erlenmeyer flasks, which were then filled with a blend of autoclaved water and water sourced from the Celery Bog. These flasks were subjected to a regime of darkness and agitation for a duration of 8 weeks. Subsequently, samples were plated onto media, and the resulting colonies were visually enumerated, and their diversity documented. Morphologically unique colonies were then transferred to pure culture for molecular identification, yielding a total of 133 fungal isolates.

Preliminary findings indicate a lack of significant difference in colony forming units across different concentrations of coal ash. Nonetheless, further study is required to ascertain the precise identities of the isolated species and to elucidate the full extent of coal ash's impact on fungal biodiversity. This research is important, as it may directly influence critical ecological processes such as the carbon and nitrogen cycles within wetland ecosystems.

Keywords: Ascomycota; Diversity; Community; Ecology

Mentor(s):

Daniel Raudabaugh (Agriculture); Cathie Aime (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1246**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Interplay Between N6-methyladenosine RNA and R-loop Biology in Aging and Neurodegeneration

Life Sciences

Author(s):

David Fries† (Agriculture, JMHC)

Abstract:

[Abstract Redacted]

Keywords: Alzheimer's Disease; R-loops; m6A RNA

Mentor(s):

Hana Hall (Agriculture); Kendall Cottingham (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1247**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Mapping the Terrain of Military Youth Experiences

Social Sciences/Humanities/Education

Author(s):

Anaelle Gackiere† (HHS, Liberal Arts)

Abstract:

Introduction

Thirty-seven percent of military personnel are parents and their deployments expose their children to a unique set of challenges and opportunities. To the best of our knowledge, no studies to date document the timing and accumulations of particular life events and transitions in the lives of children in military families. This research aims to examine military youth trajectories using novel life history data from parent and adolescent pairs participating in the Operation Military Experience Project, an ongoing longitudinal study at Purdue University's Military Family Research Institute.

Methods

Participants reported life events drawn from existing measures during virtual structured interviews. Our first aim was to describe patterns in adolescents' responses to life events using descriptive statistics. Second, we compared the density of parent and adolescent reports. Our final objective was to explore temporal alignment between parents' and adolescents' life events.

Results

The two most commonly reported events for adolescents were major accomplishments (n=14) and changing schools (n=12). Adolescents reported between 1 to 22 events in total, with an average of 0.85 events each year (median=0.625) during the reporting period.

Analyses for our second and third aims are ongoing.

Implications

These insights will be useful to carry out more extensive analyses of the life history data across the entire sample to predict a possible correlation between familial ties and risk and resilience in military children.

Keywords: Deployment; Military Youth; Risk and Resilience; Life Course; Temporal Alignment

Mentor(s):

Shelley MacDermid Wadsworth (Centers & Institutes)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1248**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**High Temperature Heat Pumps with Low-GWP Refrigerants**

Physical Sciences

Author(s):

Darshak Gadagkar† (Engineering)

Abstract:

This presentation shows the preliminary results of a high-temperature heat pump (HTHP) configuration operating at a heat sink temperature of 200 °C. While previous high-temperature heat pumps have reached temperatures of 160-170 °C, this HTHP configuration will be the first of its kind in the US to reach this temperature threshold. Not only is this HTHP configuration concerned with reaching 200 °C, but it is also concerned with using refrigerants that have a low global warming potential (GWP). Oftentimes, cycles utilize refrigerants that carry a significant carbon footprint, but this cycle will attempt to reach the requisite high temperatures while simultaneously identifying a fluid, or fluid mixture, that minimizes the carbon footprint. Thus, researchers developed a theoretical model in Python to first identify the ideal low-GWP fluid or fluid mixture for the cycle, and to then predict and analyze the performance of the cycle. The expectation is that this cycle will be efficient enough in producing heat to exceed the costs associated with this project. The theoretical model takes this into account, transforming the physical quantity of heat into dollars and estimating global warming impact, adding much-needed context to the cycle's performance. As this is an ongoing project, the next steps include merging the theoretical model with the physical prototype that remains to be constructed. The model will be updated with physical parameters for the components that make up the cycle, ultimately resulting in a robust model that can accurately depict the performance of the HTHP cycle.

Keywords: High Temperature Heat Pump; Low Global Warming Potential; Refrigerants

Mentor(s):

Riley Barta (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1249**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Investigating the Impact of a Co-curricular Learning Community on the Sense of Belonging and Mental Wellness of College Students

Social Sciences/Humanities/Education

Author(s):

Kylee Gall† (HHS)

Abstract:

Belongingness is not just about feeling connected to others but also mattering to them. This sense of connection is critical to our mental and social wellness, yet it can be even more impactful for youth. During times of transition, like those college students experience, belonging can be paramount to their success especially those from lower socioeconomic backgrounds, different cultural backgrounds, and racial minorities. This assurance can diminish one's feelings of isolation and anxiety thus enhancing their ability to thrive and succeed. Co-curricular activities such as learning communities, service-learning projects, and common reads are thought to aid in seeding connection across some traditionally perceived diversifying lines, establishing threads of belonging. When centered around an area discipline or field of interest, synergy across diversity can be further enriched and facilitate a broadening of one's viewpoint to afford greater understanding and establish deeper connection and vulnerability that can be shared and explored in a safe environment. Common reads provide a unique opportunity for students in learning communities to discuss their shared passion, make connections to class material, and explore differing views. For this study, students will reflect on their co-curricular engagement in a field-of-study-based learning community using a survey containing Likert and free-response questions. Survey responses will give insight into the effectiveness of participation in co-curricular activities associated with the learning community in fostering connectedness, collaboration, an increased sense of belonging, improved mental wellness, and greater self-efficacy for its members.

Keywords: Common Read; Learning Community; Belonging; Self-Efficacy; Mental Wellness

Mentor(s):

Lisa Hilliard (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1250**

*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Perceived Participant Learning Gains Attained While Participating in an REU Program

Innovative Technology/Entrepreneurship/Design

Author(s):

Mridulla Ganesh† (Engineering)

Abstract:

Motivation – Through this study, we hope to make the National Science Foundation (NSF) Research Experience for Undergraduates (REU) program a better experience for students and motivate them to enroll in graduate school. By providing insights about their experiences to REU site managers and NSF directors, REU can be improved for all.

Methods – Students that participated in the REU program were asked to answer questions about their learning gains and experiences participating in an entrepreneurship focused research program. Their responses were loaded into NVivo, and a thematic analysis was performed. By organizing the students' responses into themes, we were able to identify patterns in their experiences.  We found 4 major themes, which were further broken down into 2 or 3 subthemes each.

Preliminary Results – The major themes that we discovered in the students' responses were IDEA  (inclusion, diversity, equity, and access), Seeing Value, Self-Efficacy and Supportive Environment. We were able to break down IDEA into Diversity of Ability, Diversity of Background and Diversity of Thought. Seeing Value was broken down into Soft Skills Value and Technical Skills Value. We broke down Self Efficacy into Prior Soft Skills Experience and Prior Technical Skills Experience. Supportive Environment was broken down into Peer Support and Mentor Support.

Implications - This study will allow REU program managers and NSF directors to make informed decisions about the changes that they might make to the program. By having access to this information, they will be able to make decisions that will benefit all students, particularly underrepresented students.

Keywords: Engineering; Education; REU; NSF; Research

Mentor(s):

Lisa Bosman (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1251**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Machine learning support for semiconductor nanodevice design

Mathematical/Computation Sciences

Author(s):

Ansh Gangapurkar† (Science); Sangjin Lee* (Engineering); Andrew Liu* (Science); Rahul Menon* (Science); Hyun (Eric) Kang* (Science)

Abstract:

Semiconductor nanodevice designs present many challenges due to the high simulation cost. Due to the current size of semiconductors, developing semiconductors requires us to simulate at the atomic level. One idea to achieve this is to use low-rank approximations to reduce simulation costs, which require device-specific basis representations. Our research aims to address the need for a sufficiently large database of device-specific basis representations by using Purdue's quantum code and the NEMO5 cluster to generate basis representations. This requires human pattern recognition skills to train the model and validate the representations. In the future, we will train machine learning algorithms on these representations to automate and optimize the entire process. By integrating machine learning into semiconductor nanodevice design, our research will help advance simulations for industry applications. Faster computation will allow developers to streamline the production and R&D process. This can potentially revolutionize the way semiconductor devices are designed and optimized.

Keywords: Semiconductors; Computer Science; Machine Learning

Mentor(s):

Tillmann Kubis (Engineering); Logan Melican (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1252**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Novel Injector Breaks Down Translational Barriers Paving Path for Superior Vocal Fold Medialization Materials

Innovative Technology/Entrepreneurship/Design

Author(s):

Andrew Gangstad† (Engineering, JMHC); Shaiv Mehra† (Engineering, JMHC); Tommy Mullin† (Engineering); Joshua Sexton† (Engineering, JMHC)

Abstract:

Individuals with unilateral vocal cord paralysis (paralysis of one vocal cord) often face challenges when speaking and eating. Temporary relief is commonly provided with injections of hyaluronic acid, saline, or autologous fat to bulk or augment the nonfunctional cord, allowing the functional vocal cord to aid in vocalization and ingestion. Unfortunately, bulking is temporary, with material biodegradation or fat reabsorption and necrosis occurring over a two to twelve month period of time, requiring follows-ups for re-injection. Multi-component in-situ polymerizing biomaterials have potential to bring more permanent bulking solutions for vocal fold medialization applications; however, current vocal fold injectors do not accommodate such materials. Here, we describe HarmoniJect, an injector device that supports simultaneous mixing and injection of two-solution, in-situ polymerizing biomaterials. Unlike previous injectors, HarmoniJect combines component solutions into a single fluid path with a static mixer, thereby avoiding unwanted pre-polymerization of the biomaterial. Additionally, it features a clinician inspired design with ergonomics. HarmoniJect provides compatibility with current needles and laryngoscopes allowing for seamless clinical integration. Testing to verify the mixing performance of the device was conducted by measuring the pH and mechanical properties of injected biomaterials. Force testing was also conducted to assess the amount of force required to inject a sample from our device. These verified the effectiveness of HarmoniJect's mixing capabilities and the ease with which materials can be injected. By improving clinical workflow, HarmoniJect represents a potential critical device to assist in the translation of in-situ-polymerizing biomaterials for more permanent vocal fold medialization applications.

Keywords: Medical Device; Novel; Vocal Fold Medialization; Unilateral Vocal Cord Paralysis; Polymeric Collagen Biomaterials

Mentor(s):

Sherry Harbin (Engineering); Stacey Halum (Indiana University); Theodore Puls (GeniPhys)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1253**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Exploring the Surface Dynamics and Flowability of Soy-Derived Products for Diverse Applications.

Physical Sciences


Author(s):

Junezuh Ghang† (Engineering)



Abstract:

Soybeans are renowned for their dual role as a nutritional staple for both humans and livestock, but their utility extends far beyond edibles. They are integral to a multitude of common household products, including adhesives, lubricants, and paper. A critical factor in product development is largely governed by particle morphology characteristics such as particle size, shape, texture and surface composition. The interaction of particles at the surface dictate adhesion-cohesion interactions and how powders will behave during handling and flowability. This study scrutinizes a spectrum of analytical tools including surface characterization – visualization by Scanning Electron Microscopy (SEM) and surface energetics by Inverse Gas Chromatography (IGC) - and powder assessment to evaluate bulk density, flowability using dynamic avalanching angle and shear stress of various soy-derived products, such as soy flour, soy protein isolate, and soybean hulls. Each factor provides insight into the discrete and collective behaviors of powder particles, contributing to a comprehensive understanding of the flow properties inherent to soy powders. The results reveal that the interactions among distinct soy powder particles are markedly influenced by surface properties, the external forces and environmental conditions applied. These findings highlight the complex nature of powder behavior and underscore the importance of tailored handling and processing techniques for soy-based applications.



Keywords: Surface Dynamics; Flowability; Surface Characterization; Soy-Derived Product; Particles



Mentor(s):

Teresa Carvajal (Agriculture)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1254**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Examining neurophysiological responses to emotionally salient stimuli in children with ADHD

Social Sciences/Humanities/Education

Author(s):

Grace Gilbert† (HHS, JMHC); Trina Tagamolila‡ (HHS); Sarah Ramsey‡ (HHS)

Abstract:

There is a deficit in the understanding of how attention and emotion interact in children with Attention Deficit Hyperactivity Disorder (ADHD). This neurodevelopmental disorder is characterized by impairing levels of inattention and/or hyperactivity-impulsivity. The present study examines the neurophysiological responses of 258 children ranging from 7 to 11 years old when viewing emotional stimuli. 105 of these children were diagnosed with ADHD using the Kiddie Schedule for Affective Disorders and Schizophrenia (K -SADS), which is a clinical interview, administered by a trained staff member. Electroencephalography (EEG) data was analyzed to derive a proposed measure of attention to emotional stimuli known as the Late Positive Potential (LPP), which is an Event-Related Potential (ERP). The LPP was averaged from the CPz electrode across all children. Participants self-reported their emotional affect and strength in response to stimuli taken from the International Affective Picture System. The LPP in this study found a larger amplitude associated with positive and negative stimuli when compared to neutral stimuli. We plan to further examine how the LPP relates to participant self-report of emotion and strength of emotion when viewing the stimuli. Strong correlations found between emotionally salient stimuli and LPP will aid in the examination of emotional reactions in other contexts. Future analysis examining differences between ADHD and non-ADHD subgroups can provide insight into differences in emotional processing and response.

Keywords: ADHD; Children; Neurophysiology; Emotion; Attention

Mentor(s):

Sarah Karalunas (HHS); Sarah Pieper (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1255**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Image Processing for Lane and Object Detection for Autonomous Vehicles

Innovative Technology/Entrepreneurship/Design


Author(s):

Jennifer Gillette† (Engineering); Jaron Hunt† (Engineering); Danny Thornewell† (Science)



Abstract:

The purpose of our research is to develop an autonomous driving system for an electric kart, integrating a ZED stereo camera with image processing for lane detection, object detection, and navigation. This system enables the kart to traverse tracks independently, adhering to track boundaries, avoiding obstacles, and moving through optimal race line paths for speed.

Several design constraints and specifications need consideration to implement these features utilizing the ZED stereo camera. Components and algorithms must be compact, durable, and energy-efficient to minimize weight and power consumption while enduring the impacts of racing. The onboard processing unit must be powerful for real-time image processing tasks, like edge detection, object avoidance, and race line calculations, to ensure quick decision-making. These capabilities are essential for safety, efficiency, and performance.

We used Python image processing to identify the lines in the image using OpenCV. Using Gaussian thresholding, morphological operations, and several probabilistic line transforms, we were able to extract a series of points that formed an accurate basis for the lanes. This manual image processing offers several advantages over the machine learning methods as it is more lightweight and runs faster on our onboard processing unit.

Ultimately, the goal is to produce a polished implementation of the ZED camera for track detection and object avoidance, to achieve faster lap times.



Keywords: Autonomous Vehicles; Image Processing; Lane Detection; Object Detection



Mentor(s):

Shreya Ghosh (Engineering); Samuel Labi (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1256**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# "I'm 17 and can't tell my parents...": Evaluating 19-months of messages to a youth-focused, reproductive justice text line in Missouri

Social Sciences/Humanities/Education

Author(s):

Emma Gordon† (HHS)

Abstract:

Objectives:

Right By You (RBY) is a youth-focused, reproductive justice text line connecting Missourians to abortion care, birth care, adoption and parenting, contraception, and information about their rights.  Texts sent to RBY are anonymous and texters can continue their conversations over several days. We aimed to assess the feasibility of the RBY text line model and identify areas for improvement.

Methods:

We reviewed all anonymized text messages sent to RBY between April 2022 and October 2023 (inclusive). We carried out content and thematic analysis of these conversations and engaged in reflexive memoing throughout our analytic process.

Results:

Between April 2022 and October 2023, RBY received texts from 345 unique texters. 60.6% of texters provided their zip code. Of those, 26.7% of texters were from outside of Missouri. Texters who reported their age ranged from 14 to 40 years old. Texters contacted RBY about varying topics including abortion, contraception, and pregnancy. Through these conversations we identified three themes; the convenience of the text line model, the flexibility of the text line model, and the complicated nature of abortion funding processes.

Conclusions:

In an increasingly fragmented landscape of reproductive health care across the US, the services provided by RBY highlight gaps that many people – especially adolescents – face when accessing care related to contraception and abortion. RBY is helping to fill these gaps. Expanding services like RBY to other states appears warranted, as does streamlining information and processes related to abortion funding.

Keywords: Reproductive Health; Qualitative Research; Adolescents; Health Service Delivery

Mentor(s):

Kathryn LaRoche (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1257**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**PFOA Product Determination.**

Life Sciences

Author(s):

Paige Greenfield† (Engineering)

Abstract:

This research aims to investigate the effectiveness of various reactor setups developed at Purdue Northwestern in breaking down perfluorooctane sulfonic acid (PFOS) into less harmful compounds. PFOS is categorized as a "forever chemical," indicating its persistence in nature and living organisms. Its applications range from packaging to non-stick cookware due to its resistance to heat, water, and grease. This study holds critical importance as it addresses the removal of toxic "forever chemicals" from water sources, aligning with the priorities of the U.S. Environmental Protection Agency to ensure safe water and environmental sustainability. This project is significant due to the limited accessible or cost-effective methods available for removing forever chemicals from water. PFOS are continually introduced into the environment through production pollution and human waste, resulting in their accumulation in individuals who consume them. The project seeks to identify decay compounds from the reactors at Northwestern and assess the efficiency of each reactor design. Tap water and PFOS solutions will undergo treatment in different reactors and product samples will be analyzed using liquid chromatography with tandem mass spectrometry. This analysis aims to reveal what is left behind in the water samples after the PFOS is broken down to show variations in efficacy and potential alternative reaction pathways influenced by reactor types, sample concentrations, and reaction durations.

Keywords: Forever Chemicals; Mass Spectrometry; Liquid Chromatography

Mentor(s):

Tillmann Kubis (Engineering); William LeFever (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1258**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Epigenetic Modification of Genes Involved in the Phenylpropanoid Pathway to Alter Metabolic Outputs in Petunia Flowers

Life Sciences

Author(s):

Kayla Grennes† (Agriculture)

Abstract:

VOCs, or volatile organic compounds, are released from tissue in plants to communicate with the environment where they reside (Patrick et al., 2021). VOCs play a role in seed dispersal, pollinator attraction, herbivore defense, organ signaling within the plant, among other functions (Patrick et al., 2021). Many genes are required for VOC synthesis, including EPSPS1 and ODO1, which are two core genes that are targeted in this project. This project focuses on developing an epigenetic editing tool to modify the chromatin states associated with the genes encoding for the enzymes involved in VOC synthesis, using petunias as a model system. Epigenetics refers to changes in gene expression without altering the genetic sequence of an organism. Establishing this epigenetic tool will allow us to: (i) study the function of chromatin regulators and how they control floral VOCs; and (ii) provide an alternative approach to metabolic engineering by not modifying the genes but modifying the epigenetic status of genes. This project contains three objectives: (i) develop an epigenomic editing toolkit, (ii) test the toolkit for transient overexpression, and (iii) measure the effectiveness of the transformation. Specifically, epigenetic regulators ELP3 and HDA8 are of focus for testing, as they were identified by preliminary data in Li Lab to be the writer or eraser of histone acetylation marks at relevant genes for floral VOCs.  In the Fall 2023 and Spring 2024 semester, the focus has been on objective one – constructing the plasmids for the epigenome editing toolkits.

REFERENCES

Patrick, R. M., Huang, X., Dudareva, N., & Li, Y. (2021). Dynamic histone acetylation in

floral volatile synthesis and emission in petunia flowers. Journal of Experimental Botany, 72(10), 3704–3722. https://doi.org/10.1093/jxb/erab072

Keywords: Volatile Organic Compound Synthesis; Molecular Epigenetics; Modification of Chromatin States; Horticultural Genetics

Mentor(s):

Ying Li (Agriculture); Ryan Patrick (Agriculture)

**Poster Presentation Abstract Number: 1259**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Accelerating Radiation Damage Simulation through Machine Learning

Innovative Technology/Entrepreneurship/Design

Author(s):

Vinay Gupta† (Science); Shrienidhi Gopalakrishnan‡ (Engineering)

Abstract:

This study explores the challenge of material degradation from radiation exposure, a phenomenon that significantly impacts fields ranging from materials science to nuclear engineering and space exploration. As of today, the primary solution of conventional simulation techniques are computationally expensive, making them impractical for widespread use. The difficulty of usage combined with complex methods to run simulations for many of these techniques limit accessibility to the research community, making it an important obstacle in solving radiation damage.

To address these challenges, we propose two solutions: First, we analyze meaningful data from Geant4 (a leading simulation tool), including solid properties, positioning, and materials, along with firing many different particles through the virtual world and collecting data through python scripts. Second, using these methods of data extraction, we will be able to predict the trajectories of any particle in a similar world state by building a convolutional neural network (CNN) which infers trajectories based on our data, bypassing the need for re-running computationally expensive simulations and directly providing trajectory outcomes.

Early results from this approach show promising signs of particle trajectory extractions and excellent scope for predictions through CNNs, streamlining the research process and facilitating faster, more efficient exploration of materials under radiation exposure. Through this method, we hope to mitigate radiation damage by providing more efficient and accessible ways to run simulations.

Keywords: Advanced Radiation Damage Simulation Techniques; Material Degradation Under Radiation Exposure; Deep Learning for Particle Trajectory Prediction; Geant4 Simulation Data Optimization; Computational Efficiency in Radiation Research

Mentor(s):

Alejandro Strachan (Engineering); Brian Lee (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1260**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Impact of Generative AI on Education

Innovative Technology/Entrepreneurship/Design

Author(s):

Riddhi Gupta† (Science)

Abstract:

As Generative AI's use increases drastically, also influencing education, understanding its impact becomes crucial. This study investigates Generative AI's role in education, focusing on language-specific differences in outcomes, specifically Spanish to English Translations, AI detector performance in how different AI detectors yield different results for the same dataset, and implications of AI on teaching.

The study addresses four central objectives: (1) comparing outcomes for Spanish and English assignments using AI detectors, (2) evaluating different AI detectors' performance, (3) exploring teaching implications, and (4) examining Generative AI's impact on research. Methodologically, statistical analysis and an extensive literature review guide the study.

This research provides valuable insights for both educators and researchers to tackle the advent of Generative AI and its immense usage within students especially when writing assignments are involved. By understanding Generative AI's nuances, educators can optimize teaching strategies, while researchers can harness its capabilities for scholarly exploration.

Keywords: Generative AI Education Impact; Language Translation AI Detectors; Teaching Implications of AI; AI Detector Performance Analysis; Generative AI Research Influence

Mentor(s):

Lisa Bosman (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1261**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Boilermaker Food Security

Social Sciences/Humanities/Education

Author(s):

Jarren Haggard† (Liberal Arts); Katie Peterson* (Liberal Arts)

Abstract:

Students on U.S. college campuses face higher rates of food insecurity than the national average, due to the high costs of education, rising expenses for food and housing, and high levels of unemployment or underemployment among students. Financial constraints are not the sole obstacle to a healthy diet for many college students: time constraints due to academic and extracurricular commitments, lack of transportation for grocery shopping, and limitations in on-campus dining options contribute to the problem. While campus food pantries offer some relief, they do not address the fundamental structural challenges driving food insecurity.

Despite these known challenges, a report administered by Foster Success and the Indiana Commission for Higher Education found that in the state of Indiana, “high-quality data on the prevalence of student food and housing insecurity is essentially nonexistent.” To address this gap, this mixed-methods study focuses on understanding the lived experience of food insecurity on Purdue’s West Lafayette campus, exploring both the economic factors and social barriers contributing to food insecurity. The research team has initiated participant observation and interviews with students, and in collaboration with ACE Food Pantry, will be distributing a survey on campus food security. During the 2024 – 2025 school year, we will continue collecting data via food journals and a photovoice project.

Ultimately, this is an action-oriented study that aims to improve campus food security by providing university decision-makers with ethnographically-rich insights into the diverse ways that Purdue students navigate their experiences of food insecurity and opportunities for interventions.

Keywords: Food Insecurity; Food Aid; Food Pantries; College Students; Economic Insecurity

Mentor(s):

Sarah Renkert (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1262**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## The Effect of Home Processing on Nut Oxalate Concentrations

Life Sciences


Author(s):

Anna Hardy† (HHS, JMHC)



Abstract:

Nuts may reduce cardiovascular disease risk in people with chronic kidney disease (CKD), but are not encouraged because they contain a high amount of oxalate. High oxalate levels have been linked to CKD progression and the formation of kidney stones. It’s necessary to target and regulate oxalate intake because of reduced excretion and the ability of oxalate to form crystals with minerals such as calcium and magnesium. Food processing is one technique that may alter the oxalate content of foods. However, the effect of home processing on the oxalate content of nuts has not been explored and may represent a low-cost strategy to include nuts in the diets of people with CKD.  The purpose of this study is to explore various home processing techniques including soaking, roasting, and blanching to reduce the oxalate content of nuts. Raw and unpasteurized nuts were obtained and roasted, soaked, or blanched according to commonly available recipes for each individual nut. The amount of oxalate in each sample will be determined by calorimetric assay (abcam 196990) in duplicate. The quantity of calcium and magnesium will be determined by Microwave Plasma-Atomic Emission Spectrometry. Values will be presented as the mean +/- the standard deviation for each treatment. To determine the effect of the treatment, we will be using a one-way ANOVA for analysis. The expected results of this study will determine if food processing can reduce the oxalate content of nuts making them a more appropriate option for consumption by people suffering from CKD.



Keywords: Chronic Kidney Disease (CKD); Oxalate; Microwave Plasma-Atomic Emission Spectrometry; Calorimetric Assay; ANOVA



Mentor(s):

Brandon Kistler (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1263**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Effect of Small Arms Fire on Simple and Complex Auditory Processing

Life Sciences


Author(s):

Audrey Harrison† (Science)



Abstract:

Hearing loss is the largest reported disability within the Armed Services. One cause of hearing loss is exposure to small arms fire. This form of noise exposure will impact both hearing sensitivity and temporal processing of the auditory system, altering hearing thresholds and speech perception. Understanding how the auditory system responds to simple (click) and complex (speech envelope of utterance of “Purdue”) stimuli after blast exposure will inform the generation of future diagnostic tests as well as therapies. To study this relationship exposure to small arms fire was mimicked with a 2.5-minute biphasic pulse at 120 or 60 dB peak SPL. Subjects’ auditory responses to simple and complex stimuli were longitudinally recorded until day 56 post-exposure. Small arms fire produced lasting threshold shifts to simple stimuli, measured using click-evoked auditory brainstem responses. Temporal processing of the complex stimuli displayed reduced cross correlation between the baseline envelope following response (subjects’ ability to track the envelope of a sound) and envelope following response after exposure for the 120 dB SPL condition. Multiple versions of the complex stimuli were tested. The preliminary results indicate a persistent decrease in cross correlation for all stimuli except the tone rectified. These findings indicate that carrier and envelope may be differentially affected by noise exposure and by time of recovery.



Keywords: Small Arms Fire; Hearing Thresholds; Speech Perception; Envelope Following Response



Mentor(s):

Edward Bartlett (Science); Meredith Ziliak (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1264**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## AI-Supported Personal Ultrasound to Improve Maternal Outcomes

Innovative Technology/Entrepreneurship/Design

Author(s):

Abigail Heppelmann† (Engineering)

Abstract:

The United States is one of just two countries in the world that have reported significant increases in maternal mortality rates (MMR) over the past two decades. From 1990 to 2019, the United States of America reported a nearly three-fold increase in pregnancy-related deaths; maternal mortality rates increased from 8.0 deaths per 100,000 live births to 20.1 deaths per 100,000 live births. Globally, 808 people die every day from preventable, pregnancy-related causes. Maternal ultrasound scans play an important role in monitoring pregnancy and fetal health. However, access to imaging is often limited in resource-scarce settings, with high maintenance and training costs heavily contributing to this inequity. The focus of this project is to evaluate the feasibility of integrating artificial intelligence (AI) into point-of-care ultrasonography (POCUS) to reduce accessibility issues in rural, low-income areas of the United States. Research was done by reading papers on maternal mortality trends, POCUS, and existing research on AI-supported ultrasound devices. Additionally, existing handheld ultrasound device options were summarized and compared to evaluate hardware options currently on the market. It is concluded that the combination of portable ultrasound machines and AI technology offers a promising future for making maternal care more attainable and affordable, though thoughtful development and implementation will be integral to ensuring that such advancements have an effective impact on patients.

Keywords: Maternal Mortality; POCUS; Maternal Ultrasound

Mentor(s):

Steve Steinhubl (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1265**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Using THz spectroscopy to identify corrosive waste and plastics

Physical Sciences

Author(s):

Marco Herbsommer† (Engineering)

Abstract:

Terahertz time-domain spectroscopy (THz-TDS) is used to measure the spectral signature of polymers in the terahertz range for common recyclable polymers. The terahertz radiation creates a unique spectral signature for polymers, depending on the optical properties and chemical structures of the polymer. A fast Fourier transform is used to convert the measured time domain response to frequency domain response. Raman spectroscopy is used concurrently with THz-TDS to feed into a Deep Neural Network (DNN) based classification algorithm. By utilizing both spectra and incorporating them as an input into a Deep Neural Network Classification model, we can create a robust method of identifying recyclable plastics. This study presents a framework for creating a database of material spectral responses with THz-TDS and Raman spectroscopy using a 785 nm femtosecond laser and developing a multi-class classification model for the purpose of identifying common recyclable plastics.

Keywords: THz Time-Domain Spectroscopy; Polymer Identification; Raman Spectroscopy; DNN Classification Model

Mentor(s):

Vikas Tomar (Engineering); Sushrut Karmarkar (Engineering); Meghana Sudarshan (Engineering); Mahavir Singh (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1266**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Circulating Immune Cell Population in Early Lactation Multiparous Dairy Cows**

Life Sciences

Author(s):

Addison Hill† (Agriculture); Lauren Jones‡ (Agriculture); Brianna Gast‡ (Agriculture, JMHC); Ellie Ketcham‡ (Agriculture, JMHC)

Abstract:

Metabolic health of early lactation dairy cows is reflected in populations of circulating immune cells, with greater immune cells associated with disease. The presence of lipid laden macrophages, foam cells, are associated with inflammation and disease in humans. Whether foam cells are present in dairy cattle circulation is currently unknown. The objective of this study was to determine if immune cells and blood packed cell volume (% PCV) change between calving (D0) to 14 days after calving (D14). We hypothesized that D0 hematocrit will be lower than D14 hematocrit due to potential blood loss during calving; and more immune cells would be present in circulation on D14 compared to D0 due to increased metabolic stress and potential for higher immune response after calving. To test these hypotheses, 12 multiparous non-lactating cows were enrolled and monitored for signs of calving. A blood sample was collected via the tail vein within 4h of calving and another blood sample was taken on day 14 of lactation. Hematocrit was conducted with the whole blood and blood smears were created and stained with a Hema3 kit to visualize the immune cells. Images of 6 densely populated areas of cells were captured at 20X magnification with an Echo Revolution microscope. Immune cells in the 6 images were identified by phenotypic features and counted. Day had a significant effect on mean hematocrit ($P=0.03$) with D0 at 24.09% ± 0.43, and D14 at 21.04% ± 0.43. Analysis of immune cells in blood is still ongoing.

Keywords: Foam Cells; Hematocrit; Immune Cells

Mentor(s):

Theresa Casey (Agriculture); Linda Beckett (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1267**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Investigating Glutamate and ATP Dysregulation in cortical neurons carrying the SCN2A epilepsy associated variant L1242P: Implications for Neuronal Hyperexcitability

Life Sciences

Author(s):

Seoyeon Hong† (Pharmacy)

Abstract:

The SCN2A gene, which encodes the Nav1.2 sodium voltage-gated channel, is implicated in various neurological disorders, including epilepsy and seizures [4]. Neuronal hyperexcitability, primarily resulting from mutations in the Nav1.2 channel, is proposed as one of the mechanisms underlying these conditions. Specifically, the Nav1.2-L1342P mutation has been identified as one of the main contributors to early-onset and refractory seizures [2]. During seizure events, neurons excessively release neurotransmitters, contributing to excitotoxicity [3]. Notably, glutamate and ATP have been implicated as key neurotransmitters for this phenomenon.

Glutamate, a major excitatory neurotransmitter, is tightly regulated within synaptic space. Disruptions in this regulation due to disease can lead to excessive glutamate release, and trigger hyperexcitability and excitotoxicity in neurons. Furthermore, prior investigations have suggested elevated extracellular ATP levels during heightened neuronal activity and seizure-like occurrences [1].

Previously, in our previous work published in the Journal of Neuroscience, we observed increased neuronal hyperexcitability in neurons carrying the L1342P variant [2]. Given that these neurons in vitro also have the capacity to release extracellular molecules, we hypothesized that changes in glutamate and ATP levels might be enhanced in neurons carrying the epilepsy associated variant, likely impacting the hyperexcitability observed in neurons carrying the L1342P mutation.

In our study, we cultured both wild-type and mutant Nav1.2 L1342P neurons for 45 days and measured extracellular glutamate and ATP production using the Glutamate-glo Assay and RealTime-Glo Extracellular ATP assay kits, respectively. Our findings revealed a notable increase in glutamate and ATP production in mutant L1342P neurons compared to conteols. This result implies augmented Glutamate and ATP release as a potential mechanism underlying the hyperexcitability associated with the L1342P mutation. These findings provide valuable insights into the specific molecular mechanisms implicated in the pathogenesis of seizures due to the L1342P mutation, highlighting the role of glutamate and ATP release in in vitro hyperexcitability models.

Keywords: SCN2A; Neuron; Seizure; Epilepsy; Glutamate

Mentor(s):

Maria Olivero-Acosta (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1268**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Understanding Social Acceptance and Safety Aspects of Sidewalk Delivery Robots

Innovative Technology/Entrepreneurship/Design

Author(s):

Hoang Hua† (Engineering); Areli Viveros-Hernandez† (Science)

Abstract:

The recent deployment of Sidewalk Delivery Robots (SDRs) has brought limited knowledge regarding the interaction, perception, and safety aspects among pedestrians. To address the gap, our systematic literature review within the Web of Science database follows the PRISMA process, which involves identifying and screening relevant papers, removing duplicates, and assessing titles, abstracts, and keywords. Our research probes into the characteristics of these robots, categorizing them based on type (delivery, prototype, or others) and the operation environment (indoor or outdoor). A review of existing studies was conducted, scrutinizing the methodologies employed in published papers, such as surveys, videos, observations, and the types of questions posed (Likert, etc.). Evaluation criteria encompassed speed, distance, functionality, appearance, and the potential impact of social demographics.

The findings emphasize crucial aspects of interaction, perception, and safety, stressing the importance of improving delivery robots' human-like characteristics for trust and acceptance. Pedestrians favor SDRs that possess audio and visual feedback mechanisms, move at a slower pace, maintain a specific distance, and exhibit social friendliness. Safety considerations revolve around the robots' speed and path.

During our investigation, we underscored the dearth of standardized knowledge regarding these robots, revealing that bystanders express empathy when these machines encounter obstacles. Job displacement looms large, contrasting with the prospects for individuals with reduced mobility. Notably, visually impaired individuals articulated apprehensions due to the lack of accessible feedback and standardized knowledge, underpinning the crucial nexus between safety, acceptance, and public comfort in the presence of SDRs.

Keywords: Sidewalk Delivery Robots; Human-Robot Interaction; Literature Review; Pedestrian Perception; Pedestrian Safety

Mentor(s):

Tho Le (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1269**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# How does proximity to moving water impact biodiversity of a Central Indiana habitat, using AI and geo-informational technology?

Life Sciences

Author(s):

Sierra Hunnicutt† (Science, JMHC); Zhixin Cai‡ (Science, JMHC); Ryan Feller‡ (Science, JMHC); Katie Hong‡ (Agriculture); Luca Iacobucci‡ (Agriculture); Hannah Reyes Charles‡ (Agriculture, JMHC); Anthony Tan‡ (Science)

Abstract:

Urbanization has resulted in increased habitat fragmentation, which negatively impacts wildlife (Tigas et al. 2002). A popular solution to this problem is known as wildlife corridors—natural paths of land that various species will take to reach a new destination in dispersal or migration. Several previous studies from across the country have found rivers and creeks to be preferential areas for movement, specifically in mesocarnivores (Abouelezz et al. 2018). Bobcats (Lynx rufus) have historically held a crucial position in the Indiana ecosystem as prominent predators that feed on rabbits, rodents, and birds. This study will determine how proximity to moving water in proposed bobcat corridor land may impact the biodiversity of birds and mammals in the area. We used camera traps and acoustic sensors (n=14) in several locations along the Wabash River in various states of ecological health, another prominent variable being proximity to the Wabash River and Indian Creek. We collected acoustic data on the types and frequencies of bird calls heard and photographic data of the various species seen in each location. The intent of this large-scale study is to determine viable land for conversion into wildlife corridors that would encourage bobcat population movement back into northern Indiana.

Keywords: Bobcat; Fragmentation; Corridor; Biodiversity; Water

Mentor(s):

Kristen Bellisario (JMHC)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1270**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

### Structural Investigation of Ulleungmycin A Offloading Mechanism

Life Sciences


Author(s):

Dabin Jung† (Science, JMHC)



Abstract:

Non-ribosomal peptides are a class of medicinally relevant natural products that showcase extraordinary structural diversity. They are synthesized by Non-Ribosomal Peptide Synthetases (NRPS), multi-modular enzymes that create nonproteinogenic linear and cyclic polypeptides. These NRPS's rely on in cis thioesterase domains to facilitate offloading of finished products. Some NRPS's, like that for ulleungmycin A, lack this domain, yet they retain the ability to create and release a cyclic product. In the case of ulleungmycin A, Ulm16 instead acts in trans of this conveyor system, behaving as this missing domain by cyclizing the linear precursor. Currently, this offloading mechanism is not well understood. Here, we clone and express the C-terminal module for the cognate NRPS, UlmB. Upon reconstitution of the UlmB-Ulm16 complex, we intend to carry out structural characterization of this offloading mechanism.



Keywords: Structural Biology; Natural Products; Non-Ribosomal Peptides; Gene Expression


Mentor(s):

Chitta Das (Science); Rishi Patel (Science); Zach Budimir (Science); Yu Nishio (Science); Betsy Parkinson (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1271**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Slope break burn rate testing of DCPD propellant

Physical Sciences

Author(s):

Alex Karns† (Engineering)

Abstract:

Solid propellant burning rates have a proportional relationship with pressure, with higher pressures leading to higher burning rates. Typically this relationship is proportional to the pressure take to an exponent. Many ammonium perchlorate composite propellants exhibit a sudden, stronger pressure dependence, a higher exponent, above some critical pressure. This sudden change is referred to as a slope break. A known relationship is that softer (low modulus) propellants have slope breaks at lower pressures so the hypothesis is that stiffer (high modulus) propellants would have a higher pressure slope break. To test this hypothesis, a stiff Dicyclopentadiene-based solid propellant is mixed, then poured into molds to cure. The propellant is then removed from the molds and cut into small samples. The samples are burned at various pressures (100-4000 psi) of nitrogen in a windowed pressure vessel, then imaged with a high-speed camera and analyzed using imaging software, to produce data with which a burning rate relationship can be fitted. Preliminary testing has shown no slope break behavior below 3000 psi. The results are being compared to a typical (soft) HTBP binder that has the same solids loadings, particle distributions, and a similar burn rate, to look for a difference in the relationship between burn rate and pressure.

Keywords: Propellant; Burn Rate; Solid Propellant; Energetics

Mentor(s):

Steven Son (Engineering); James Cooper (Engineering); Tim Manship (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1272**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Addressing Model Architecture Misclassification for open-source Pre-trained Model packages

Mathematical/Computation Sciences

Author(s):

Mingyu Kim† (Engineering); Heesoo Kim† (Engineering)

Abstract:

Deep Neural Network (DNN) techniques serve as preeminent components in modern software systems. However, there is a prevailing trend in creating new DNN models that leans towards incorporating more layers and parameters, particularly as state-of-the-art architectures become increasingly complex. In response, the notion of reusing and fine-tuning pre-trained models (PTMs) has gained prominence. Hugging Face, a renowned open-source PTM platform, has been one of the environments for implementing this concept. However, prior work shows that a new challenge has emerged in the form of model architecture misclassification. As the diversity and intricacy of PTMs increase, there is a risk of misclassification in model architecture, potentially preventing users from selecting the most suitable model for their own purposes. This could also lead to a substantial amount of waste in time and resources without obtaining the desired performance improvements.

In response, we propose a solution aimed at accurately categorizing current PTMs and automatically categorizing incoming PTMs, thereby rectifying existing misclassifications and preventing future ones. Our solution exploits a pre-trained RoBERTa model to convert DNN layers into high-dimensional vector representation, and is fine-tuned through a contrastive learning model. Continuing our work from last semester, we built a more robust pipeline with 1) balanced dataset, 2) classifier head, and 3) optimized parameters. We evaluated our model using recall, precision, and F1 score. We believe this solution addresses challenges related to model architecture misclassification, leading to more efficient utilization of time and resources in software development.

Keywords: Software Reuse; Machine Learning; Deep Learning; Contrastive Learning

Mentor(s):

James Davis (Engineering); Wenxin Jiang (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1273**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Using single-cell RNA sequencing to identify leukocyte subsets present in benign prostatic hyperplasia

Mathematical/Computation Sciences

Author(s):

Andree Kolliegbo† (Science)

Abstract:

Benign Prostate Hyperplasia (BPH) is characterized by the non-cancerous enlargement of the prostate. BPH and the associated lower urinary tract symptoms result in significant morbidity and around $3.9 billion (about $12 per person in the US) in annual medical expenses in the US. The current medications for BPH are often ineffective, with undesirable side effects and high rates of patient non-compliance. Using single cell RNA sequencing (scRNA-seq) data, our goal is to identify and characterize subsets of leukocytes in normal and enlarged human prostate to better understand the association between BPH and inflammation. ScRNA-seq was generated from 20 patient samples. We sequenced 5,.000 cells from 10 small (<40g) and 10 large (>90g) BPH prostate tissue samples to determine the composition of individual leukocyte populations in the patient samples using size to determine the progression of the disease. The resulting data were aligned to the human reference genome using Cell Ranger followed by downstream analysis using the package Seurat to identify distinct clusters of cells from both large and small samples. Notably, we have determined that BPH tissues exhibit elevated levels of T cells, B cells, and macrophages, similar to autoimmune and inflammatory disease environments. Moving forward, subsets of T cells and macrophages will be compared with publicly available scRNA-seq datasets generated from patients diagnosed with autoimmune and inflammatory conditions to identify and characterize the subsets of macrophages and T cells using similar alignment methods. Understanding the subsets of immune cells present in BPH compared with the population will provide potential therapeutic targets with the potential for personalized treatment approaches.

Keywords: Bioinformatics; Cancer; Immune Cells; Prostate; BPH

Mentor(s):

Nadia Lanman (Veterinary Medicine)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1274**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Determining the roles of MLO1 and MLO15 in plant development through the characterization of mutant and overexpressor lines

Life Sciences


Author(s):

Molly Kosiba† (Agriculture)



Abstract:

MILDEW RESISTANCE LOCUS-O (MLO) proteins, recently discovered as calcium channels in Arabidopsis, are involved in powdery mildew susceptibility, reproduction, and root tropism. Calcium signaling is an important process in the development of features such as pollen tubes and root hairs and mediates stress response. There are 15 MLO genes encoded in the Arabidopsis genome, many of which are uncharacterized. MLO1 is expressed throughout the plant, whereas knockout and overexpression of MLO1 proteins doesn’t have a distinguishable phenotype. MLO15, the most closely related protein to MLO1, was characterized with MLO1 to determine if these two proteins complement each other and produce a stronger phenotype. MLO1 and MLO15 have been previously implicated in pollen tube growth together, but other phenotypes have yet to be studied. Therefore, MLO1 and MLO15 were crossed to produce mlo1; mlo15. The double mutant, mlo1, mlo15, MLO15 overexpressor and wild type were phenotyped for changes in root length, root hair, and rosette size. For future projects, additional changes in phenotypes will be observed in these plants due to environmental stressors, such as over-watering or drought.



Keywords: Plant Biology; Development; Reproductive Biology; Arabidopsis



Mentor(s):

Sharon Kessler (Agriculture); Sienna Ogawa (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1275**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Quantification of Tumor-associated Macrophages in Gliomas treated with Ferumoxytol

Life Sciences

Author(s):

Ashlyn Kwan† (HHS)

Abstract:

Radiation therapy is a crucial component when treating cancer, however, despite treatment, tumors may still come back. A proposed method for enhancing radiation therapy treatment includes using drugs to target tumor-associated macrophages (TAMs). TAMs are relatively resistant to radiation and help tumor cells regrow after radiation. Studies have shown that the iron-replacement drug, Ferumoxytol, can be repurposed for therapeutic targeting of TAMs. Ferumoxytol has been observed to cause TAMs to switch into a tumor-killing subtype. The objective of this study is to observe the effects of various dosages of fermoxytol on TAMs in the brain, and if it will induce the right changes so that macrophages will kill the tumor rather than assist its growth. In these experiments, a cohort of 4 dogs with gliomas were enrolled in the study. Two canines received ferumoxytol and two received no ferumoxytol to serve as controls. For all dogs, their cancerous brain tissue was resected and stained for various tumor-killing macrophage types as well as cell proliferation. For the two dogs who received ferumoxytol, the tumor resections occurred 24 hours after intravenous ferumoxytol injection. The resected tissue samples were imaged using a digital microscope and subsequently analyzed using the program, Qupath. Data analysis demonstrated no noticeable change in macrophages or cell proliferation between treatment groups. Despite these findings, further studies with greater sample sizes and more varied time frames for tissue sampling can more adequately assess if ferumoxytol can induce macrophage polarization and decrease tumor cell proliferation.

Keywords: Microglia; (Tumor-Associated) Macrophage; Feramoxytol; Glioma; Cell Proliferation

Mentor(s):

Matthew Scarpelli (HHS); Scotty Secrist (VP Diversity and Inclusion)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1276**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Social Supports in the Microelectronics Workforce Development Program

Social Sciences/Humanities/Education

Author(s):

Briana Lavine† (Engineering)

Abstract:

SCALE (Scalable Asymmetric Lifecycle Engagement) is a Department of Defense sponsored microelectronics workforce development program designed to promote students’ interest in pursuing careers within the microelectronics industry by providing students with mentorship and work experience. The purpose of this study is to understand the social support students have that develops their career development in the microelectronics industry. The research question is: 1) what differences in levels of support exist in the various technical areas? We utilized a survey that focused on students’ perceived cohesion (sense of belonging and morale) and mentorship. The Mentoring Social Capitol Survey consisted of questions regarding belonging and morale; then, asked them to list mentors who support them. The survey was distributed to 244 students across the county; after data cleaning through screening questions, there were 134 surveys. Our findings indicate that there are differences in students' perceived cohesion and mentorship levels based on their technical area. For example, students in Embedded Systems/Trusted AI scored lower with belonging and satisfaction in the SCALE program compared to the other technical areas. Additionally,  the data shows that students in every technical area report lower levels of support from mentors in terms of feeling supported with their career interests and goals. One recommendation for this is to create less of a divide in technical areas and improve mentorship by connecting their interests and goals to their future careers. Future research should include a longitudinal analysis of career development for SCALE students through involvement and mentorship in the program.

Keywords: Microelectronics; Career Development; Perceived Cohesion; Mentorship; Technical Areas

Mentor(s):

Kerrie Douglas (Engineering); Melissa Dyehouse (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1277**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## The Energy Transition

Physical Sciences


Author(s):

Seungho Lee† (Engineering)



Abstract:

As the climate crisis grows more urgent and its consequences only seem to increase, it is widely accepted that a transition away from fossil fuels as our primary source of energy is necessary. In this paper, we seek to better understand the relationship between society and energy, its impact on biophysical limits, and potential strategies that can be employed in the transition away from fossil fuels. We systematically analyzed current research focusing on the pace of energy infrastructure buildout, inclusion of rebound effects, alternative fuels, electrification of current infrastructure, and improvements to battery technology to enable renewable energy sources. Upon performing an analysis of several hundred research papers, we expect to find a system of different feedback mechanisms, and to sort these by their effectiveness at handling the climate crisis. Through our analyses, we evaluated which strategies may be the most effective for a transition away from fossil fuels and towards a sustainable energy infrastructure, along with possible improvements to current battery technology that may enable renewable energy significantly in the near future.



Keywords: Renewable Energy Transition; Fossil Fuels; Alternative Energy; Literature Review



Mentor(s):

John Mulrow (Engineering); Kendrick Hardaway (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1278**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Decoration of Carbon Nanotubes with Carbon-Coated Iron Nanoparticles for Multifunctional Self-Sensing Materials

Physical Sciences

Author(s):

Lisa Li† (Engineering, JMHC)

Abstract:

Nanoparticles such as carbon nanotubes (CNTs) may be added to materials as nanofillers to impart desirable properties such as electrical conductivity and piezoresistivity. This is useful in the creation of multifunctional self-sensing materials, which are of interest in embedded sensing applications. Prior work indicates that adding both CNTs and carbon-coated iron nanoparticles (CCFeNPs) to a polymer matrix composite can impart electromagnetic properties not intrinsic to polymers. This nanofiller combination was found to affect properties beyond the capabilities of either nanofiller alone, even when controlled for the total weight fraction of nanofiller. It is hypothesized that CNTs and CCFeNPs can be combined to create a material that is simultaneously magnetoresistive and piezoresistive—that is, the resistivity of the material changes as a function of both strain and magnetic field. However, evidence of magnetoresistivity in this material system has not yet been established, possibly due to uneven dispersion or interruption of contact magnetism between nanoparticles. This research proposes a procedure of chemically binding CCFeNPs to the surface of CNTs. The CCFeNPs will be first treated using hydrochloric acid and nitric acid to attach -COOH functional groups to the carbon surface, then bound through esterification to CNTs functionalized with -OH groups. The product can then be examined via electron microscopy to validate procedure results. Such CCFeNP-decorated CNTs can be used in future work to determine if the product results in simultaneous magnetoresistivity and piezoresistivity when dispersed in a polymer matrix composite.

Keywords: Carbon Nanotubes; Iron Nanoparticles; Nanofiller; Multifunctional Materials; Magnetoresistivity

Mentor(s):

Tyler Tallman (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1279**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Visual exploratory behavior and dominance in European starlings (Sturnus vulgaris)

Life Sciences


Author(s):

Nathaniel Lindsay† (Science); Bonnie Cimack* (Science); Katie Tooley* (Science); Catherine Bell* (Science)



Abstract:

In a time of rapidly changing environments, animals' capacity to adapt may hinge on their problem-solving behavior when confronting novel situations. Adaptive problem-solving behavior relies on the ability to gather information (ie. exploration) through sensory systems. The visual system is a widely used sensory system that offers a relatively low-cost method of gathering information on potentially important objects. Despite the importance of vision, little is known about how areas of the visual field are used in when exploring in a problem-solving context. This study aims to investigate the use of the visual field and visual exploratory strategies in a novel problem-solving task. Furthermore, while social rank has been established as influential in cognitive tasks, little is understood of social rank's importance in the exploratory behaviors necessary in problem-solving situations. Therefore, this study also investigates social rank's effect on the use of the visual system in exploration proceeding problem-solving behavior. European starlings, a gregarious bird with a well understood visual system and problem-solving ability, were selected as the model species in this study. Using video recording of groups and the program Behavioral Observation Research Interactive Software (BORIS), social ranks were determined agonistically with an EloRating system. Visual exploratory behavior was observed during a novel puzzle box task. Video recordings were analyzed, and visual field use was determined using BORIS and DeepLabCut, an AI tracking program. Analysis is ongoing, however preliminary results reveal European starling groups have stable social ranks and individuals display variable and consistent use of the visual field.



Keywords: Animal Cognition; Visual System; Problem-Solving; Sensory Systems; Social Rank



Mentor(s):

Jeff Lucas (Science); Rebecca Trapp (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1280**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Quantum Metrology for New-Era Electronics

Innovative Technology/Entrepreneurship/Design

Author(s):

Joseph Lopez† (Engineering, JMHC); Caleb Suhy* (Engineering, Science, JMHC)

Abstract:

The development of a new type of computer, quantum or probabilistic, has posed many problems such as how to measure its quantum or probabilistic states. This project focuses on one type of material defect, nitrogen-vacancy (NV) centers in diamond, that has been proven to provide reliable results in initializing and reading the spin states of electrons. A central question of this project is how one can utilize the photoluminescence and room temperature aptness of this system to create reliable quantum sensors for quantum phenomena being utilized in novel computing developments. Coming into this project, two mentors demonstrated the possibilities of this research as confocal microscopy and resonance-induced electron manipulation have already been researched and are commonly accepted as quantum system practices. This research reports on how relaxometry experiments using confocal microscopy techniques paired with magnetic noise can prove that the NV center is a viable quantum sensor. By noting the resonance of spin states, 2.87 GHz, and energy separation of spatial states, 637 nm red light, this group will observe the initialization, manipulation, and configuration of spin states with confocal microscopy paired with magnetic noise. The continuation of this research will utilize this experimental setup to develop reliable quantum sensors and verify magnetic tunnel junction structures made at Birck Nanotechnology Center, which are the building blocks of probabilistic computers.

Keywords: Quantum; Probabilistic; Optics; Quantum Sensing; New-Era Electronics

Mentor(s):

Pramey Upadhyaya (Engineering); Abhishek Solanki (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1281**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Inflammation, Insula Structure, and White Matter Integrity in a National Sample

Social Sciences/Humanities/Education

Author(s):

Samantha Maari† (Science); Lauren Voss* (HHS); Quinn Clemenz* (Science); Olivia Richter* (HHS, JMHC)

Abstract:

This study is part of a larger research agenda on the extent to which biological signals from the body affect subjective perceptions of health. Inflammation is a physiological response to harmful stimuli, such as pathogens or damaged cells, that also affects mood and cognition. Some studies have implicated brain regions and neural pathways involved in proprioception, perception of the body's internal state, as targets of inflammatory signals, including the insula and the uncinate fasciculus, a major white matter tract connecting the insula to other brain areas. The aim of this study was to examine the relationship between circulating levels of inflammation and insula structure as well as integrity of the uncinate fasciculus. Data (N=197) were from the Midlife in the US study (MIDUS) study, specifically the neuroscience sub-studies from third wave (2013-2014; n=116) and the Refresher cohort (2013; n=81). All participants were scanned in a 3T scanner. Inflammatory proteins (interleukin-6 and C-reactive protein) were measured in fasting blood samples. Measures of insula cortical thickness, surface area, and volume (adjusted for total intracranial volume) were calculated via FreeSurfer software using the Destrieux brain atlas. Data from diffusion-weighted images were used to estimate fractional anisotropy, a general measure of white matter tract integrity. Linear regression models adjusting for demographic and health factors were created, and results showed no linear relationships among the key measures. The absence of a linear relationship may be attributed to the large, heterogeneous sample, which could mask subtler, population-specific effects.

Keywords: Inflammation; Insula; White Matter Integrity; Uncinate Fasciculus; Population Sample

Mentor(s):

Elliot Friedman (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1282**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# NanoMCMC and Polytensor

Mathematical/Computation Sciences

Author(s):

Rohan Malavathu† (Engineering, JMHC)

Abstract:

Our objective was to develop two Python packages: NanoMCMC and Polytensor. These packages are designed to work in tandem, facilitating highly parallelized, autograd-friendly Markov Chain Monte Carlo (MCMC) simulations using PyTorch. MCMC is a powerful algorithm applicable to Boltzmann distributions and other problems, which we utilized to test energy models in our research. The NanoMCMC package enables efficient MCMC calculations on PyTorch. To complement NanoMCMC. we introduced the Polxtensor package, which exploits the 'einsum' function in PyTorch for asymptotically faster computational results. This approach significantly optimizes tensor operations, crucial for complex model evaluations and simulations. our benchmark tests highlight the performance benefits of these packages. For instance, NanoMCMC demonstrates substantial speed improvements, with computations on a CUDA-powered A5000 GPU being approximately 100 times faster than on an Intel Xeon W-2245 CPU, particularly at batch sizes of 10^6. This comparison underscores the potential for exponential performance gains when leveraging GPU acceleration. In summary, the NanoMCMC and Polytensor packages represent significant advancements in the field of computational physics, offering tools that enhance the speed, efficiency, and accessibility of sophisticated simulations and analyses.

Keywords: PyTorch; Python; Monte Carlo

Mentor(s):

Alexandra Boltasseva (Engineering); Blake Wilson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1283**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Drinking Water Quality

Life Sciences

Author(s):

Lillian Maldia† (Engineering)

Abstract:

The Federal Government does not regulate private domestic well water in the United States. The well owner is responsible for maintaining their drinking water quality and safety. While testing water quality is important, testing is not always done due to cost and time. While the risks of heavy metals and gastrointestinal pathogens are relatively understood, there is little data about chemical and microbial risks. In the study, we investigated well water quality using a citizen-science approach. Six private Tippecanoe County wells provided hot and cold water kitchen sink samples. All wells were repeat samples from a 2023 study. These winter samples were chosen to capture potential seasonal deviations in water quality. The total cell count, pH, dissolved oxygen content, and detection of coliform quantify water quality. Samples were filtered to collect biomass for DNA extraction to determine the microbiome content, which has yet to be analyzed. Metals and nutrients are to be analyzed, as well. Those tests will be factored into the water quality. The results are expected to confirm that the well water is safe. Seasonal and weather variations are expected to contribute to fluctuations. Well-users who submit samples will be informed about the contents of their water. The results of the water quality are helpful to well-users but will also contribute to a better understanding of water quality risks, effective treatment, and the effects of seasonal fluctuations on the results. Results from the microbiome community analysis are expected to provide a baseline for microbial effects in this environment.

Keywords: Well Water; Water Quality; Drinking Water

Mentor(s):

Caitlin Proctor (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1284**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Chemical Conjugation Method for Enhanced Diacylglycerol Multiple Reaction Monitoring Profiling

Life Sciences

Author(s):

Mia Martinez† (Science, JMHC); Paige Davis‡ (Science)

Abstract:

Recently, the detection of subtle disturbances in lipid metabolism has provided key insights into many human pathologies like Alzheimer's Disease and other neurodegenerative diseases. Multiple reaction monitoring (MRM)-profiling offers an unprecedented level of analytical power in lipid analysis, yet still faces significant challenges, particularly for neutral lipids like diacylglycerols (DGs). Briefly, DGs are glycerol derivatives carrying two fatty acyl chains and serve as essential lipid intermediates for cellular transport and signaling. However, MS-based DG analysis is challenged by both the DG structure's low proton affinity and acidity, along with its low abundance under normal biological conditions. Here, we describe the development of a simple transesterification chemistry strategy to enhance DG ionization efficiency and characterization.

Keywords: Novel Chemical Conjugation; Enhanced Diacylglycerol Identification; Diacylglycerol Quantitation; MRM-Profiling

Mentor(s):

Gaurav Chopra (Science); Guang Yang (Science); Pooja Saklani (Science); Harshit Arora (Science); Caitlin Randolph (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1285**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Understanding Students' Perception of Emerging Career Pathways and Job Roles in the Gaming Industry

Social Sciences/Humanities/Education

Author(s):

Michael Maslowski† (Polytechnic)

Abstract:

As technology innovates, so too do the industries that revolve around it. The gaming industry is one of these intertwined industries and it advances alongside technology. However, there arises a problem when approaching education for this industry. How can an educator equip a student with the proper skills and knowledge for a world growing in unpredictable ways? Our ongoing research project focuses on addressing this concern by analyzing previous research publications alongside students' current perceptions of the gaming industry and new technologies. This is a work-in-progress study, and we plan to gather information through a qualitative survey into the influences, perceptions, and plans of students interested in the gaming industry. Our survey is based on four factors from Social Cognitive Career Theory (SCCT) which are prior experience, social support, self-efficacy, and outcome expectation. Additionally, our survey includes questions regarding education provided by the curriculum and exposure to VR/AR/AI technologies. Although we are gathering data from the survey, we hypothesize that we will find a need for broader exposure, education, and certification in the gaming industry. This is based on the research publications analyzed in preparation for the survey. Additionally, publications pointed to a lack of prior experience and a shifting skill set focus within the gaming industry and related fields. The rise of AI within the workspace is creating uncertainties within the future of the gaming industry. These factors can be possible areas of improvement for the current landscape of education.

Keywords: Technology Education; Workforce Development; Experiential Learning

Mentor(s):

Nandhini Giri (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1286**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Semantic Feature Category's Impact on Early Word Learning

Social Sciences/Humanities/Education

Author(s):

Kathryn McGregor† (Science); Ellen Densmore* (HHS); Madison Miller* (HHS); Katelyn Decker* (HHS)

Abstract:

Children go from producing only a handful of words starting around age 1 to producing hundreds of words by age 2 (Fenson et al., 1994). As vocabularies increase, their structures change. By the end of their second year, children have dense vocabulary networks. One way to classify semantic structure is by the degree of shared semantic features (e.g., has fur, is an animal, has 4 legs) between words (e.g., DOG and CAT). Shared semantic connections encode both functional and perceptual features. Functional features capture information about how one interacts with an object (used for sports); perceptual features are accessed via the senses (has 4 legs). The current study aimed to establish a causal connection between children's existing lexico-semantic structure and their vocabulary growth through an individually-tailored word learning task.

Caregivers of 18.0-27.99-month-old children (N=32) were given 8 words and asked to teach their child over a two-week period. All words shared either perceptual or functional overlap with the child’s existing knowledge. Parents reported whether their child understood the 8 words after 2-weeks, and updated a survey of their child’s vocabulary size after 1-month. Children said 75% (6 of 8) of the words after 2-weeks. Critically, children in the perceptual condition learned more words after 1-month than children in the functional condition (Growth-Rate, >1=more than expected: Perceptual-M=2.52, Functional-M=1.94).

These findings provide insight for theories of conceptual development, and inform caregivers, educators, and clinicians in how to design maximally supportive learning environments.

Keywords: Semantic Networks; Language Acquisition

Mentor(s):

Amanda Yuile (HHS); Arielle Borovsky (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1287**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Integrating AI in Higher Education: Opportunities and Challenges

Innovative Technology/Entrepreneurship/Design

Author(s):

Vihaan Mercchant† (DSB)

Abstract:

Background:

In my research, I investigate the evolving role of AI in higher education, exploring its potential to enhance learning outcomes and streamline administrative processes. I delve into the benefits and challenges of AI integration, considering ethical implications, technical complexities, and logistical hurdles. My aim is to provide insights to facilitate responsible and effective implementation of AI in academic environments.

Objectives:

1. Assess AI's current impact on teaching, learning, and administration in higher education.
2. Investigate future AI trends in education.
3. Evaluate ethical, technical, and logistical challenges of AI integration.
4. Offer recommendations for maximizing AI benefits while minimizing risks.

Methodology:

The research will conduct a thorough literature review and gather qualitative data from interviews with educators, administrators, and tech experts. It aims to identify best practices, challenges, and outcomes of AI integration in education while addressing ethical considerations and potential biases.

Expected Results:

The research will explore diverse AI applications in higher education, including personalized learning and automated administration. It will emphasize strategic planning, ethics, and ongoing evaluation for successful AI integration. The study aims to show AI's potential for improving education and efficiency, alongside challenges like privacy and bias.

Value Added: Significance, Implications, and/or Contributions

This research adds to AI integration in education knowledge, acknowledging both potential and pitfalls. It offers a thorough analysis for educators, policymakers, and tech enthusiasts, guiding informed decisions. It emphasizes ethical guidelines for equitable benefits to all students.

The goal is to comprehensively explore AI integration in higher education, focusing on ethical and practical aspects. It strives to contribute significantly to the discussion on educational technology's potential to enhance learning environments through thorough analysis and actionable recommendations.

Keywords: Artificial Intelligence; Higher Education; Ethical Considerations; AI and Educational Administration

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1288**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Examination of Sex Differences in Click Auditory Brainstem Recordings and Auditory Thresholds Following Small Arms Fire-Like Noise Exposure

Life Sciences


Author(s):

Valentina Micolisin† (Science); Emily Bell‡ (Science); Andy Navarro‡ (Science)



Abstract:

Exposure to loud noises often experienced by military personnel in the line of duty can result in Noise Induced Hearing Loss (NIHL). Understanding sex differences in changes to auditory evoked potentials due to this noise is crucial in developing effective neuroprotective strategies and treatment options for both sexes. The click auditory brainstem responses (Click ABRs) of F-344 rats (F = 6, M = 6) were measured to quantify the neurophysiological changes in the auditory brainstem and the auditory nerve. Before measurement, rats were sedated with dexdomitor and ketamine and exposed to the small arms fire-like noise (SAF). This SAF noise consisted of a series of biphasic pulses, presented at a rate of 0.33 Hz (repeated 50 times in 2.5 minutes) at 120 dB peak SPL. Auditory evoked potentials were measured with subdermal electrodes and performed before SAF exposure and on days 2, 7, 14, 28, and 56 following exposure. To assess change in auditory thresholds, the threshold shifts were compared to the baseline for all the time periods. Additionally, the relative contributions of the auditory nerve and inferior colliculus were examined by comparing wave I and wave V ratios. Preliminary results point towards female rats exhibiting higher auditory threshold shifts from baseline than male rats when exposed to the SAF-like noise over time. This suggests that female and male rats respond differently to NIHL due to hormone or size differences. These results underscore the importance of understanding sex differences in response to noise exposure and the need for targeted intervention.



Keywords: Central Auditory Processing; Sex Differences; Auditory Brainstem Response; Noise Induced Hearing Loss; Noise Exposure


Mentor(s):

Edward Bartlett (Science); Meredith Ziliak (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1289**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## The Role of Parent-Child Relationship Quality on the Association between Racial-Ethnic Socialization and Youth Well-being in Transracial Adoptees

Social Sciences/Humanities/Education

Author(s):

Audrey Middaugh† (HHS)

Abstract:

Previous research has shown that how parents socialize their children about their culture and race (racial-ethnic socialization, or RES) is positively associated with youth socioemotional well-being (Wang & Benner, 2016), but little research has been conducted on how the parent-child relationship can influence this process. Extant research suggests that the association between RES and youth well-being may depend on the parent-child relationship (Cooper & McLloyd, 2011). For example, in Black families, it has been found that adolescent boys who receive RES from their mothers have fewer depressive symptoms when they are closer to their mothers, suggesting that the influence of RES messages on youth well-being may be stronger within closer parent-child relationships (Lambert et al., 2015). Transracial adoptees (TRAs) are children adopted by parents of a different race, and their experiences may be different from those of same-race adoptees because parents have different lived racialized experiences than their children. Given their unique family context, the next step in understanding RES in transracial adoptee families is to examine the relationship quality between adoptive parents and their children. Therefore, this study will investigate the role of relationship quality as a moderator in the association between parental RES of Korean American TRAs and their well-being. I hypothesize that the association between RES and well-being will be stronger among TRAs with a closer parent-child relationship than those with a less close relationship. Understanding the link between parental RES and TRA well-being can help inform interventions with TRA families to better support TRA mental health.

Keywords: Racial Socialization; Transracial Adoptees; Family Functioning; Well-Being

Mentor(s):

Annabelle Atkin (HHS); Nathan Lieng (HHS); Rich Lee (University of Minnesota); Amelia Blankenau (University of Minnesota)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1290**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## How Does Drought Stress Affect Cold Acclimation in Plantago lanceolata?

Life Sciences

Author(s):

Joanna Miller† (Agriculture, JMHC)

Abstract:

With climate change, it will be important for plants to be able to adapt to changing conditions. Such changes could potentially involve multiple stressors that act synergistically. This research uses a factorial design to examine responses to drought and cold temperatures in the herbaceous perennial Plantago lanceolata. I compared soluble sugar accumulation, osmotic potential, and biomass under controlled conditions. These traits are important for many things. Soluble sugars regulate different metabolic processes, osmotic potential is what allows water to move into the plant, and biomass represents how much energy is stored in the plant. The factorial design was applied such that one group experienced drought, one group experienced cold, and one group experienced drought followed by cold. Each group was compared to a warm, well-watered control group. Results indicate how this species makes physiological adjustments in response to cold and drought. The potential for synergistic or antagonistic responses of drought followed by cold will additionally be discussed. These results provide greater insight into plant responses to the environment, which is increasingly important in the face of climate change.

Keywords: Plantago; Botany; Cold Acclimation; Drought Stress

Mentor(s):

Christopher Oakley (Agriculture); Samuel Mantel (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1291**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Examining the relationship between attention and negative affect in infancy

Social Sciences/Humanities/Education

Author(s):

Lillian Millspaugh† (HHS)

Abstract:

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders diagnosed in childhood (Scandurra et al., 2019). Early intervention can reduce the long-term effects of ADHD and even prevent the emergence of symptoms (Sonuga-Barke, 2011). For early intervention to be effective, early detection must also be well-developed. ADHD frequently results in relationship difficulties, trouble managing risky behaviors, and other consequences later in life (Faraone et. al, 2021). Further examining these symptoms is vital for exploring more advanced diagnostic and clinical tools. Mothers (N=300) completed the Infant Behavior Questionnaire-Revised (IBQ-R) related to their infant's behavior and temperament at one, six, and twelve months.  A cross-lag panel model of an analysis will be used to examine relationships between the two variables: attention and negative affect across the first year. The model is used for testing causal relationships between variables over time by controlling for any reverse relationships between variables and predicts changes at various time points in data collection. The cross-lag model controls for simultaneous associations and ensures the stability of each variable at T1, T2, and T3. MPLUS will be used to analyze the data at the three time points, with results expected in early 2024. The project aims to examine these constructs and gain insight into their early relationships, to better develop early detection and diagnostic tools. Although it is merely the first step in understanding the early development of aspects of ADHD, it may open a larger conversation about preliminary signs of ADHD.

Keywords: ADHD; Infancy; Development; Attention; Emotion

Mentor(s):

Sarah Karalunas (HHS); Madelyn Blake Heise (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1292**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Determination of Superfund Sites Near Historical Residences Among Current Hartford City Residents

Life Sciences


Author(s):

Nicholas Mitchell† (HHS, JMHC)



Abstract:

Residents in Hartford City are concerned about potential metal exposure as a result of the operation of a nearby metal recycling facility. This prompted a comprehensive study of the environmental contamination and community health, with data collection documenting what contamination exists now, and understanding past exposures.

Therefore, the objective of this research is to compile the residential history of participants and identify whether they lived near known contamination sites over their lifetime, specifically superfund sites.

Residential history (dates and location) were collected via questionnaire from study participants. The U.S. EPA's superfund database was used to identify any nearby sites, (defined as city of residence in densely populated areas including sites within the city, and a 10 mile radius for less densely populated areas) and in time (defined as 9 years since the participant lived at their listed residence). Data was organized in MS Excel and is being used to create cumulative exposure estimates for each participant by calculating the total number of contaminated sites each participant could have been exposed to.

From comparing the data to the established criteria, 75 of the 80 participants have been exposed to at least one contaminated site within their lifetime. Although there are limitations to this approach, such as the superfund database not providing explicit information about individual exposure, the results are anticipated to provide a relative index for each participant's history of proximity to contaminated sites, which will contribute to interpreting our data on current exposures and health.



Keywords: Exposure to Contaminants; Residential History; Superfund Sites



Mentor(s):

Ellen Wells (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1293**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## RoboMasters Launcher Optimization

Innovative Technology/Entrepreneurship/Design


Author(s):

Alexander Nishio† (Science); Dhanush Tipparaju† (Engineering); Jayson Stansbury* (Engineering)



Abstract:

Using the available parts on McMaster Carr, we will calculate and find the most optimal spring for a spring-based launcher for the RoboMasters Hero Robot. The spring launcher needs to meet the game constraints while also meeting the following criteria: high accuracy, high consistency, ease of manufacturing and design, low weight, small size, adjustable angles, and high resilience. The goal of the optimized launcher is to replace the current design for the robot to help integrate other mechanical subsystems.



Keywords: Launching; Robotics; Optimization



Mentor(s):

Abolfazl Hashemi (Engineering); Zijian He (Engineering); Shivam Bhat (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1294**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Statistical Process Control in

Innovative Technology/Entrepreneurship/Design

Author(s):

Darbin Oh† (Engineering, JMHC); Benjamin Tofil‡ (Engineering); Gangsan Lee* (Engineering); Cheong Eun Kim* (Engineering); Lyu Jia Sue* ; Rakhmatillokhon Abdubaev* (Engineering); Jozue Kim* (Engineering)

Abstract:

The research question I aim to address focuses on the variability in two crucial processes within semiconductor fabrication: photolithography and metal deposition. Photolithography involves creating intricate patterns on a semiconductor wafer's surface using ultraviolet light. This step is essential for defining the circuitry and features of semiconductor devices. Metal deposition is a process where a thin layer of metal is applied to the semiconductor wafer. This metal serves various purposes, such as connecting circuit parts or acting as a protective coating. The thickness of this deposited metal layer is critical parameter in semiconductor manufacturing, influencing the functionality and performance of electronic devices.

My investigation specifically delves into the variation in thickness within a wafer and among different wafers during these processes. The overarching goal is to identify and quantify these variations, contributing to a comprehensive understanding of data variation in tools utilized in the Birck Nanotechnology Center cleanroom.

Implementing SPC strategy such as Gaussian distribution and Control Chart, my methodology builds on industry practices to enhance fabrication process stability. The significance lies in optimizing cleanroom processes for both students and faculty at Birck, ensuring reliable results for ongoing research.

Keywords: SPC; Photolithography; Metallization; Variation; Assignable Cause

Mentor(s):

Zhihong Chen (Discovery Park); Joerg Appenzeller (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1295**

*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Structural and Functional Characterization of Phospholipase C β3

Life Sciences

Author(s):

Kennedy Outlaw† (Science)

Abstract:

Phospholipase C β (PLCβ) plays an important role in cardiovascular diseases and opioid analgesia. PLCβ catalyzes the hydrolysis of the inner membrane lipid phosphatidylinositol-4,5-bisphosphate (PIP2) to inositol-1,4,5-triphosphate (IP3) and diacylglycerol (DAG). IP3 and DAG are crucial secondary messengers that activate multiple signaling pathways to change cellular behavior. PLCβ is a downstream effector of G-protein coupled receptors (GPCRs) and is activated by both the Gαq and Gβγ subunits. Activation by G□q requires a unique 400 amino acid C-terminal region of the lipase, which is subdivided into the proximal and distal C-terminal domains (CTDs). These domains are required for allosteric activation by G□q and for membrane binding. Our lab and others have reported that PLCβ is more flexible in solution, as compared to crystal structures of the protein. In small-angle X-ray scattering (SAXS) experiments, the solution structure of PLCβ had additional density that cannot be accounted by the crystal structure. We hypothesize that PLCβ3 will exist in the open, low activity conformation, and will shed light on possible allosteric interactions between the distal CTD and the core. To test this hypothesis, we used cryo-electron microscopy (cryo-EM), which allowed us to determine a solution structure of PLCβ to a higher resolution than SAXS studies. We determined the solution structure of full-length PLC β3 to 4.08 angstroms. PLC β3 primarily existed in a rigid closed confirmation, which suggests that it is not flexible in solution.

Keywords: Structural Biology; Signal Transduction; Biochemistry; Cardiovascular Disease

Mentor(s):

Angeline Lyon (Science); Isaac Fisher (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1296**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**The Behavior of Anchorages and Subassemblies Under Moment Loading**

Physical Sciences

Author(s):

Raahil Pattan† (Engineering)

Abstract:

Column-to-foundation connections are crucial in both building and bridge structures, requiring careful design to handle regular loads and extreme forces like those from earthquakes. When these connections face horizontal loads, they experience bending moments on the anchors linking the structural elements. This study aims to comprehend how similar structural assemblies behave under moment loading. The Finite Element Method will be employed to analyze how various factors influence the behavior of moment-loaded anchorages. This method involves discretizing the structure into elements and solving differential equations to simulate its behavior. Validated Finite Element models offer accurate insights into concrete and anchorages, reducing costs associated with extensive experimentation. Ultimately, the findings of this study will contribute to the advancement of earthquake-resistant building and bridge designs, improving the safety of infrastructure worldwide.

Keywords: Civil Engineering; Concrete; Forces; Finite Element Method; Innovative

Mentor(s):

Akanshu Sharma (Engineering); Gaurav Chobe (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1297**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## The Impact of Adversarial Node Placement in Decentralized Federated Learning Networks

Mathematical/Computation Sciences

Author(s):

Adam Piaseczny† (Engineering)

Abstract:

As Federated Learning (FL) grows in popularity, new decentralized frameworks are becoming widespread. These frameworks leverage the benefits of decentralized environments to enable fast and energy-efficient inter-device communication. However, this growing popularity also intensifies the need for robust security measures. While existing research has explored various aspects of FL security, the role of adversarial node placement in decentralized networks remains largely unexplored. This paper addresses this gap by analyzing the performance of decentralized FL for various adversarial placement strategies when adversaries can jointly coordinate their placement within a network. We establish two baseline strategies for placing adversarial node: random placement and network centrality-based placement. Building on this foundation, we propose a novel attack algorithm that prioritizes adversarial spread over adversarial centrality by maximizing the average network distance between adversaries. We show that the new attack algorithm significantly impacts key performance metrics such as testing accuracy, outperforming the baseline frameworks by between 9% and 66.5% for the considered setups. Our findings provide valuable insights into the vulnerabilities of decentralized FL systems, setting the stage for future research aimed at developing more secure and robust decentralized FL frameworks.

Keywords: Federated Learning; Machine Learning; Distributed Frameworks; Machine Learning Security

Mentor(s):

Christopher Brinton (Engineering); Eric Ruzomberka (Princeton University); Rohit Parasnis (Massachusetts Institute of Technology)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1298**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Formulation of Preservation Solutions for Model Generation with In Vivo Tissue Morphology

Life Sciences

Author(s):

Holly Pickett† (HHS)

Abstract:

Historically, standard tissue fixation methods have demonstrated a poor ability to longitudinally retain the in vivo morphology of organic tissue, leading to undesirable alterations such as loss of elasticity and hardening. Tissue preserved in this manner hampers anatomy students' ability to understand core connections between form and function. The aim of this project is to develop a new tissue preservation method to conserve organ structure and thus living function with improved fidelity. Three trials were conducted by immersing dissected porcine lungs in solutions containing different concentrations of a modified-release fixation component, electrolytes at physiological concentrations, albumin, and glycerin. Over the course of eight months, submerged lung lobes were assessed biweekly to discern integrity of preservation and retention of in situ properties using visual observation and tactile manipulation. As expected, the modified-release fixation component was effective at preventing tissue degradation for an extended period of time, and with the incorporation of glycerin as well as the biologic components electrolytes and albumin, improved tissue pliability and functionality was obtained. Further experimentation will focus on applying the newly established preservation solution to an intact set of lungs and assessing functionality using mechanical ventilation. Once developed, this preservation method can then be applied in the construction of functional anatomical models to be utilized in active learning environments. These models would demonstrate normal and altered functionality outside the body to support an enriched depth and breadth of understanding about the intimate connection between structure and function required to foster diagnostic skills critical for clinical practitioners.

Keywords: Preservation; Tissue Preservation; Anatomical Models; Lung Tissue; Physiology

Mentor(s):

Lisa Hilliard (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1299**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Investigating PFOS Induced Neurobehavioral Hyperactivity and Motor Behavior

Life Sciences

Author(s):

Hurshal Pol† (HHS, JMHC)

Abstract:

PFAS are a group of persistent organic pollutants that accumulate in the human brain. Perfluorooctanesulfonic acid (PFOS), the most prevalent PFAS pollutant, targets dopaminergic pathways which may lead to motor and neuropsychiatric disorders, including Parkinson's Disease, attention deficit/hyperactivity disorder (ADHD). We hypothesized that chronic exposure to PFOS causes motor deficits in mice. Mice were treated with drinking water containing 1.0 mg/kg/d PFOS or 0.5% tween-20 vehicle. They performed neuro behavioral tests after 16 months of dosing, cognitive and motor function were assessed. Locomotor activity measured exploratory activity levels in a box over one hour. Male PFOS-treated mice showed significantly elevated activity levels compared to controls. There was no effect on female mice. Nigrostriatal motor function was assessed via challenging beam traversal in which mice traversed a wire-mesh beam. The results demonstrated male PFOS-treated mice took significantly less time to traverse the beam whereas female PFOS-treated mice took significantly more time to traverse the beam. Male mice had significantly increased errors/step and total errors compared to female mice, with no effects of PFOS treatment. This study demonstrates that chronic exposure to PFOS causes sex-specific hyperactivity in male mice and potentially decreased motor function in PFOS-treated female mice. Absent PFOS-related changes in errors/step indicate changes in motor function are likely independent of the nigrostriatal pathway affected in Parkinson's disease. Changes in activity level may suggest PFAS affect dopaminergic pathways (e.g. mesolimbic pathway) involved in neuropsychiatric disorders such as ADHD. Further experiments will be conducted to assess PFOS's feminizing activity towards male mouse models.

Keywords: Chronic PFOS Exposure; Neurotoxicology; Dopaminergic Pathways; Motor Behavior

Mentor(s):

Jason Cannon (HHS); Josephine Brown-Leung (HHS); Fatema Currim (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1300**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## The comparison between the presence/absence of health insurance, educational level and physical health, among rural Latine adults from agricultural and farmwork families

Social Sciences/Humanities/Education

Author(s):

Alejandra Porras Hernandez† (HHS)

Abstract:

Latine have among the highest uninsurance rates (17.7%), and are likely to be overweight. Research suggests an association between insurance and Body Mass Index (BMI). Studies suggest that higher education is related to higher probability of being insured. Using data from an on-going study with rural Latine caregivers, this study sought to understand how presence/absence of health insurance and educational level is related to physical health. We hypothesized that (1) health insurance rates will be lower in those with less higher education, and (2) BMI will be higher in those with no insurance.

In total, 288 adults completed ($M_{age}$= 38.95 [21-65 years of age], Females=87.8%) a survey. Results from two t-tests showed that there was a significant difference between having insurance and not having insurance and BMI. The 159 participants reporting no having insurance ($M$ = 31.820, $SD$ = 6.3317) compared to the 122 participants reporting having insurance ($M$ =33.468, $SD$ = 7.2926) suggest that having insurance is associated to lower BMI, $t$ (270) = -1.993, $p$ = .047.Results suggest that there was a significant difference in the level of education, between having no insurance ($M$ =2.43, $SD$ = 1.598) and insurance ($M$ =2.99, $SD$ = 1.649); $t$ (278) = -2.875, $p$ = .004.

In conclusion among Latine adults from agricultural and farmwork families, those who have obtained higher education are most likely to have health insurance, while those with health insurance are more likely to have lower BMIs compared to those without health insurance.

Keywords: Latine Adults; Agricultural/Farmwork Families; Health Insurance; Educational Level; Physical Health

Mentor(s):

Yumary Ruiz (HHS); Alexia Carrizales (HHS); Zoe Taylor (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1301**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## ECELabs.io Electrical Engineering Technology Circuit Board

Innovative Technology/Entrepreneurship/Design

Author(s):

Zachary Purcell† (Engineering); Rauf Erkiletlioglu* (Engineering); Minh Nguyen* (Engineering)

Abstract:

The purpose of this project is to expand ecelabs.io to be available for not just ECE classes but also for ECET (Electrical Engineering Technology) classes. It involves creating a circuit board that can be connected to an FPGA(Field Programmable Gate Arrays) device, making sure the circuit board can allow the FPGA to communicate with a website, and lastly, creating a website for the board to be used on. FPGA devices are a great option for practicing programming since they are reprogrammable. ECE270 is a Purdue course intended to introduce students to digital system design, which is made possible through the ecelabs.io website that allows students to practice digital system design without owning their own FPGA. The methods used for creating the circuit board for this project are like the methods used for the ECE270 circuit board. More specifically, the circuit board contains five IO expanders that are connected to the FPGA input/output pins and to the I2C pins of the Raspberry Pi and the FTDI(Future Technology Devices International) chip for communication. The board has four copper layers and a USB-C connector to power the board. The website for ECET also has great similarities to that of the ECE270 portion of the ecelabs.io website where students can create circuit block diagrams, run breadboard simulations, write Verilog code, and test out their design. ECET makes use of the DE0-CV FPGA which contains 7-segment displays and an array of switches and LEDs. Future iterations of this project may need to reconsider the FTDI chip that is used due to its transfer speeds. The addition of a faster FTDI transfer chip could also get rid of the need for the Raspberry Pi and greatly reduce costs.

Keywords: Electrical Engineering Technology; Field Programmable Gate Arrays; Future Technology Devices International; ECE270; Raspberry Pi 4

Mentor(s):

Junfei Li (Engineering)

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**Poster Presentation Abstract Number: 1302**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Evaluation of ketamine's prosocial effects in SCN2A-deficient mice**

Life Sciences


Author(s):

Rineet Ranga† (HHS); Akila Abeyaratna‡ (Agriculture, JMHC)



Abstract:

Autism spectrum disorder (ASD) is a neurodevelopmental disorder affecting 1 in 36 children, characterized by deficits in social communication and interaction. ASD has been associated with various genes; however, SCN2A, a gene encoding a sodium ion channel (Nav1.2), has been identified as one of the leading monogenic causes of ASD. Our lab has characterized a novel mouse model of SCN2A deficiency, which recapitulates many of the phenotypes seen in ASD patients, such as social deficits. Serotonin, a neuromodulator, plays an important role in social behaviors and has been implicated in ASD pathology. Ketamine, an N-methyl-d-aspartate (NMDA) receptor antagonist, has recently been evaluated as a therapeutic in autistic children, showing significant improvement in social communication and social withdrawal. Interestingly, ketamine also increases serotonin release in major brain regions affected in ASD, like the prefrontal cortex. Using the 3-chamber assay and Stranger Interaction tests, we have identified that an acute injection of 20 mg/kg of ketamine produces prosocial effects in Scn2a-deficient mice. Since ketamine is a promiscuous drug, we further evaluated which receptors were behind the prosocial effects in Scn2a-deficient mice. We used 7-Cholrokynuric acid, an NMDA receptor antagonist, as well as CP-94, 253, and Psilocybin, 5HT1B and 5HT2A receptor agonists, respectively. We have found that NMDA antagonism does not produce prosocial effects; however, agonism of 5HT1B and 5HT2A significantly increases sociability in Scn2a-deficient mice. Our findings highlight the potential use of compounds that perturb the serotonergic system as a therapeutic in SCN2A-related ASD.



Keywords: SCN2A; Serotonin; Ketamine; Autism; Psilocybin



Mentor(s):

Yang Yang (Pharmacy); Brody Deming (Pharmacy)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1303**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Democracy for Busy College Students: Reimagining the Demands of Political Participation For College Age Citizens

Social Sciences/Humanities/Education

Author(s):

Jaixai Reineke† (Liberal Arts); Misri Shah‡ (Liberal Arts, DSB)

Abstract:

While voter turnout in the US has gone up in recent years, it still lags significantly behind other developed countries. Political scientists have tried to understand the causes of political disengagement among voting-eligible citizens as well as potential ways to address it. Our research takes a different approach by reexamining these expectations of political participation in the first place. Following recent work in political theory, we consider whether participation expectations are too high, especially when it comes to young, busy, college-age citizens. We ask: are people owed a low-effort way to engage in politics? If so, what is a reasonable amount of time and effort we can expect citizens, specifically busy college-age students, to dedicate to political participation?

Drawing on work in political philosophy and political theory, we articulate the minimum level of participation we can demand from busy college-age individuals. We aim to address different dimensions of political inactivity and identify which aspects of participation hold the most significance for this demographic. Through this exploration, we theorize how to foster meaningful civic engagement among young adults within the constraints of their busy lives.

Keywords: Political Participation; Political Philosophy; Democratic Theory; Democratic Citizenship; Political Apathy

Mentor(s):

Molly Scudder (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1304**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Prevalence of and Factors Associated with Non-Iron Deficiency Anemia in Women of Reproductive Age in Urban, Rural, and Tribal Areas of Select Districts of Madhya Pradesh, India

Life Sciences

Author(s):

Emily Ren† (HHS)

Abstract:

The purpose of this study was to identify the prevalence of non-iron deficiency anemia (NIDA) in a population of Indian women of reproductive age (WRA) as well as to analyze dietary and non-dietary factors contributing to NIDA. These findings represent a secondary analysis of extant data from a quasi-experimental study on 10,467 WRA within 10 districts of Madhya Pradesh, India. Blood samples, food frequency questionnaires, demographics, and surveys on general health status and behaviors were collected. Marginal distributions were used to assess prevalence of NIDA in the population based on hemoglobin (Hb) and ferritin (Ft) concentrations. The NIDA sample was further categorized based on mean corpuscular volume (MCV). Logistic regression and odds ratios were used to explore the association between dietary and non-dietary variables and the presence of NIDA. The total prevalence of anemia in the population was 60.7% (n=6353) while the NIDA prevalence was 47.4% (n=4963). Of those with anemia, 78.1% were NIDA. Recent consumption of dairy products, recent consumption of eggs, recent consumption of seafood, and use of mosquito repellant was associated with a significant decrease in odds of having NIDA (0.09, 0.16, 0.09, and 0.17, respectively). Our results suggest that both dietary and non-dietary behavioral modifications could be encouraged in order to reduce the burden of NIDA in these WRA in India. Further work needs to be conducted to determine causal relationships and optimal public health interventions for NIDA in this population.

Keywords: Anemia; Non-Iron Deficiency Anemia; Women of Reproductive Age

Mentor(s):

Laura Murray-Kolb (HHS); Elina Dawoodani (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1305**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

**Size matters more when you don't know "it"**

Social Sciences/Humanities/Education

Author(s):

Oliwia Rentley† (HHS)

Abstract:

Previous research has found that participants respond more efficiently (i.e., either faster or more accurately) to words representing large objects (over small ones) and to more familiar words (over less familiar ones). However, no studies have examined if these factors interact. The present investigation employed a set of 220 words to test for a possible interaction between semantic size and familiarity. Our results indicate significant main effects for both size and familiarity in both response time (RT) and a combined measure of both RT and accuracy (inverse efficiency scores; IES). That is, participants were faster for larger and more familiar words, even when controlling for changes in accuracy. Additionally, we observed significant interactions between size and familiarity on RT, indicating that the size advantage (for words representing large objects) was greater for unfamiliar words (e.g., walrus vs scarce) compared to familiar words (e.g., museum vs smile). These findings suggest that size may be represented differently in familiar and unfamiliar words, possibly due to differences in the strengths of brain representations for familiar and unfamiliar words.

Keywords: Cognition; Semantics; Size; Familiarity

Mentor(s):

Anne Sereno (HHS); Daniel Larranaga (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1306**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Longitudinal Increases in Inflammation Predict Decreases in Subjective Health

Social Sciences/Humanities/Education


Author(s):

Olivia Richter† (HHS, JMHC); Lauren Voss* (HHS); Quinn Clemenz* (Science); Samantha Maari* (Science)



Abstract:

People's perceptions of their health are predictive of mortality beyond objective health status. Inflammation (e.g., interleukin-6) is implicated in a range of age-related diseases, and higher levels of inflammation are associated with feeling sick and worse mood. We hypothesized that inflammation may inform people's subjective perceptions of their health and how they change over time. Our previous work with data from the Midlife in the US (MIDUS) study showed that higher interleukin-6 (IL-6) concentrations in the blood correlated with lower subjective health scores. In this study we further probed these findings by examining changes in IL-6 and subjective health over a 7-8 year follow-up period, predicting that a greater increase of IL-6 would predict greater decreases in subjective health. Data were from people who participated in the Biomarker subsample in both the second and third wave of MIDUS (N = 747). IL-6 concentrations (pg/mL) were measured in overnight fasting blood samples. Linear regression models, adjusting for multiple sociodemographic and health factors, showed negative correlations between IL-6 and subjective health at MIDUS 2 and MIDUS 3, but little correlation longitudinally. In further analyses, we determined that subjective declines in SRH were only evident in participants whose circulating concentrations of IL-6 crossed a specific threshold between 2 – 2.5 pg/mL. Participants whose IL-6 concentrations stayed below this range over time perceived no significant changes in their health. These results suggest that increases in IL-6 are perceptible and can affect subjective health, but mainly when they breach a specific physiological threshold.



Keywords: Subjective Health; Inflammation; National Sample; Longitudinal Study


Mentor(s):

Elliot Friedman (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1307**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Customers' Experiences of Racial Discrimination at Southern Waffle Houses

Social Sciences/Humanities/Education

Author(s):

Mia Rodriguez† (HHS, Liberal Arts)

Abstract:

Current research and news coverage suggest various instances of racial discrimination at Southern Waffle Houses. This differs from other large chain restaurants, which have implemented anti-discriminatory policies that have reduced cases of employee-perpetrated racial discrimination. Evidence from lawsuits filed from 1980-2022, indicates that Waffle House has not taken effective action to discourage employee discrimination against customers.

The proposed investigation is designed to explore customers' experiences of racial discrimination at Southern Waffle House establishments. This qualitative study will document the experiences of a purposively selected sample of 10-15 individuals, recruited through methods of advertising the study through social media posts, flyers, and snowball sampling as the study progresses.

The means of data collection will be through virtual individual and focus groups (3-5 participants) interviews of individuals who meet the study criteria (i.e. experienced racial discrimination in the last 10 years). Individual interviews will be utilized for a deeper analysis of specific incidents that otherwise were not fully discussed within the focus group.

Data will be collected through semi-structured interviews from the focus group and individual interviews. The usage of semi-structured interviews promotes interviewer-participant rapport, fosters engagement, and facilitates the collection of rich data. Content analysis will identify dominant themes from the narratives.

The implications of this study seek to provide insight into the experiences of discriminated individuals at Waffle Houses and what actions the institutions can take to discourage racial discrimination. This study can also provide insight into how other institutions can improve their policies to be more inclusive environments.

Keywords: Racial Discrimination; Institutional Racism; Southern Imaginary; Southern Waffle Houses

Mentor(s):

Youli Mantzicopoulos (Education); Xiang Zhou (Education); Brenda Shein (Education)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1308**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Generating Realistic Faces using Techniques involving Generative Adversarial Networks

Mathematical/Computation Sciences


Author(s):

Avigdor Roytman† (Engineering); Ashwin Sreedhar† (Engineering); Abhiram Nambiar† (Engineering); Chris Sigmund† (Engineering); Kris Gurung† (Engineering)



Abstract:

In the past year, the field of Generative Artificial Intelligence has seen significant advancements, particularly with the emergence of models like GPT and image generation networks such as DALL-E and Stable Diffusion. This project delves into synthetic image generation and introduces a novel detection process to discern between real and synthetic images. After evaluating various techniques, our team adopted the Generative Adversarial Network (GAN) approach due to its unique dual-network structure, comprising a Generator and a Discriminator that refine each other's outputs through adversarial training. Our exploration includes variations like SAGAN (Self Attention GAN) and TRANSGAN, a notable enhancement where GAN is infused with Transformer architecture to improve the learning efficiency and quality of generated images. We assess their performance using Fréchet-Inception Distance scores, with TRANSGAN showing particular promise in generating high-fidelity images. Preliminary results demonstrate promising advancements in image realism and diversity. Additionally, we initiated an investigation into optimizing GAN models with Bayesian Optimization to enhance image quality further. This semester's work primarily focused on refining the image generation process, setting a solid foundation for our ultimate objective: generating photorealistic human faces. This endeavor not only advances our understanding of synthetic image generation but also opens new avenues for realistic visual content creation.



Keywords: Machine Learning; Artificial Intelligence; Transformers; Generative Adversarial Networks; GPT



Mentor(s):

Edward Delp (Engineering); Carla Zoltowski (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1309**

*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Semi classical Spin Liquids Using Landau Lifshitz Dynamics

Physical Sciences


Author(s):

Gustavo Saez Cruz† (Science)



Abstract:

There's growing interest in quantum spin liquids, as they could be used for quantum computing due to their topological properties. This research project explores the dynamics of classical spins in magnetic lattices with the aim to introduce quantum corrections to study the behavior of spin liquids. A honeycomb lattice of spins was created with Heisenberg and Kitaev interactions, and the ground state found using simulated annealing. Spins were then flipped at random to simulate disturbances in the ground state, which generate dynamics in the lattice. The time evolution of the lattice is computed using the Landau-Lifshitz equation. The dynamical structure factor of the spins dynamics is then calculated over a high symmetry path in the Brillouin zone of the lattice. The dynamical structure factor showed high energy modes, as well as no gap for $\omega=0$ at $\Gamma$. In the future, quantum corrections will introduce a gap at $\omega = 0$ at $\Gamma$, which will lead to topological properties in the material.



Keywords: Spin Liquids; Condensed Matter



Mentor(s):

Arnab Banerjee (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1310**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Constructing a Membrane Based Dehumidification System: Gathering Key Components

Innovative Technology/Entrepreneurship/Design

Author(s):

Ryan San Juan† (Engineering)

Abstract:

This work discusses the process of acquiring key components to construct a lab scale prototype of a predeveloped theatrical model of a novel heat pump based dehumidification system for industrial drying purposes, coined as MemDry. The MemDry system drastically reduces dehumidification energy loads using water vapor permeable membrane modules. The project was motivated by the nationwide movement towards electrification and reduction of carbon emissions, especially in common industrial processes. While theoretical models have been developed, none have been realized, making this the first. The validation of the model in the lab will provide insight into the accuracy of the models and any unforeseen technological issues, bringing the project one step closer to a functioning full-scale system. To achieve this, the correct parts must be properly sized, quoted, and ordered for the lab-scale prototype. Multiple components will be custom made because of the unique operating conditions of the system, such as 95% relative humidity, recirculated air, the use of the low GWP R1234ze(Z) refrigerant, and a newly developed membrane module configuration. Sizing each part is extremely important. To properly estimate conditions when sizing a part, models and simulations must run accurately and abundantly. When ordering and sizing, the details of the project are discussed with experts within the vendor companies to guarantee the correct selection. After that, quotes are obtained, and lead times must be considered in order to begin construction. The constructed prototype will then be compared to an industrial drying process through energy savings and refined with new results.

Keywords: Membrane; Ordering Parts; Energy Savings; Heat Pump; Dehumidification

Mentor(s):

David Warsinger (Engineering); Jinwoo Oh (Engineering); Junyan Ren (Engineering); Makena Thompson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1311**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Developing a Dual Enzyme Spectrophotometric Assay to Quantify Hydrogen Sulfide Production by Recombinant Tryptophanase

Life Sciences

Author(s):

Kali Sayovitz† (HHS)

Abstract:

Colorectal cancer (CRC) is a leading cause of death in the United States. A carcinogenic agent, hydrogen sulfide (H2S) is a product of the bacteria Odoribacter splanchicus, whose genus was found in high quantities in patients with CRC compared to controls1. Hydrogen sulfide is produced from the amino acid cysteine through the enzyme Tryptophanase A (TnaA) in O. splanchnicus. Cysteine is common in the Western diet due to high consumption of animal products and food additives. Previous studies of the production of H2S from recombinant TnaA enzyme from O. splanchnicus used a colorimetric bismuth chloride assay, a less accurate method. In this assay, the enzyme TnaA is combined with the enzyme lactate dehydrogenase. Tryptophanase A utilizes cysteine to produce one molecule of pyruvate and H2S. Lactate dehydrogenase uses pyruvate to oxidize one molecule of NAHD to NAD+. The rate of cysteine metabolism is determined by the change in absorbance by accumulated NAD+ as read by a nanodrop spectrophotometer. Determining the rate of production is relevant to determine intestinal exposure to H2S by bacteria that metabolize dietary cysteine via TnaA.

Keywords: Colorectal Cancer; Hydrogen Sulfide; Sulfur Metabolism; Microbiome

Mentor(s):

Patricia Wolf (HHS); Apekshya Chhetri (HHS); Jellie Snyder (HHS); Mirandia Szramowski (Purdue University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1312**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Understanding the Dynamics Between the SCN2A Mutation L1342P and Axon Initial Segment Morphogenesis in Developing Neurons

Life Sciences

Author(s):

Vinayak Shankar† (Pharmacy, JMHC)

Abstract:

The SCN2A gene encodes for sodium channel Nav1.2, a voltage-gated sodium channel critical in generating neuronal action potentials. Mutations in this gene are linked to autism spectrum disorder and epilepsy1. The Nav1.2-L1342P mutation is found in some patients with intractable seizures, epileptic encephalopathy, and cortical brain atrophy2. The axon initial segment (AIS) is a structure presenting after the axon hillock and formed shortly after axon specification3. Critical in generating and shaping the action potential before propagation along the axon, the AIS plays a crucial role in neuronal excitability4. Sodium channels are aggregated in high density along the AIS, making this structure relevant for our research5. Studies have indicated that AIS length6, distance to soma7, and sodium channel distribution can impact altered neuron excitability, making these valuable measures in understanding the Nav1.2-L1342P mutation. Our lab previously established a human-induced pluripotent stem cell-derived cortical neuron monolayer model of the L1342P mutation, which displayed increased hyperexcitability2. Our current objective is to determine if the Nav1.2-L1342P mutation impacts the AIS morphology and sodium channel distribution in the in vitro neuronal models. We measured AIS metrics through immunostaining, imaging using confocal microscopy, and image analysis. We found that neurons with the L1342P mutation had altered AIS length and distance from soma. Our findings aim to shed light on the effects of the Nav1.2-L1342P mutation on AIS geometry and potentially elucidate a mechanism between the AIS morphology and hyperexcitability.

Keywords: SNC2A; Axon Initial Segment; L1342P; Sodium Channel; Morphology

Mentor(s):

Yang Yang (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1313**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Pre-Service Teachers' Perceived Relevance of Scenarios Reflecting Motivational Challenges during Field-Based Experiences

Social Sciences/Humanities/Education

Author(s):

Anshi Shastry† (Education)

Abstract:

It is common for pre-service teachers (PST) to face various motivational challenges throughout their field placements, courses, and overall degree program (Cho, in progress; Cho & Rogat, 2023). Cho (in progress) took a multidimensional approach to examining challenges that PSTs experience in the field, drawing on the expectancy x value perspective (Eccles & Wigfield, 2020). Building on the in-progress research, this study explores PSTs' motivational challenges relevant to their field experiences by using the five newly developed scenarios, informed by a previous pilot interview study (Cho & Rogat, 2023), that highlight expectancy and value challenges. The research objective is to investigate 1) the different patterns in PSTs' perceived relevance of scenarios in the teaching context and 2) what specific experiences informed these relevance perceptions. Participants were nine elementary education majors who had three or more semesters of field placements. We will 1) calculate the means and modes for participants' ratings of the scenarios based on their perceived relevance to the field and 2) qualitatively analyze for key themes and experiences which exemplify each challenge scenario. The study is intended to promote PSTs' preparation for the field through, not only increased awareness of potential motivational challenges, but also relevant skill-building practices.

Cho, H. (in progress). Pre-service teachers' motivational challenges and use of value regulation strategies in authentic field experiences [Doctoral dissertation in progress]. Purdue University.

Cho, H., & Rogat, T. K. (October 2023). Preservice teachers' regulation of values in a teacher education program. The Scholarly Consortium for Innovative Psychology in Education (SCIPIE) Biennial Conference, Portland State University, OR.

Eccles, J. S. & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. Contemporary Educational Psychology, 61, 101859. https://doi.org/10.1016/j.cedpsych.2020.101859

Keywords:

Mentor(s):

Toni Rogat (Education); Hyeree Cho (Education)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1314**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Effects of Prescribed Fire on Timber Quality in Central Hardwood Forest Region

Life Sciences

Author(s):

Jonathan Shimizu† (Agriculture)

Abstract:

Forest managers in the Central Hardwood Forest Region use prescribed fire as a tool to promote healthy and diverse forests, but are concerned that fire use may damage standing timber and reduce stand value. This study observes the change in grade of select hardwood species over time following repeated prescribed burns. This study observed hardwood species, primarily oak (Quercus spp.), on two burns sites in the Hardwood Ecosystem Experiment (HEE) of central Indiana, located in Morgan-Monroe State Forest. Fifty-three individuals were graded using the United States Forest Service (USFS) tree grading scale and measured prior to a prescribed burn in 2015, 2016, 2019, and 2023. Generally, high quality trees experienced minimal damage and a minimal decrease in tree grade. Lower quality individuals and species which are known to be more susceptible to fire damage (e.g., red oak; Q. rubra), experienced more damage and decreased in USFS grade. Notably, high-quality white oaks (Q. alba), the most valuable species on these sites, generally showed no change in grade and experienced minimal fire damage. Prescribed fire as a management tool appears to not threaten the economic potential of Indiana’s valuable hardwood species.

Keywords: Fire Ecology; Quercus; USFS Tree Grade; Timber; Natural Resources

Mentor(s):

Mike Saunders (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1315**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Intro to SoCET

Physical Sciences


Author(s):

Yashashwini Singh† (Engineering); Leo Malachowski† (Engineering); Tushar Singh† (Engineering); Alex Tauriainen† (Engineering, JMHC); Michael Lee† (Engineering); Arjun Siderys† (Engineering, JMHC); Duc Pham† (Engineering); Eduard Tanase† (Engineering, JMHC); Khanh Nguyen† (Engineering); Justin Sanchez† (Engineering); Venya Bhardwaj‡ (Engineering); Geetika Chitturi‡ (Engineering)



Abstract:

A SoC (System on Chip) is an integrated circuit combining components of a technological system like computers. This project's purpose is to educate new members of Purdue's System on Chip Extension Technologies (SoCET) research team through exposure to industry-adjacent practices and topics covered by its sub-teams. These topics include digital design, physical design, overall design flow, and system design. At the end of this semester, members of the Intro to SoCET team will be equipped with the skills to join a specific sub-team of their choosing. The research consists of: analyzing logical circuit designs, implementing and enhancing their uses through applications such as Verilator, Cadence Virtuoso, and GTKWave, and understanding how these skills can be utilized in other instances. By translating the theoretical implications of these designs and implementing them in experimental scenarios, a deeper understanding of chip design is gained and utilized in broader applications. Students learned to develop and analyze designs of transistors and transistor-based components, such as inverters and amplifiers. Students also designed, programmed, and tested digital designs of adders, counters, and state machines. This project provides students a foundational understanding of the system-on-a-chip design process, as well as introductory skills required to contribute to a larger system-on-a-chip design project in a specific sub-team in future semesters.



Keywords: System-On-A-Chip Design; Digital Design; Analog Design; Physical Design


Mentor(s):

Mark Johnson (Engineering); Jude Pinto (Engineering); Cole Nelson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1316**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Examining the Relationship Between Academic Burnout and College Students

Social Sciences/Humanities/Education

Author(s):

Lyndsey Sipe† (DSB)

Abstract:

In this exploratory research project I examine the relationship between burnout and college students. It is a concerning issue affecting students around the nation. Burnout is an issue that greatly affects college students, but it lacks the recognition which makes people feel like they are alone. This project highlights the main causes of burnout as well as ways to prevent it. The main objective of my research is to see if there is a correlation between burnout and the major and/or year a student is in. I also want to spread information about the resources here at Purdue that students can take advantage of for their mental health. I created a questionnaire to receive responses from my fellow peers and people here at Purdue. I sent it out to my fellow Purduettes as well as posted it to a Purdue social media page. I expect juniors and seniors to be the most burnout, and I also think rigorous majors will also be more burnt out than easier ones. Being a freshman, I expect the majority of people answering my questionnaire to be freshmen. This topic is important because students need the reassurance that they are not alone in this struggle. Bringing this topic to the surface starts the conversation on how to combat this issue.

Keywords: Burnout; Academic Motivation; Interventions; Academic Pressure; Anxiety

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1317**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# The role of the histone variant protein H2A.Z in H3K27me3 homeostasis in Arabidopsis thaliana

Life Sciences


Author(s):

Shelby Sliger† (Agriculture, JMHC)



Abstract:

[Abstract Redacted]



Keywords: Chromatin; Arabidopsis; Gene Expression; Epigenetics; Biochemistry



Mentor(s):

Joe Ogas (Agriculture); Jiaxin Long (Agriculture)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1318**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Visual sampling patterns in a naturalistic setting for toddlers with autism

Social Sciences/Humanities/Education

Author(s):

Katherine Stockhausen† (Science, JMHC)

Abstract:

A notable body of research in clinical- and screen-based settings document different gaze patterns for autistic children (Guillon et al., 2014; Papagiannopoulou et al., 2014). However, recent research in naturalistic settings (Yurkovic et al., 2021; Perkovich et al., 2022), calls this pattern into question. The present study builds on this research and aims to evaluate toddler gaze patterns with head-mounted cameras in their home environment. In this study, the gaze patterns of autistic (ASD) and typically developing (TD) children were coded in five-minute pieces for the frequency of looks to their parent's face and body, as well as the total duration of these looks. Linear regression models with family income and number of people in the video as covariates revealed that there was no significant difference between groups with respect to all four of the measures - frequency look to face, $F(1, 18) = 3.37$, $p = 0.09$, body, $F(1, 18) = 2.34$, $p = 0.15$, duration look to face, $F(1, 18) = 3.33$, $p = 0.09$, or body, $F(1, 18) = 3.277$, $p = 0.09$. The lack of robust differences between the ASD and TD groups is consistent with the findings of previous studies in naturalistic settings (Yurkovic et al., 2021; Perkovich et al., 2022). Our findings can help inform future research efforts and social intervention measures in the home by creating a more robust understanding of the visual attention patterns of children while they are engaging with their world.

Keywords: Egocentric Vision; Autism Spectrum Disorder; Visual Experience; Naturalistic Environment

Mentor(s):

A.J. Schwichtenberg (HHS); Carolyn McCormick (HHS); Claire Rosenberger (HHS); Mehreen Hassan (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1319**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Early Prediction of Cardiac Arrest: Machine Learning Vs. Mews

Life Sciences

Author(s):

Kirsten Strout† (HHS); Jason Cachur* (HHS); Joshua Harp* (HHS); Chris Parrett* (HHS); Reagan Fahey* (Science, JMHC); Olivia Phillips* (HHS, JMHC); Ashley Lund* (HHS); Kellyn Bucceri* (HHS); Hannah Negash* (HHS); Anabelle Nelson* (HHS)

Abstract:

Abstract

Introduction:

Cardiac arrests occurring in emergency departments (ED) represent 10-20% of all in-hospital cardiac arrests (IHCA). Healthcare staff battle overcrowded ED and alarm fatigue while attending to patient needs. The current cardiac arrest detection system, MEWS, has limited effectiveness causing high levels of false positives that can contribute to alarm fatigue. Machine learning (ML) works as a more accurate and efficient predictive model of cardiac arrest. Incorporating machine learning to detect cardiac arrest in EDs can give healthcare providers more time to take preventative measures.

Purpose:

This research aims to create a machine learning model for early prediction of precardiac arrest patients to prevention rates of cardiac arrests.

Methods:

This is a retrospective secondary analysis of the Medical Information Mart for Intensive Care (MIMIC) IV-ED dataset. This dataset comprises ED patient encounters from Beth Israel Deaconess Medical Center from 2011 to 2019. The primary outcome is the prediction of in-hospital cardiac arrest (IHCA). Feature variables, including age, sex, and changes in vital signs, will be incorporated into a Multi-Layer Perceptron (MLP) binary classifier. The model's performance will be measured by the area under the receiver operating characteristics curve (AUROC) and the area under the precision-recall curve (AUPRC). The results of each will then be compared to a logistic regression.

Impact:

Our work aims to improve the accuracy of early cardiac detection in Emergency Departments to lower the overall morbidity and mortality of these patients.

Keywords: Machine Learning; Cardiac Arrest; Artificial Neural Network; Mews; Healthcare

Mentor(s):

Laura Moffat (HHS)

**Poster Presentation Abstract Number: 1320**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Activity-based Behavioral Cooking Proficiency Estimation with Graph Neural Networks and Transformer

Mathematical/Computation Sciences

Author(s):

Dayoon Suh† (Science)

Abstract:

Activity-based Behavioral Cooking Proficiency Estimation with Graph Neural Networks and Transformer

Abstract: Estimating cooking proficiency has the potential to enhance a person's cooking experience by providing tailored feedback, recommending recipes and techniques aligned with individual skills, and even managing the cooking process. While research has extensively explored the estimation of skill proficiency in various single tasks such as suturing and knotting in surgeries, and welding, the estimation of cooking proficiency remains largely unexplored. Unlike single tasks, cooking requires a series of various actions over time. Each task within a recipe demands different skills and levels, introducing dynamics into the cooking process. This complexity makes estimating cooking proficiency more challenging compared to assessing single tasks, as it requires a comprehensive evaluation of a range of skills and their execution throughout the cooking activity.

To address this issue, we propose a new framework for objective skill assessment in egocentric videos capturing individuals engaged in cooking tasks. Our approach leverages action-based video structures and hand motions to predict one’s cooking proficiency. Recognizing that one’s cooking proficiency cannot be determined by a single action alone, we segment the video based on actions to form meaningful scenes. We then evaluate the proficiency level of each action individually and aggregate these evaluations to derive an overall assessment of cooking skills. To effectively capture the spatial-temporal relations inherent in cooking actions, we combine graph-based neural networks with hand skeleton data. The model then evaluates the performance of the individual cooking with different levels of expertise, following the EgoExo4D dataset proficiency score annotations.

Keywords: Skill Proficiency; Graph Transformer; Computer Vision; Video Understanding; Behavior Analysis

Mentor(s):

Byung-Cheol Min (Polytechnic); Go-Eum Cha (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1321**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## AdaptPoint: Adaptive 3D Object Detection System for Embedded GPUs

Mathematical/Computation Sciences

Author(s):

Christopher Tan† (Engineering)

Abstract:

Current state-of-the-art object detection models like Centerpoint and DSVT must make consistent trade-offs between detection accuracy and latency. We identified that for a fixed group of models, as we vary input data, each one of these models performs on occasion better than all others in the group despite perhaps having lower overall accuracy. With varying latency requirements due to environmental changes, for example, performing detection more often at higher vehicle speeds, we wish to both maximize accuracy and meet these requirements. As such, we propose a content-aware controller architecture that consistently selects the best model for the given input while meeting latency requirements. We performed per-frame and per-video analyses to determine how each model responds to different inputs and trained a neural network to determine the best compliant model. We find that this architecture consistently increases overall accuracy and outperforms even the best individual model for every given latency bracket. Based on our findings, we present this architecture as a way to leverage the advantages of different models; in future research, we intend to continue studying model scheduling for computer vision.

Keywords: Computer Vision; Machine Learning

Mentor(s):

Somali Chaterji (Engineering); Saurabh Bagchi (Engineering); Yin Li (University of Wisconsin); Pengcheng Wang (Engineering); Fangzhou Mu (University of Wisconsin)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1322**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Investigation of Ribosomal Activity in Novel Bacteriophage, Miss Americana

Life Sciences


Author(s):

Lauren Thompson† (Agriculture, JMHC); Bradley Shannon† (Engineering); Ryan Houser† (Agriculture, Engineering); Priyanshu Datta Roy† (Agriculture, Engineering)



Abstract:

Bacteriophages, viruses that predominantly infect bacteria, are currently a promising area of research as an alternative to antibiotics. The current setback with bacteriophages is the difficulty in finding an appropriate phage to infect a specific host bacteria. A better understanding of these bacteriophages and a larger database is crucial to the advancement of this area of treatment. Miss Americana, a recently discovered bacteriophage, contains a gene originally noted as a hypothetical protein. Using databases such as NCBI and phagesDB for comparative genome analysis, it was determined that there was no definitive information to determine the function of gene located from base pair 5872-6096 when compared to other bacteriophages. HHpred is a bioinformatics software that compares protein sequence and structure from various databases. However, HHpred provided an overwhelming number of hits with ribosomal activity. Using this software, this region had consistent similarities with ribosomal structures as displayed by its probability scores, indicating MissAmericana participates in a diverse pool of genome transfer with bacterium likely resulting in this gene containing similarities with ribosomal functions. Further investigation showed overlap with the large 50S ribosomal proteins found in human gut bacteria, Enterococcus faecalis, as well as Thermophilic Bacteria, Thermus thermophilus. These similarities were investigated using a myriad of resources including Alphafold and Pymol to model the structure of comparative sequences, in addition to further work with NCBI to create a Phylogenetic tree. This indicates there is a significant amount of diversity and a plethora of possible applications for these ribosomes moving forward.



Keywords: Bacteriophage; Ribosomal Activity; Biotechnology


Mentor(s):

Harry Ashbaugh (Engineering); Kari Clase (Engineering); AJ Gin (Engineering); Daphne Fauber (Engineering); Adam Quinn (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1323**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Temperature-Controlled Transition Boiling at the Stagnation Zone during Submerged Jet Impingement of a Dielectric Fluid

Physical Sciences

Author(s):

Austin Throckmorton† (Engineering)

Abstract:

[Abstract Redacted]

Keywords: Jet Impingement; Two-Phase; Shoulder Effect; Stagnation Zone; Next-Gen Power Modules

Mentor(s):

Justin Weibel (Engineering); Alexander Ceperley (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1324**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Autopilot Integration for Lightweight Unmanned Fixed Wing Aircraft in PURT Testing Facility

Innovative Technology/Entrepreneurship/Design


Author(s):

Enzo Tiptur† (Polytechnic); Elliot Wong* (Engineering); Christian Davus* (Engineering); Jack Slater* (Science); Nicholas Gano* (Engineering); Andrew Song* (Engineering)



Abstract:

This research focuses on the development and testing of autopilot systems for lightweight unmanned fixed-wing aircraft within a controlled environment, utilizing the Purdue University PURT facility. The study aims to create a simple fixed-wing aircraft using predominantly off-the-shelf components, replicating the characteristics of the Windracers fixed-wing aircraft, for comprehensive testing under various conditions.

The design of the aircraft allows for the simultaneous operation of multiple units, facilitated by an active LED marker board that distinguishes and identifies individual aircraft. This feature enhances the scalability and efficiency of experimentation within the PURT testing facility.

PURT serves as a motion capture facility, leveraging an array of cameras to simulate sensors on the aircraft and gather comprehensive data during flight operations. This innovative approach enables researchers to evaluate and refine the performance of autopilot systems under a range of simulated conditions, providing valuable insights into navigation, control algorithms, and overall system robustness.

The integration of autopilot technology in lightweight unmanned fixed-wing aircraft holds significant potential for various applications, including surveillance, monitoring, and data collection in challenging environments. The results of this research contribute to the advancement of autonomous aerial systems, offering a platform for further developments in the field of unmanned aerial vehicles.



Keywords: UAS; Computer Vision; Fixed-Wing; Windracers; Motion Capture



Mentor(s):

James Goppert (Engineering); Worawis Sribunma (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1325**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Developing a Social Justice-focused Pedagogy Intervention through Poetry for Secondary School Instructors.

Social Sciences/Humanities/Education

Author(s):

Adeline Waltz† (HHS, Liberal Arts); Xinmeng Zhou† (Education, HHS)

Abstract:

There is widespread agreement in the field of English Education that teaching poetry is one of the hardest subjects to tackle in the classroom. Yet, teachers are expected to perform their duties and teach poetry without having sufficient training on how it is best to do so. Consequently, in high school classrooms, many teachers view poetry as a roadblock in their own curriculum. Of note, there is a dearth of empirical inquiry on poetry-focused instructional programs designed for teachers who want to improve their instructional skills. To address this need, we propose to develop an intervention which tackles one subject domain of poetry instruction: social justice through poetry in high school classrooms. Our intervention is grounded on the view that poetry is a powerful tool for inclusivity and is designed to provide windows into seeing and embracing differences. The development of our intervention draws on Vygotsky's sociocultural theory, incorporates evidence from past interventions, and allows space for participant feedback to shape future versions. We identified past interventions in the literature through an extensive search using the following keywords: "poetry teacher interventions", "how to teach poetry", "teaching poetry writing", and "social justice for teachers". Our goals for this intervention include enhancing pedagogical skills, creating inclusive learning environments, and providing physical materials and insights into resources for subsequent curriculum integration. The outcome of this intervention should strengthen English/Language Arts instructors' competencies in the subject field of social justice through poetry.

Keywords: Poetry Intervention; Teacher Intervention; Social Justice Through Poetry; Teaching Poetry; Teacher Workshops

Mentor(s):

Youli Mantzicopoulos (Education)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1326**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Connectivity, Relative Pitch, and Transposition in Carolina Chickadees (Poecile Carolinensis) of Central Indiana

Life Sciences

Author(s):

Bruce Ward† (Temporary)

Abstract:

Due to changes in habitat connectivity where many birds reside, the birds' songs have been shown to change across different regions, creating dialects. This is significant for songbirds because many males rely heavily on their song as a key part of their lives.

We want to study the use of song transposition in male Carolina Chickadees and the role that transposition may play in the defense of their territories. We are working at ten different locations, five of which have previously demonstrated males that do transpose their songs and five which have not.

We want to investigate two hypotheses:

1) Transposition is used by males to express dominance and quality to other chickadees. We predict that at locations where transposition occurs, males will be hesitant to approach the playback of a transposing song; those who do will sing at a faster rate. This would show that males that do transpose view the songs of transposing males as they would local birds and are hesitant to respond to them. Males that do not transpose would likely react no differently to a transposing male than they would in response to a male that did not transpose.

2) Chickadees may match frequencies as a means of showing aggression, regardless of transposition. We predict that males that take longer to approach the playback or do not approach at all will not match frequencies, whereas males that do approach the playback will challenge the playback's song by matching frequencies with it to show their aggression.

Keywords: Partial Connectivity; Avian Communication; Relative Pitch; Transposition; Chickadees

Mentor(s):

Jeff Lucas (Science); Jonathan Jenkins (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1327**

*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## The Integration and Implementation of Artificial Intelligence in Education

Innovative Technology/Entrepreneurship/Design

Author(s):

Ryan Weiss† (Engineering)

Abstract:

The implementation and integration of artificial intelligence (AI) into the classroom makes way for a new revolutionary change to how the education system works and functions. This article explores the vast benefits of the integration and implementation of AI. in the classroom for both students, yet also teachers. This research will dive thoroughly in depth into topics at the forefront of this integration such as customized learning plans. This writing will also touch on the benefit that AI not only brings to the learner, but also the teacher. Through in depth research and analysis, this paper will demonstrate the benefits of what AI brings to the classroom in the present, yet also the implications that it has to completely change education in the future. I will analyze studies done on classrooms that have implemented AI, and reveal how this integration caused and is causing a net beneficial impact on the students' understanding of material in the classroom. The findings of my research not only point to an increased understanding of class material with AI in the classroom, but an overall urge to learn more about the topics from the students, due to their clear and concise understanding of the topics. This article will also go into depth about the safety implications with integrating AI into the classroom, and show how certain safety measures are being put in place to ensure that AI only does good for the students, and does not have a negative impact.

Keywords: Artificial Intelligence; Education; Learning; Technology; Educational System

Mentor(s):

Sidney Ducleroir (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1328**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

# Beyond the Dorms: Probing Purdue's Housing Crisis through Student Insights and Institutional Strategies

Social Sciences/Humanities/Education

Author(s):

Carter Wilson† (Exploratory Studies)

Abstract:

Universities across the country are grappling with a housing supply and demand mismatch, driven by a significant rise in college enrollment rates. This influx of enrollment has put a strain on college housing resources, prompting a critical need for strategic solutions. This issue is also affecting Purdue University as recent data shows that student housing vacancy rates are at or near zero (Christopherson, 2023). Moreover, students have increasingly become more vocal about their dissatisfaction with housing on campus. The purpose of this exploratory research project is to investigate students' thoughts, feelings, and attitudes toward the housing crisis at Purdue. Additionally, this project aims to better understand what measures Purdue is taking to address the housing crisis on its campus. In addition to extensive secondary research on college housing, I share insights collected from interviews with both Purdue students and Purdue leadership. This research project aims to fill knowledge gaps about student perspectives and the university's response, raise awareness around the severity of the housing crisis at Purdue University, and shed light on the impacts the crisis has on students.

Christopherson, M. (2023, Feb 08). City Council calls for action on Purdue housing. Journal & Courier https://www.proquest.com/newspapers/city-council-calls-action-on-purdue-housing/docview/2774052419/se-2

Keywords: Exploratory Research; College Housing; Enrollment Rates; Purdue Initiatives; Student Response

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1329**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## A Longitudinal Analysis of Developmental Changes in Twitch Patterning during REM Sleep

Life Sciences

Author(s):

Claire Wolfer-Jenkins† (Science, JMHC)

Abstract:

Movement enables us to carry out functions essential to life such as locomotion and fine motor tasks. In infancy, movements are less coordinated as our sensorimotor system is still developing. Sensorimotor development allows infants to gradually learn how to effectively move their body within their surrounding environment; this entails a cyclic process involving neural activity, motor output, and sensory feedback. During REM sleep, this cyclic process occurs with the motor output being a twitch, a self-generated and spontaneous movement. These twitches are key, observable components of sensorimotor development, and because they drive neural activity, they can help us understand the development of sensorimotor circuitry. Despite this, there have been no longitudinal studies on the production and patterning of twitches across infancy. Thus, using infant rats, my project quantifies how twitches during REM sleep are patterned across several developmental stages (from postnatal day 5 to postnatal day 25). To accomplish this, infant rat sleep is recorded using high-speed video, its limbs are tracked using a machine learning software (DeepLabCut), and twitches during sleep are analyzed for a number of suspected patterns. This research will aid in subsequent sensorimotor development research measuring the developmental effects of neural manipulations in rat pups. By better understanding of the relationship between sleep and typical sensorimotor development, we will be able to better characterize the complex roles sleep quality and sensorimotor deficits play in the development of Neurodevelopmental Disorders such as Autism Spectrum Disorder.

Keywords: Developmental and Behavioral Neurobiology; Sensorimotor System; Rem Sleep

Mentor(s):

Jimmy Dooley (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1330**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Examination of Turbulence Models for Free Jet

Physical Sciences

Author(s):

Madeleine Yee† (Engineering, JMHC)

Abstract:

This work is part of a larger project that examines a free jet of liquid iron. Specifically, this project provides a qualitative analysis of turbulence models commonly used within computational fluid dynamics. Turbulence is described as chaotic flow that may contain instabilities with changes in pressure and flow velocity. The instabilities provide a significant challenge to modeling turbulent behavior computationally. Several methods have been developed, all of which are based on the governing Navier-Stokes equations for fluid mechanics. The k-epsilon model involves solving two transport partial differential equations to provide a general description of turbulence. The k-omega model uses the Reynolds-averaged Navier-Stokes equations and two partial differential equations for turbulence kinetic energy and the rate of dissipation. The Scale-Adaptive Simulation model involves solving unsteady Reynolds-Average Navier-Stokes equations, and focuses on the turbulence scale equation. These models were qualitatively evaluated based on the scenario of liquid water leaving an elevated reservoir. Each model was run with a constant mesh size and boundary condition parameters to reduce variability from other factors. Each turbulence model was applied to multiple meshes to achieve mesh independence. Once all cases have been completed, a qualitative and quantitative comparison will be completed to determine the best turbulence model to be applied to the liquid iron jet.

Keywords: Computational Fluid Dynamics; Turbulence; K-Omega; K-Epsilon; Scale-Adaptive Simulation

Mentor(s):

Samuel Nielson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1331**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Quantification of Sodium Flux in the Hyperexcitable Nav1.2-L1342P Mutation via Single-Channel Voltage Gated Patch-Clamp Electrophysiology in HEK293 cells.

Life Sciences

Author(s):

Benjamin Zirkle† (Science)

Abstract:

The voltage gated sodium ion channel Nav1.2-L1342P mutation is a documented hyperexcitable mutation of the SCN2A gene, which has been detected in patients with early onset epileptic encephalopathy (EE). The mutation has been noted to increase the density of current flowing through the channel when stimulated (Que Z&, Olivero-Acosta M&, et. Al, 2021). Previous data suggest that the mutation showed profound and complex changes in channel gating (Begemann, et. al., 2019). However, it is unknown how the change in sodium channel structure and its gating properties affects the number of ions entering the cell. Voltage-clamp electrophysiology has proven to be effective in the identification of gain of function mutations in voltage gated sodium ion channels (Nogueira, 2019). Most commonly, this identification occurs through the analysis of current density released during electrical stimulations and through analyzing current released into the cell as a function of voltage. There has been a noticeable absence in research aiming to quantify the number of ions which disperse through a single channel in a set period. Further specification of the channel's dysregulated physiology through sodium flux characterization may lead to increased understanding of severe EE phenotypes being caused by increasing dysregulation of charge that is unable to be properly discharged in the cell. For this reason, a cell line with low levels of endogenously expressed ion and leak channels was chosen in HEK293 cells. This study proposes a novel patch clamp analysis technique to quantify this parameter through modifying linear current equations in single-channel voltage-clamp electrophysiology.

Keywords: Channelopathies; Electrophysiology; Encephalopathies; Biophysics; Targeted Medicine

Mentor(s):

Yang Yang (Pharmacy); Maria Olivero-Acosta (Pharmacy); Kyle Wettschurack (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1332**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Investigating Undergraduate Students' Interpretation of Error Bars

Life Sciences

Author(s):

David Zis† (Agriculture); Anna McCoy† (Pharmacy)

Abstract:

This study aims to evaluate undergraduate students' understanding of data variability in biology. We are interested in understanding how students interpret error bars, how the number of semesters at the collegiate level affects student's interpretation of error bars, and how student understanding of variability explains their interpretation of error bars. An online assessment to study student graphing practices also contains questions about variability within and between treatments for different graph types. Around 1000 students have completed the assessment as an assignment. Quantitative and qualitative responses along with demographic and institution type were collected from each participant. We used an open-ended response: “What type of information do the error bars provide about the data represented” to develop a code book using a subset of responses from several courses and by coding across courses. Preliminary results have shown that students understanding of error bars can be grouped into four categories: all-encompassing terms, form of error, defining by example, and trend analysis. All-encompassing terms and forms of error show less understanding of the error bars, while defining by example and trend analysis show greater understanding of the error bars. Coded responses will be analyzed using statistical methods. We expect students who have attended more collegiate semesters to exhibit more comprehension of error bars. We also expect students with an increased comprehension of variability to have a better understanding of error bars. Through this study, we anticipate a better understanding of how students interpret variability so that teaching quantitative reasoning skills can be improved.

Keywords: Error Bars; Variability; Graphing; Qualitative Analysis

Mentor(s):

Lauren Stoczynski (Science); Stephanie Gardner (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1333**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Chemical synthesis of building blocks to access γ-Butyrolactones from Streptomyces species

Life Sciences

Author(s):

Caroline Zu† (Science)

Abstract:

[Abstract Redacted]

Keywords: Natural Product; Biosynthetic Gene Cluster; Streptomyces Coelicolor Butanolide; Gamma-Butyrolactone; Beta-Keto Thioesters

Mentor(s):

Betsy Parkinson (Science); Haylie Hennigan (Science); Lauren Wilbanks (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1334**
*Presentation Time: April 9 in Session 2: 10:30am-11:30am*

## Using Calculus to Solve Quadratics Faster

Mathematical/Computation Sciences

Author(s):

Aarav Zutshi† (Science, JMHC)

Abstract:

Quadratics and the quadratic equation is an extremely overdone part of mathematics; every relationship or connection in the area has already been previously discovered and is now well known by mathematicians and non-mathematicians alike—or so is the convention. Although it's also known that the zero of a perfect square trinomial quadratic equation can be found by using the derivative of the function, somehow no one has thought to actually quantify that relationship before or relate the derivatives to the factors of those functions. This project fills that hole through discovering a theorem that quantifies and explains the relationship between the factors of these "perfect" quadratic equations and their derivatives.

Keywords: Quadratics; Calculus

Mentor(s):

Kaitlyn Hood (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1400**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Statistic Analysis Dashboard**

Mathematical/Computation Sciences

Author(s):

Saleh Alaayed† (Science)

Abstract:

This project is focused on creating an advanced system designed for the real-time monitoring of user activities and the analysis of errors within a software development setting. Its main goals are to monitor user interactions, including actions like creating and deleting files,

utilizing functions, and the errors encountered throughout the development process. Our methodology for addressing errors involves capturing the state of files before and after the correction of errors in the form of a design log, alongside performing an analysis to pinpoint and record the changes that rectified these errors. A database architecture will underpin this system, gathering user data through team-developed applications and using polling scripts to continuously refresh the repository with files that have encountered errors. By analyzing this information, the project aims to uncover common errors and their solutions, prioritizing significant issues over minor errors. The ultimate objective is to boost developer efficiency by

shedding light on the underlying causes of errors and speeding up their resolution with a comprehensive database of solutions and best practices.

Keywords: Real-Time Monitoring; Polling Scripts; User Activity Analysis; File State Capture; Error Pinpointing

Mentor(s):

Junfei Li (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1401**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Proposed Native Bee Conservation Initiatives on Purdue's West Lafayette Campus

Life Sciences


Author(s):

Natalie Anderson† (Engineering)



Abstract:

Native bees play a vital role in the pollination of cultivated and wild Midwestern plants and, in doing so, safeguard interconnected human and environmental interests while a majority of their species simultaneously face decline. This research paper explored potential implementations Purdue University can launch within various subdivisions of its West Lafayette campus to support native bee conservation. A foundational discussion of native bee benefits, principal threats, and local habitat and diet preferences was formed from ecological literature and published Midwestern-specific experimental results. General habitat adjustments and flora additions were proposed before Purdue’s campus was categorized into semiurban, agricultural, and natural environments for area-specific analysis. Native-bee-friendly initiatives designed around individual aspects of each area were categorically detailed and recommended with a particular focus on heavily trafficked residential and academic areas (semiurban), Purdue Student Farm managed by the Department of Horticulture and Landscape Architecture and various greenhouses maintained by the Department of Forestry and Natural Resources (agricultural), and undomesticated wooded areas, primarily Horticulture Park (natural). Current Purdue bee conservation projects headed by students, faculty, and the university at large are acknowledged and analyzed. This paper then draws inspiration from successful and native-bee-specific implementations at other universities, with an emphasis on Midwestern campuses. The broader implications of this research open the door to increased awareness, appreciation, and active involvement in the protection of native bees and other pollinators by students and faculty as well as the revamping of Purdue University West Lafayette to match the environmental conscientiousness of neighboring campuses.



Keywords: Native Bees; Environmental Conservation; Purdue Campus Development; Ecology; Pollinator Preservation



Mentor(s):

Sidney Ducleroir (Liberal Arts)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1402**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Harnessing Cytoscape: Visualizing Systemic Lupus Erythematosus Symptoms and Treatment

Innovative Technology/Entrepreneurship/Design

Author(s):

Kihunn Anderson† (Polytechnic)

Abstract:

Abstract:

Systemic Lupus Erythematosus (SLE), a rare autoimmune disease, presents a unique challenge in medical research due to its vague and diverse symptomatology. Often times, symptoms mimic symptoms of other diseases, complicating diagnosis and treatment. This research project seeks to address this challenge by harnessing the power of Cytoscape, a network analysis and visualization tool, to create an interactive web-based visualization of reported symptoms commonly manifested by SLE patients. This research's ultimate goal is to offer a user-friendly web-based tool that not only visualizes the complex interplay between SLE symptoms and treatment strategies but also fosters collaboration among researchers. By doing so, we aim to improve the management and treatment of SLE, contributing to a better quality of life for affected individuals.

Our approach involves identifying, categorizing reported symptoms, treatments, and related data from secondary data sources that include research journals and online sources. Retrieving comprehensive information about SLE symptoms is always an ongoing process. Information regarding lupus is acquired from secondary sources that includes research papers and medical journals which discuss the symptoms, treatments, and other factors.

A centralized dataset of symptoms with their treatment from medical and research journals related to SLE was created. As we move forward, the data visualization we create will serve as a vital resource and example of showcasing large amounts of data into a visualization for researchers and clinicians, allowing for a more holistic understanding of SLE.

The result of the project provides a simplified data visualization of relationships between symptoms and treatment extracted from medical and research journals. The purpose of this research project is to provide an easier way to extract and absorb information while providing a better understanding of Lupus and their interactions.

Keywords: SLE; Symptons; Treatment; Lupus; Cytoscape

Mentor(s):

Vetria Byrd (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1403**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**The Effects of pH on Lichen Thallus, Lichen-Associated Algae, and Lichen-Associated Fungi.**

Life Sciences

Author(s):

Kay Annunziata† (Agriculture)

Abstract:

Lichens are symbiotic organisms comprised of a thallus-forming fungus, an alga, and/or a cyanobacteria and have recently been found to harbor a diverse mycobiome. The following research aims to explore the influence of pH on the several lichen forming partners previously stated. We hypothesized that because lichens produce acidic compounds, that the lichen partners would exhibit increased tolerance under the acidic conditions as compared to alkaline conditions. Three distinct lichen species — Candeleria concolor, Physcia aipolia, and Usnea hirta — were selected for this study. Initially, Usnea hirta was sprayed with pH solutions ranging from 2 to 12 and showed that response from the lichen thallus preferred more acidic pH. Lichen associated fungi, specifically Caproni asp. isolated from Candeleria concolor and Fusicolla sp. from Physcia aipolia, were cultured on potato dextrose agar with varying pH levels from 5 to 11. The growth rates of these lichenicolous fungi were obtained by measuring the colony diameters over time after an initial three-day acclimation period. Again, results were similar to the thallus experiment in that the lichen associated fungi showed enhanced growth and tolerance to the acidic media as compared to the alkaline media. Ongoing investigations include the examination of the algal partner extracted from Usnea hirta. The importance of this study is to provide a greater understanding of the effects of pH on lichen and how acid rain can affect these understudied and novel fungi.

Keywords: Lichen; Fungi; Algae; pH

Mentor(s):

Daniel Raudabaugh (Agriculture); Cathie Aime (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1404**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Modeling Protein Secondary Structures of Bacteriophage Genes to Predict Function

Life Sciences

Author(s):

Abigail Antonishek† (Engineering, JMHC); Emma Jeffries† (Engineering); Madeline Stevenson† (Engineering); Molly Shean† (Engineering); Faith Wagner† (Engineering, JMHC); Emma Kessinger† (Engineering, JMHC)

Abstract:

Antibiotics have treated bacterial infections since the early 20th century but have become less effective over time due to excessive use. Bacteriophages are viruses that infect bacteria, resulting in bacterial lysis, which could be useful as an alternative treatment of bacterial infections. To develop bacteriophage therapy, a strong understanding of the bacteriophage's genome is required to assess the potential side effects in the human body. Currently, around 70% of bacteriophage genes are classified as hypothetical proteins with no known function. Correlations between protein structure and gene function were analyzed for MellowYellow gene 54. This short nucleotide sequence does not have a known function and is not conserved in other annotated genomes. Structural comparisons were used to predict the functionality and validity of this hypothetical protein. PyMOL software modeled the secondary structure of other potential proteins in MellowYellow's genome. MellowYellow gene 54 was then compared to genes of similar length from different phages in the same cluster, such as Beagle whose genome has high alignment to MellowYellow. Correctly identifying short nucleotide sequences as protein-encoding genes will provide evidence-based guidelines to predict the function of hypothetical proteins, thus facilitating future development of bacteriophage therapy.

Keywords: Bacteriophage Therapy; Hypothetical Proteins; Protein Structure; Genome

Mentor(s):

Adam Quinn (Agriculture); Harry Ashbaugh (Engineering); AJ Gin (Engineering); Daphne Fauber (Engineering); Kari Clase (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1405**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Platinum-Containing Compounds have Potential Roles as Cyanide Antidotes

Physical Sciences


Author(s):

Ari Arzumanian† (Pharmacy)



Abstract:

Cyanide, a deadly toxin that inhibits cellular oxygen use, poses a high risk in events like fires and terror attacks. Current IV-administered antidotes are impractical for mass casualties, necessitating the development of rapidly deployable alternatives. The efforts of our Purdue Team are developing novel cyanide countermeasures. Two of the promising compounds are bis-methionine (S, N)-platinum (II) dichloride (Met2Pt) and bis- (methionine-carboxamide (S, N))-platinum(II) dichloride ([Met(NH2)]2Pt). Both of which demonstrate rapid cyanide binding and effective mitigation of cyanide toxicity in animal models. During the development of these complexes, our group focused on optimizing safety and efficacy. Throughout the study, there was an emphasis on mitigating the potential nephrotoxicity associated with platinum-based compounds, like cisplatin. Our studies in Sprague Dawley rats indicated a lower risk of acute kidney injury (AKI) with carboxamide-containing complexes. Pharmacokinetic analysis helped understand the behavior of these complexes in biological systems. Our studies have revealed a similar pharmacokinetic profile in both compounds, characterized by rapid absorption and high plasma exposure when administered IM. These findings imply a quick systemic distribution profile, essential for counteracting cyanides' rapid effects. Equally important, these data support the rationale for further optimization of the Pt (II) complexes by modulation of the bidentate sulfide ligand structures.



Keywords: Cyanide; Antidote; Platinum Complexes; Nephrotoxicity; Pharmacokinetics



Mentor(s):

Jo Davisson (Pharmacy); Vallabh Suresh (Pharmacy)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1406**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## SigStore: Enhancing Software Supply Chain Security

Innovative Technology/Entrepreneurship/Design


Author(s):

Ishaan Bajpai† (Engineering); Adithi Praveenkumar† (Engineering); Parth Doshi† (Engineering); Jonathan Oppenheimer† (Science); Julia Dolpies‡ (Engineering); Ivan Ni* (Science); Vaibhav Turaga* (Engineering)



Abstract:

In the realm of software security, the assurance of code integrity and provenance remains paramount. Sigstore emerges as a pioneering open-source solution designed to streamline the process of signing and verifying software, thereby fortifying the trustworthiness of distributed code. Leveraging Sigstore Rekor, this research seeks to augment the security mechanisms by introducing a robust policy framework focused on meticulous logging and proactive alert management.

Our work aims to meticulously scrutinize patterns of software utilization by analyzing audit trails captured within Sigstore Rekor's comprehensive logs, thereby enabling precise backtracking of activities to their corresponding temporal markers. Central to our investigation is the formulation of stringent policies that mandate the recording of critical alerts and the automatic dissemination of notifications for escalated security incidents.

These policies will be engineered to trigger alerts upon the detection of anomalous behaviors, such as repetitive actions that deviate from established norms or a surge in identical operations, which could indicate potential security breaches. Additionally, we propose the implementation of preemptive measures, including the temporary suspension of implicated addresses, to curb suspicious or aberrant activities that could undermine the software supply chain.

The anticipated outcome of this research is a significant contribution to the reinforcement of software supply chain defenses. By hindering malicious actors' efforts to inject compromised elements into software delivery channels, the proposed policy framework aims to create a more resilient and impenetrable ecosystem, thereby preserving the sanctity of software deployments.



Keywords: Software Supply Chain; Cybersecurity; Integrity; Trustworthy



Mentor(s):

Santiago Torres-Arias (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1407**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Performance Optimization and Thermal Management Solutions for a Sustainable Microsized Hydrogen-Powered Turbo-Shaft Engine

Life Sciences


Author(s):

Nikolai Baranov† (Engineering)



Abstract:

Analyzing the aerospace and automotive industries, there is a transition to sustainable energy generation. Aiming to bridge industrial emissions with the worldwide net zero goal by 2050, one widely considered solution for long-range drones and small aircraft is compact turbo-shaft engines combusting clean hydrogen gas to produce shaft work. The small size and energy-dense fuel allow for a universal powerplant with high specific power output that fits a wide variety of existing solutions. One such micro-sized turboshaft internal combustion engine was created to test the potential power output, thermal management, and combustor optimization of the existing stainless steel assembly. The computational models predicted a potential power output of 72 kW from the turbine assembly, with the compressor dissipating 70.5 kW, indicating a usable 1.5 kW from the overall engine. During standard operation at a rotational speed of 98,000 RPM, the models predicted thermal failure of the rear combustor wall after reaching the operational time mark of 2 minutes, which was later physically verified. During data collection, several thermocouples and strain sensors indicated heat concentration and compression near the corners of the rectangular combustor. Additional ventilation was created, allowing cooler air to circulate the outgoing exhaust gases faster with a relative loss of combustor performance due to additional turbulence. Overall, the project has proven that micro gas turbines can be utilized for clean power generation on larger drones. Future developments may prompt the use of higher-grade materials and thermal insulation to help boost the thermodynamic performance of this promising potential solution.



Keywords: Micro Gas Turbine; Thermodynamics; Thermal Management; UAVs; Sustainability


Mentor(s):

Li Qiao (Engineering); Holman Lau (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1408**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Effect of ketamine-dexdomitor anesthesia on outer hair cells following small arms fire-like noise exposure

Life Sciences


Author(s):

Emily Bell† (Science); Andy Navarro‡ (Science)



Abstract:

Noise-induced hearing loss (NIHL) is commonly observed in various occupations, especially in the military. Studies have suggested the periphery is more susceptible to noise-induced damage, requiring injury to structures preceding the auditory nerve– the cochlea and outer hair cells (OHCs). Ketamine is an N-methyl-D-aspartate (NMDA) receptor agonist frequently used for anesthesia. This study aims to compare the effect of ketamine-dexdomitor cocktail concentrations (40 mg/mL and 60 mg/mL) on OHC functionality. Preliminary analysis of auditory evoked potentials (AEPs) show increased thresholds and decreased amplitudes compared to baseline, indicating reduced cochlear sensitivity. We hypothesize OHC damage will be more severe in the 60 mg/mL group than 40 mg/mL compared to sham, characterized by increased thresholds and signal-to-noise ratios (SNRs) in distortion product otoacoustic emissions (DPOAE) recordings. F-344 rodents were anesthetized with a ketamine-dexdomitor cocktail and exposed to 12 small arms fire-like (SAF) biphasic pulses over 2.5 min at 120 dB peak SPL. AEP recordings were used to measure neural population activity and sensitivity thresholds in response to click stimuli (20 - 80 dB), comparing amplitudes and thresholds across baseline (pre-exposure), and 7, 14, 28, and 56 days post-exposure. DPOAE recordings (4, 8, & 10 kHz) were used to measure OHC functionality across days. Further data analysis of DPOAEs will be used to compare the effects of ketamine anesthesia on OHC function post-SAF exposure. Recognizing that damage to OHCs can impact both cochlear function, and potentially ascending auditory structures, is crucial for improving diagnostic hearing tests and NIHL treatment.



Keywords: Noise-Induced Hearing Loss; Ketamine; Auditory Evoked Potentials; Distortion Product Otoacoustic Emissions


Mentor(s):

Edward Bartlett (Science); Meredith Ziliak (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1409**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Reverse, Reverse: An Investigation into the Purpose of Gene Orientation in Phages with Arthrobacter globiformis Host

Life Sciences

Author(s):

Isabella Belperio† (Science, JMHC); Irina Zhilinskaya† (Science); Laney Shafer† (Science); Alexander Higgins† (Science, JMHC)

Abstract:

Bacteriophages are viruses that infect and kill bacteria by inserting their viral DNA into a bacterial host forcing the hosts to replicate the bacteriophage until cell death occurs. Through the SEA-PHAGES program, bacteriophages isolated from Arthrobacter Globiformis hosts were sequenced and annotated to understand both the bacteriophage genome and their potential applications. Genome annotation of bacteriophage MellowYellow, an A. globiformis bacteriophage, revealed a notable transcription pattern in genomes of its subcluster AP2, with genes in the forward direction for the first half of the genome and in the reverse direction for the second half. The purpose of the shifts between the forward and reverse direction along the genome are not well-known, though it is believed to be related to gene regulation. As such, this investigation aims to characterize the composition of forward and reverse genes of other bacteriophages isolated from A. globiformis hosts within the AP2 cluster and similar clusters to understand the significance of this direction shift. Quantitative analysis was performed using information from PhagesDB, Phamerator, and a Python script. Analysis may reveal that clusters of genes within the same direction are under the control of the same operon and that a direction shift may occur to provide a regulatory distinction between groups of clustered genes controlled by separate operons. This finding may spark investigations into the nuances of the regulation of gene expression in bacteriophages to further current understandings of bacteriophage genomes for various applications in medicine and agriculture.

Keywords: Bacteriophage; Arthobacter globiformis; Gene Orientation; Genome Comparison

Mentor(s):

Adam Quinn (Agriculture); Daphne Fauber (Engineering); AJ Gin (Engineering); Harry Ashbaugh (Engineering); Kari Clase (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1410**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Acid Catalysis by Hydronium Ions in the Dissociation of Aqueous Zeolitic Acids

Physical Sciences

Author(s):

Arjun Bhadoria† (Engineering, JMHC)

Abstract:

Zeolites are porous frameworks formed from aluminosilicates and are the most widely used solid-acid catalysts in petrochemical and fine chemical production. Recently, studies have shown that zeolites have great potential in the biomass-conversion industry, but this field is still relatively new and unexplored. It is known that the Hydronium (H3O+) ions within the zeolite crystals provide catalyst sites for reactions through dissociations for specific organic sugars, such as cellulose. Equations can be derived that determine the dissociation rate for Hydronium (H3O+) ions and study the repulsive forces within the zeolite framework. Studying cellulose hydrolysis through zeolite catalysts provides a new methodology to deal with bulky reactants such as cellulose in an industrial capacity. Testing the Hydronium content through a review of differing zeolite effects on the pH level of a solution would determine the variations that may allow for the variance in zeolite frameworks and silicon-to-aluminum ratios that would be most beneficial in improving cellulose hydrolysis through zeolite catalyst. Furthermore, research into the density of pores will determine a dissociation factor of the zeolite catalyst into an aqueous substance. These methods are expected to find that a more aluminum-heavy ratio and a tetrahedron structure (specifically MFI structures) would result in the most efficient catalyst for cellulose hydrolysis.

Keywords: Zeolites; Catalysis; Reaction Kinetics; Cellulose Hydrolysis

Mentor(s):

Raj Gounder (Engineering); Enrique Iglesia (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1411**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## (Re)Considering Gender Inclusivity in Educational Research

Social Sciences/Humanities/Education

Author(s):

Aanant Bhagat† (HHS, Liberal Arts)

Abstract:

Although educational researchers have generally accepted that there are more than two genders, educational research continues to be overrepresented by binary gender representations. This study will identify the representative percentage of research that is gender inclusive and examine the themes that emerge from gender inclusive studies to better inform future research practices and improve gender inclusivity. To do so, a systemic literature search of articles; containing terms that were broadly related to gender was conducted in EBSCO – ERIC & Education Source. The search yielded 43,246 results. To maintain a 95% confidence interval and a 5% margin of error, sample size calculations determined that 381 studies would provide a representative sample. The articles are being screened to determine how many of them represent gender expansive identities. Thus, determining the percentage of research that is gender inclusive. The studies that were identified as gender inclusive were then examined for how they measured and represented gender and gender expansive identities. The examination of the quantitative studies will help to determine how researchers classified gender. This will lead to important conclusions about the most inclusive ways to survey participants about their gender such as which gender terms to use on surveys. In qualitative studies, we will examine how researchers recruited and represented a diverse group of genders, such as by allowing participants to self-identity. All in all, the findings can inform the future of educational research towards more inclusivity and accurate gender identities. Preliminary findings will be presented by the time of session.

Keywords: Educational Research; Gender Inclusivity; Systemic Review

Mentor(s):

Bryan Duarte (Education)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1412**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## UVM Verification for APB-AHB Bridge Design

Innovative Technology/Entrepreneurship/Design


Author(s):

Praneel Bhandari† (Engineering); Akhilesh Prasad† (Engineering)



Abstract:

Universal Verification Methodology(UVM) is a set of standards that are used in order to verify System-on-Chip(SoC) designs. The purpose of this project is to learn how to use UVM, and to implement UVM onto an SoC design. The SoC design in question is a peripheral that connects the signals between a AMBA AHB bus interface and a AMBA APB interface, also known as the APB-AHB bridge.



Keywords: SoCET; UVM; Verification; AHB-APB Bridge; Computer Engineering



Mentor(s):

Mark Johnson (Engineering); Jude Pinto (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1413**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Advancing Quantum Integrated Photonics: Harnessing Device and Circuit-Level Simulation Models for Microring-Based Photon Pair Sources

Mathematical/Computation Sciences

Author(s):

Adi Bhatnagar† (Engineering)

Abstract:

This research investigates the role of device and circuit-level simulation models in advancing microring-based photon pair souces for quantum integrated photonics. Microrings serve a pivotal role in generating entanglement between photon pairs for fully on-chip quantum photonics. Device-level models provide useful information on microring parameters such as quality factor, photon-pair generation rate, and transmission efficiency.  Circuit-level simulations offer insight into the behavior of these sources in complex integrated photonic circuits. The research here aims to address challenges in achieving reliable and efficient quantum light sources on integrated photonics platforms.

Keywords: Quantum Integrated Photonics; Microring; Quantum Light; Photon Pair

Mentor(s):

Lucas Cohen (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1414**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Investigating the Accuracy of Deep-Learning Models in Gene Identification: A Case Study of MellowYellow Gene 74

Life Sciences


Author(s):

Taylor Buchowski† (Science); Sarah Choi† (Agriculture, Engineering); Anabela Djurovic-Topalovic† (Liberal Arts, Pharmacy, JMHC); Aishwarya Menon† (Agriculture, Engineering); Amalia Rosenthal† (Agriculture, Engineering); Amelia Winkelman† (Agriculture, Engineering)



Abstract:

The objective of this study is to understand the role and uniqueness of Gene 74 in MellowYellow, a bacteriophage—a bacteria-attacking virus—isolated from Arthrobacter globiformis. Gene 74 in bacteriophage MellowYellow is a sequence of the genome that is not conserved in other bacteriophages in the AP2 subcluster—a highly-related group of bacteriophage genomes. The primary method for understanding Gene 74's singularity is to utilize programs such as Phamerator, HHPred, and AlphaFold to compare protein structures and functions of genes that have genetic similarities with Gene 74. Deep learning systems, including Deep TMHMM will also be used as a way to investigate potential transmembrane domains. Further investigation into how these programs function was done in order to explore possible errors in interpretation due to the programs' reliance on machine learning and probability. AlphaFold predicts the structure of Gene 74 as a simple helix-shaped protein, as observed in other transmembrane proteins and genes in the same subcluster. However, Gene 74 lacks additional subunits seen on other proteins, proposing either its unique function or inaccuracy in the system. Deep TMHMM predicts transmembrane proteins with 98% accuracy, but there is uncertainty when only one membrane domain is detected, as is the case with Gene 74. Investigating the mechanisms of these programs and assessing their ability to accurately predict the membrane domains and protein structure of Gene 74 of MellowYellow will allow a better understanding of Gene 74's function and further analyze its usage in phage therapy.



Keywords: Deep Learning Model; Bacteriophages; Gene Identification; Transmembrane Proteins; Arthrobacter globiformis



Mentor(s):

Adam Quinn (Agriculture); Harry Ashbaugh (Engineering); AJ Gin (Engineering); Daphne Fauber (Engineering); Kari Clase (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1415**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Analysis of Cicada appearance through a pre-built TensorFlow model BirdNet and a custom audio classifier

Life Sciences


Author(s):

Zhixin Cai† (Science, JMHC); Saloni Parkar* (Science, JMHC); Isabella Duzman* (Science)



Abstract:

Acoustic insect recognition is a challenge in agricultural and farming practices analyses. Current deep learning and Tensor Flow models accurately identify bird species and new development into insect identification are under way.  In this study, we look at how BirdNet responds to specific insect classifications, specifically the periodical cicada. In order to accomplish this task, we developed two strategies of documenting cicada presence: the use of open source BirdNet and a custom audio classifier development. BirdNet is an open source deep learning program that ingests wave files and converts it to specific type of spectrogram and then compares this image to a training set of data. In initial training, we found that 0% of periodical cicadas were identified with the existing training data. To test, we used manually labeled set of periodical cicadas and generated a custom classifier. In initial results, we had a greater than 80% precision rate at accurate match. In future work, we aim to develop custom classifiers directly from audio files using a Tensor Flow model. This outcome can support agrilcutural management practices seeking to increase biodiversity.



Keywords:


Mentor(s):

Kristen Bellisario (JMHC); Christine Elliott (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1416**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## SoC Verification: Verifying Behavior of On-Chip Modules

Mathematical/Computation Sciences


Author(s):

Siddarth Calidas† (Engineering); Jerry Chen† (Engineering); Yilin Xu† (Engineering)



Abstract:

System-on-Chip Extension Technology (SoCET) is a project-based research team within the School of Electrical and Computer Engineering (ECE) offering students an experience in system-on-chip(SoC) design, mirroring industry standards and practices. An important stage of the SoC design workflow is verification, where register transfer level (RTL) design implementations of different components of the SoC are rigorously tested. Verification is an important aspect of chip design to ensure that the final design functions as intended and minimizes silicon waste. SoCET utilizes a SystemVerilog framework known as Universal Verification Methodology (UVM) to create modular and reusable testbenches. A simulation of the RTL code, known as the Device Under Test (DUT), is fed several simulated sequences of test data, and its output is monitored by a scoreboard which checks it against the expected result. By repeating this process with sets of data that attempt to cover all aspects of the chip design, verification engineers can ensure that the design functions as intended. Our team is currently working on the verification of the synchronizer and shift register design, which are used to transmit data between a peripheral device and our chip. The synchronizer aligns all data incoming from peripheral devices with the clock speed of the system-on-chip. The shift register stores incoming data in a register and releases it when needed. Our work in conjunction with the rest of the SoCET verification team will ensure that no faulty parts make it to tapeout.



Keywords: System-On-Chip; Universal Verification Methodology; SystemVerilog; ASIC Design; VLSI



Mentor(s):

Mark Johnson (Engineering); Jude Pinto (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1417**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Water Stagnation in Buildings: Biofilm Growth and Best Management Practices for Periodically Empty Buildings

Life Sciences


Author(s):

Daniel Ceglio† (Engineering, JMHC); Catie Fleming‡ (Engineering)



Abstract:

When water is left stagnant in a building, biofilm inside the pipes will quickly grow. This can lead to serious human health consequences, as species such as Legionella pneumophila can be present. Knowing how fast this biofilm grows and best management practices can ensure that buildings that are left periodically empty, such as Airbnb's, can keep their occupants safe. Using a mock plumbing rig constructed of shower hose, CPVC, and ice maker line, and flow cytometry, stagnant water in each material was sampled over eight days to determine total and intact cell counts in each material over the time period. Then, each material was flushed with tap water, with water samples collected every 30 seconds to determine the concentration of cells during that washout period. It was found that biofilm grows most rapidly during the first 24 hours of stagnation and reaches its peak concentration after four days; with results being consistent across all materials. Shower hose cell count concentrations were roughly 10 times higher than the other two materials, demonstrating the need to flush shower hoses regularly. For all materials, cell concentration was greatly reduced after only 30 seconds of flushing, with steady-state cell concentrations being reached after only one minute of flushing. The results show that running flushing showers and faucets for only one minute once a day is an adequate best management practice to reduce the accumulation of biofilm in plumbing materials.



Keywords: Premise Plumbing; Water Quality; Biofilm; Flow Cytometry


Mentor(s):

Caitlin Proctor (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1418**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Machine Learning on Lane Detection

Innovative Technology/Entrepreneurship/Design

Author(s):

Evan Chen† (Engineering); Andrew Huang† (Engineering); Aditya Mittal† (Science)

Abstract:

Lane detection is a critical aspect of road safety and finds extensive applications in real-world scenarios, aiding drivers in maintaining proper lane adherence. Moreover, it is a fundamental requirement for autonomous motorsports, guiding high-speed vehicles along racetracks. This study focuses on implementing lane detection on a lane less racetrack for autonomous racing. We have previously used Yolo v8's segmentation model to produce promising results. We are expanding beyond it by using our own customized model specifically aimed at our application. We are incorporating datasets from Black & Gold Racing. Our model aims to assist the team with their autonomous vehicle.

We commenced by preprocessing racing footage data, where the track lacks traditional white-separating lines. The footage is passed in as frames. Each frame is manually labeled to denote the lane positions. The labeled dataset is then partitioned into training and testing batches, serving as the input for our lane detection model. The model consists of a tokenizer, CNNs, regressor, and some post processing. Lastly, the model is evaluated using unseen images.

The results demonstrate promises, showcasing the model's ability to accurately detect lanes while maintaining a high processing speed. Our result will be compared with other reinforcement learning algorithms for accuracy. This comparison will help identify potential areas for improvement and fine-tuning in lane detection algorithms for lane less racetracks.

Keywords: Machine Learning; Autonomous Driving; Racing

Mentor(s):

Shreya Ghosh (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1419**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Investigating the Effects of Ferumoxytol and Radiation on Reactive Oxygen Species Production

Life Sciences

Author(s):

Camryn Clapper† (HHS, JMHC); Valeria Rodríguez‡ (Science)

Abstract:

Reactive oxygen species cause damage to cancer cells and induce apoptosis within them. Inducing apoptotic cell death in cancer cells could be a good therapeutic strategy for treating cancer. We hypothesized that ferumoxytol, an iron nanoparticle, increases reactive oxygen species (ROS) when combined with radiation according to the Fenton reaction.  Aminophenyl fluorescein (APF) is a reactive oxygen species indicator used to identify ROS production. APF reacts with hydroxyl radicals, plus hypochlorite and peroxynitrite anions to become fluorescent. We hypothesize that with increasing amounts of ferumoxytol, more ROS will be produced, and therefore, more fluorescence intensity. GL-261 cells (murine glioma cell line) were cultured with ferumoxytol for 24 hours. The cultures were washed and the APF agent was added. The 96 well plate was then exposed to differing amounts of radiation (0, 2, and 8 Gy). Then, a plate reader was used to measure the fluorescence. Here we report that there is an increase in fluorescence intensity with an increase in ferumoxytol concentration and an increase in radiation dose. This indicates an increase in ROS in the cells, which likely leads to apoptosis and an increase in hydroxyl radicals in tumors. Iron nanoparticles could possibly be used as a potential treatment in cancer patients to help reduce tumor size.

Keywords: Ferumoxytol; Reactive Oxygen Species; Radiation; Glioblastoma; Apoptosis

Mentor(s):

Matthew Scarpelli (HHS); Jessica Veenstra (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1420**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## How Can Science of Reading Be Culturally Responsive?

Social Sciences/Humanities/Education

Author(s):

Braiden Doane† (Education); Rachel Durham† (Education)

Abstract:

Data demonstrate that only 33% of Indiana students read at a proficient level. In 2022, the average reading score in Indiana was lower than the national score (NCES, 2022). The reasons are the growing diversity of Indiana classrooms and the lack of experience and knowledge among teachers of how to address diversity, among others. The purpose of this interdisciplinary research project was to investigate how components of the science of reading can be used in a culturally diverse classroom. We used culturally responsive teaching and structured literacy framework (SLF) as theoretical and conceptual frameworks. Culturally responsive teaching includes instructional strategies that are applicable for curricular materials in multicultural classrooms (Gay, 2002). The key principle of structured literacy is "explicit, systematic, and sequential teaching of literacy at multiple levels" (Spear-Swerling, 2019). Its components are phonological awareness, phonics, fluency, vocabulary, and comprehension. We also incorporated art forms in this project. Art fosters respect for different cultures, promotes equity, and allows differentiation. Given the recent mandate of Indiana Department of Education to incorporate the Science of Reading in literacy instruction (HEA 1558), our group developed activities that use elements of culturally responsive teaching in instruction that enhance cultural responsiveness. Our study included literature review, discussion, activities, and reflection. The results will help teachers in Indiana build inclusive and equitable classrooms that are aligned with the principles of the science of reading. We created activities based on literacy programs Bookworms and Reading Rock that adhere to the science of reading.

Keywords: Culturally Responsive Teaching; Science of Reading; Structured Literacy; Morphology; Comprehension

Mentor(s):

Inna Abramova (Education)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1421**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Creating specialised data sets for particle detection in microfluidic images**

Innovative Technology/Entrepreneurship/Design

Author(s):

Abhigyan Doshi† (Engineering)

Abstract:

As the popularity of deep learning techniques increases, many scientific fields such as microfluids have been adapting these techniques. However, currently, there is a lack of tools to create large-scale labeled experimental data sets to train such models in a supervised fashion for these specialized domains. This work, developed alongside Professor Steve Werley, PhD students Sardana Pranshul and Varun Aggarwal, aims to develop a tool that can improve the accuracy and speed of the video annotation process for particle detection from microfluidic images. These particles are defocused in nature that makes their localization/tracking a complicated and time-intensive task. This work utilizes an object detection model trained on synthetic data to pre-annotate the particles in a video, then undergo supervised learning to annotate missed particles and incorrectly labelled particles through human annotation, in order to fine-tune the pre-annotation script. In the later stages of this work, the annotations of the particles will be used to extract information about the annotation quality. Our workflow will be used to create datasets for training and testing machine learning algorithms that can track particles in a video to a high degree of accuracy which can have applications in understanding fluid dynamics, to be used in fields of material science, chemical engineering, etc.

Keywords: Particles; Tracking; Annotate; Machine Learning; Experimental Data

Mentor(s):

Steve Wereley (Engineering); Pranshul Sardana (Engineering); Varun Aggarwal (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1422**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Electrodeposition in Through-Silicon Vias Using an Impinging Jet Electrode

Physical Sciences


Author(s):

Aaron Du† (Engineering)



Abstract:

With a continuously increasing demand for computing power, the semiconductor industry is searching for ways to create systems with enhanced capacity and functionality. Therefore, advanced packaging techniques are being developed for high-density computing components to aid the integration of functions into the same package and reduce interconnect length. One of these techniques, three-dimensional (3D) packaging, involves stacking IC chips vertically and connecting them using interconnects such as through-silicon vias (TSVs), connections that go through silicon substrates between chips, or microbumps, tiny bumps on the surface of a chip that contact the surface of another. However, the fabrication of these microscale interconnections is challenging. The standard process for interconnection fabrication includes sputter deposition of a seed layer and electroplating with conducting materials such as copper. But to achieve uniform electrodeposition, factors such as deposition rate control, concentration uniformity, and reach into the chip's cavities must be considered. The current electrodeposition method is to suspend the substrate as the cathode and a metal anode in a solution with additives for maintaining consistency. Ions stripped from the anode migrate towards the cathode, depositing a thin, consistent layer. Nonetheless, this approach presents a challenge when increasing TSV aspect ratio, as difficulties in ions' diffusion to the bottom may cause non-uniformity, leading to defects, voids, and eventual electrical and reliability issues. We propose to employ pressurized jets of solution to impinge on the substrate, achieving deeper-reaching electrodeposition and improving deposition in deep cavities. This presentation compares these two methods, shedding light on a new possibility.



Keywords: IC Chips; Electrodeposition; Advanced Packaging; Three-Dimensional Packaging



Mentor(s):

Tiwei Wei (Engineering); Keyu Wang (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1423**

*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# The Effect of Counterion Identity on PEDOT-Coated PTFE for Use as Gas Diffusion Electrodes for Electrochemical CO2 Conversion

Physical Sciences


Author(s):

Alexandra Earle† (Engineering)



Abstract:

[Abstract Redacted]



Keywords: CO2 Electroreduction; Gas Diffusion Electrode; Conductive Polymer; Counterion; Electropolymerization



Mentor(s):

Brian Tackett (Engineering); Hwiyoon Noh (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1424**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Integrating Lifestyle Medicine Education, Self-Empowerment, and Behavioral Assessment for Effective Systolic Blood Pressure Management

Life Sciences

Author(s):

Mallory Eller† (HHS)

Abstract:

Lifestyle modifications are the first line treatment addressing several chronic diseases, their prevention, and management including cardiovascular disease and hypertension. According to the CDC, cardiovascular disease (CVD), accounts for 80% of preventable premature deaths worldwide, and underscores the importance of addressing modifiable risk factors like poor diet, physical inactivity, and smoking. Notably, hypertension emerges as a key modifiable risk factor, highlighting the pivotal role of Lifestyle Medicine, which advocates for interventions targeting six pillars: dietary patterns, physical activity, sleep, stress management, substance avoidance, and social connections, in preventing and treating CVD. This study aims to evaluate the impact of an educational intervention on lifestyle modifications for individuals with hypertension. Systolic blood pressure (SBP) serves as the primary outcome measure, with hypertension defined as SBP greater than 130mmHg. Participants' pre-intervention SBP will be recorded at the time of the intervention, while post-intervention SBP will be self-recorded using upper arm electronic blood pressure monitors. Additionally, self-perceptions of health behaviors will be assessed using the Lifestyle Medicine Assessment (LMA), which evaluates behaviors across five domains correlating with Lifestyle Medicine's six pillars. Results are currently pending.

Keywords: Lifestyle Medicine; Cardiovascular Disease; Blood Pressure; Hypertension

Mentor(s):

Laura Moffat (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1425**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Oral Nicotine Pouches Induce Cellular Toxicity in Human Primary Oral Keratinocytes

Life Sciences

Author(s):

Jacob Eyster† (HHS, JMHC)

Abstract:

Among adolescents and young adults, oral nicotine pouches (ONPs) have become the second most prevalent nicotine product in the US, prompting concerns about potential adverse oral health effects as the pouch distributes its contents into the bloodstream via the oral mucosa. While ONPs are considered less harmful compared to traditional tobacco products, the associated risks related to toxicity remain unknown. We hypothesize that ONPs induce oral toxicity dependent on concentration and flavor, tested through an assessment of ONPs of five different flavors at nicotine concentrations of 3 or 6 mg. The ONPs were incubated in artificial human saliva or cell culture media for 1 hour and extracted components were characterized. Nicotine levels were quantified utilizing a targeted mass spectrometry approach, while other components were quantified relatively using a metabolite profiling approach; this confirmed nicotine concentrations and determined unique components based on flavors and extraction media. Human primary gingival keratinocytes (PGK), cells lining the oral mucosa, were exposed to extracts from flavored ONPs generated from incubation in cell culture media at 0% (controls), 50%, or 100% for 3 or 24 hours. Dose- and time-dependent alterations in cell death were observed via the MTT assay. Cellular uptake of nicotine was quantified at 3 hours post-exposure utilizing targeted mass spectrometry methods for nicotine and its primary metabolite cotinine. Expression of genes related to inflammation was measured 3 hours after exposure to 0% or 50% extracts; results revealed upregulation of hallmark inflammatory markers. Overall, our results demonstrate cellular toxicity associated with ONP exposure.

Keywords: Nicotine Pouch; Cytotoxicity; Cellular Stress; Nicotine Delivery; Inflammation

Mentor(s):

Jonathan Shannahan (HHS); Arjun Pitchai (HHS); Li Xia (HHS); Bruce Cooper (Centers & Institutes); Amber Jannasch (Centers & Institutes)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1426**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Wearable Voice Amplifying Accessibility Device for Parkinson's Patients Affected by Speech Impairment

Innovative Technology/Entrepreneurship/Design

Author(s):

Elizaveta Filippova† (Engineering); Seth Graber† (Engineering); Isabelle Baggio‡ (Engineering); Christopher Miotto‡ (Engineering); Brandon Mar‡ (Engineering)

Abstract:

Of the 500,000 Americans diagnosed with Parkinson's disease, approximately 90% experience speech impairment due to the deterioration of the facial muscles and larynx. This often results in speech at lower tones and with less articulation. There are multiple current speech therapy treatments such as the Lee Silverman Voice Treatment (LSVT) that have significantly improved the speech-language skills of individuals with Parkinson's. However, these therapy sessions are often more time-consuming and continuously expensive for patients to use long-term. Our speech amplifying device aims to be affordable, discrete, and universally accessible for any individual experiencing speech difficulties due to Parkinson's disease to use daily. We have developed a prototype of a daily-wear clip-on device consisting of a microphone on a flexible cord and a speaker in a 3D-printed housing holding a simple electrical circuit to amplify the voice. Design iterations have made the device more discrete to minimize the appearance of a user's disability. The sound output will be quantitatively tested over varying distances to evaluate the usability of the device in daily life. It is crucial to record and detect the volume of speech in different scenarios of both short and long distances between the speaker and the direct listeners. This speech amplification device will allow people with speech volume impairment due to Parkinson's to improve communication in common discussion settings.

Keywords: Parkinson's Disease; Speech Impairment; Accessibility Device

Mentor(s):

Aaron Lottes (Engineering); Andrew Sivaprakasam (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1427**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Characterizing Hemoglobin Expression in Chironomus dilutus Across Larval Development

Life Sciences


Author(s):

Claire Fisher† (Agriculture, JMHC); Sophia Horn‡ (Science); Hallie Jackson‡ (Science); Emma Engel* (Agriculture); Olivia Zaragoza* (Agriculture)



Abstract:

Per- and polyfluoroalkyl substances (PFAS) are ubiquitous environmental contaminants that pose hazards to humans and biota. The nonbiting midge, Chironomus dilutus, is among the most sensitive species on record with respect to PFAS toxicity. Given that PFAS toxicity is thought to be governed by protein binding and that the midge is composed of up to 90% hemoglobin (Hb), it follows that PFAS binding to hemoglobin may be the driver of toxicity in this species. However, C. dilutus development includes several larval instars (L1, L2, L3, and L4) as well as a pupal stage. The time course of natural hemoglobin expression throughout these instars has not been characterized. We are testing the hypothesis that hemoglobin expression increases throughout larval development, with a peak in the fourth instar. Working primers for C. dilutus hemoglobin isoforms and a reference gene (beta-actin) were validated and qPCR was used to assess hemoglobin expression across life stages. This study will provide critical basic physiological information that will enable the design of further effective experiments aimed at elucidating how PFAS-Hb interactions govern toxicity.



Keywords: Hemoglobin; Ecotoxicology; Invertebrates; Per- and Polyfluoroalkyl Substances (PFAs); Molecular Biology



Mentor(s):

Maria Sepúlveda (Agriculture); Tyler Hoskins (Agriculture); Nathan Mak (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1428**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Design and Evaluation of an IZUMO1-Based Contraceptive Vaccine for Wildlife

Life Sciences

Author(s):

Delilah Flora† (Science, JMHC); Gangmin Kim‡ (Pharmacy)

Abstract:

[Abstract Redacted]

Keywords: Vaccines; Immunocontraception; IZUMO1

Mentor(s):

Harm HogenEsch (Veterinary Medicine); Ahmed AbdelKhalek (Veterinary Medicine); Raluca Ostafe (Centers & Institutes)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1429**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Serum AGEs Correlation to Diabetes and Tendon Properties

Life Sciences


Author(s):

Matthew Fortino† (HHS, JMHC)



Abstract:

Diabetes is associated with an increased risk of tendon injury. In patients with diabetes and prediabetes, we have demonstrated that several serum and clinical variables, i.e., leptin, body mass index (BMI), age, and lipids, are associated with in vivo tendon biomechanics and morphology. Further, we have linked serum advanced glycation end-products (AGEs) to reduced tenocyte function and poor tendon healing. AGEs accumulate in the serum with the intake of AGE-rich foods (foods cooked at high temperatures, highly processed foods) or chronically elevated serum glucose levels (diabetes). We investigated the relationships between in vivo imaging-based tendon properties and serum AGEs across non-diabetic controls (n=8, Age: 31±3y, BMI: 23±1, HbA1c: 5.2±0.1%), pre-diabetes (n=4, Age: 38±11y, BMI: 29±3, HbA1c: 5.5±0.1), and type 2 diabetes (n=6, Age: 49±4y, BMI: 34±3, HbA1c: 6.6±0.3). Tendon modulus tended to be correlated with serum carboxymethylysine (CML) (p=0.09, r=-0.47) and age (p=0.003, r=-0.49). Tendon volume was correlated to all AGEs measured (p<0.05, r=0.43-0.75). Serum CML concentrations were associated with increasing age, BMI, insulin, and markers of inflammation (IL-6 and TNF-alpha). Tendon pathology is associated with an increase in tendon volume and reduced function. AGEs and other serum variables may serve as early predictors of tendon pathology, as AGEs can accumulate across the lifespan. We plan to expand these observations to a larger cohort and investigate the relationship of serum AGE in individuals with tendon pathology. With refinement, serum parameters could be used to enhance early diagnosis and predict post-injury recovery time.



Keywords: Advanced Glycation End-Products (AGEs); Diabetes; Patella Tendon; Biomechanics; Tendon Pathology


Mentor(s):

Chad Carroll (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1430**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## A Study on Children's Bedtime Story Books for their Effect on Children's Perception of Sleep

Social Sciences/Humanities/Education


Author(s):

Augustine Gallespen† (HHS, Liberal Arts, JMHC); Autumn Reynolds† (HHS, JMHC)



Abstract:

Intro: The way sleep and bedtime are portrayed in children's books can can influence the perception of sleep for both children and their guardians. Reading a book at bedtime can influence children and even parents to mirror the behaviors and attitudes depicted in the stories.

Methods: Our team selected picture books intended for young children and about sleep from local libraries. Each book was then evaluated by at least two team members for how sleep is portrayed, quantifying the pages of both positive and negative depictions, as well as character attitudes in the story. Disagreement in ratings was resolved by team consensus.

Results: Out of 50 books evaluated, we found that 54% of books had more positive than negative pages. 38% had more negative pages, and 8% were equally balanced. Also, 56% of books portrayed a character sleeping happily, 18% with a character not seeming happy, 18% without depiction, and 8% with a character sleeping with happy dreams.

Discussion: Our research quantified sleep depictions from children's books found at libraries. Prior research has found that sleep routines including bedtime reading are helpful for children's development. However, careful attention to how sleep is presented in the book may be important to ensure positive effects on parent and child behaviors and attitudes about sleep.



Keywords: Children; Bedtime; Reading; Books; Sleep



Mentor(s):

Michelle Garrison (HHS); Sumin Im (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1431**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## ZS project

Innovative Technology/Entrepreneurship/Design


Author(s):

Yunfei Gao† (Engineering); Carson Denoo† (Engineering); Chuan-Chen Ko† (Engineering)



Abstract:

As part of the SoCET VIP team, this sub-team proposes the recompiling of an off-chip memory cell with a newly developed standard size library. The purpose of this study is to design a standard cell library for AS800 process utilizing only open-source software in collaboration with AcuSemi. AS800 is AcuSemi's 800nm technology node developed for educational and demo purposes. The initial steps of this project, the development of schematics for basic CMOS logic gates (AND, OR, NOT, etc.) using XSCHEM, have already been completed. Further adjustments of PMOS and NMOS sizes and more simulations are needed to verify proper logic behavior. Next, layouts for each cell will be created in KLayout while performing DRC (design rule check) and LVS (layout vs schematic) checks. The standard cell library will be built through an open-source standard cell characterizer such as vsdip to generate liberty format files for use with OpenLane. OpenLane is an automated RTL to GDSII flow, which includes tools to perform synthesis, place & route, and verification. Overall, the developed Open Source PDK and standard cell library will be formally documented and made publicly available via GitHub, making it an asset for future projects, as well as any others interested in pursuing a similar integration. The team has developed a core library of logic gates in XSCHEM and is nearing completion of KLayout design as well. Future steps will involve preparing for integration into OpenLANE, which will enable automated synthesis of chip layouts with these pre-designed logic gates.



Keywords: Off-Chip Memory Cell; 800nm Technology Node; CMOS Logic Gates; Standard Cell Library; Open Source


Mentor(s):

Boyuan Chen (Engineering); Sergey Zakharov (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1432**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Investigation of VAT1 depletion in angiosarcoma

Life Sciences

Author(s):

Lauren Gartenhaus† (Science, JMHC)

Abstract:

Angiosarcoma (AS) is an aggressive vascular cancer in which the genetic drivers of the disease are largely unclear, and the prognosis of patients is very poor with only a 30 percent 5-year survival rate. Previously, our lab found that endothelial-specific Dicer1 knockout drives the development of AS in mice. Dicer1 is vital in microRNA (miRNA) biogenesis, therefore our finding indicates that miRNAs play a role in the development of AS. Previous work has identified microRNA-497-5p (miR-497) to have a tumor-suppressive role in AS and our lab confirmed that miR-497 suppresses cell viability more significantly than several other tested miRNAs. VAT1 has been validated by our lab as a direct target of miR-497 and is upregulated in AS tumors. VAT1 is also upregulated and promotes cell migration in glioblastoma. Given these previous findings, we aim to investigate the function of VAT1 in AS. To do this, we used three different methods to knockdown VAT1 in AS cell lines including siRNA, shRNA, and CRISPRi. We validated knockdown of VAT1 with each of these methods, and will determine the phenotypic consequence of this knockdown in AS cell lines. With knockdown of VAT1 we expect to see reduced cancer phenotypes including cell viability, migration, and colony formation. The completion of this work will further define the potential tumor-promoting functions of VAT1 in AS.

Keywords: Angiosarcoma; VAT1 Knockdown

Mentor(s):

Jason Hanna (Science); Annaleigh Powell-Benton (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1433**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Yes, No, Maybe So: A Deep Dive into Possible Dual-Functionality Within MissAmericana Bacteriophage 37402-39051bp Gene

Physical Sciences

Author(s):

Alexandra Gillman† (Agriculture); Lucy Ehmann† (HHS); Carolina Kim† (Pharmacy); Natalie Haynes† (Agriculture); Henrietta Ndubuokwu† (Science); Danae Youngstedt‡ (Engineering)

Abstract:

Bacteriophages, or phages, are viruses that infect bacteria to reproduce viral DNA. Phages can be used to combat bacterial infection. Recently, they have been used as phage cocktails to target and destroy specific antibiotic-resistant bacteria. MissAmericana is a podoviridae phage, a family of bacteriophages with a short tail and was isolated with an Arthrobacter globiformis B-2979 host. Literature says that dual functionality in a bacteriophage, specially sited in tail proteins, is possible by exhibiting structural and enzyme components. By using gene annotation programs such as DNA Master, Phamerator, DeepTMHMM, and HHpred, the functions of genes within sequenced genome can be determined, and it can be concluded if there is a likelihood of dual functionality in the gene. Using the comparative genomic sources on the MissAmericana genome, the gene at the region of 37402-39051bp was found to be a minor tail protein. The bacteriophage "Burro" contains many genes that are found in the same pham, or family of genetically similar genes, as MissAmericana. Gene product Burro_32 was found to correspond to MissAmericana 37402-39051bp and was identified as a hydrolase. However, all the other officially annotated phage genes in that pham have been called as a minor tail protein. The importance of understanding the function of this gene region in MissAmericana can give researchers a better understanding of the genome leading to greater knowledge of bacteriophage comparative genomics. The possibility of dual functionality for this gene is interesting as it shows a possibility of more variability within known gene functions.

Keywords: Bacteriophage; Genomics; Dual Functionality; Protein Function; Bioinformatics

Mentor(s):

Harry Ashbaugh (Engineering); Daphne Fauber (Engineering); Adam Quinn (Agriculture); AJ Gin (Engineering); Kari Clase (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1434**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Training and Evaluating LLMs for College Courses

Mathematical/Computation Sciences


Author(s):

Kush Gogia† (Engineering); Yash Mehta† (Science)



Abstract:

Large Language Models (LLMs) know a vast amount of information across broad fields of data, but the data is not domain-specific: LLMs do not know everything about a single category. The purpose of this study is to analyze the performance of LLMs when fine tuned over a small and specific dataset, which is information from the Data Structures and Algorithms course taught at Purdue University. The study will analyze the performance of three open-source LLMs over the same dataset: OpenAI's GPT-2 with 124M parameters, Google's Gemma with 2B parameters, and Gemma with 7B parameters.  The disparity in parameters across the three models will help patterns and trends — for example, the fitting of the data — between the number of parameters and the analysis of the data. The performance of the LLMs will be tested using popular LLM benchmarking techniques like Multitask Multilingual Language Understanding (MMLU) which tests question answering, and HellaSwag, which tests reasoning and inference.



Keywords: Large Language Models; College Course; Training; Evaluating



Mentor(s):

James Davis (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1435**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# A pilot study on the effect of home processing on inositol phosphates and phosphorus accessibility in almonds

Life Sciences


Author(s):

Claire Gourlay† (HHS)



Abstract:

[Abstract Redacted]



Keywords: Phosphorus; Inositol Phosphate; Chronic Kidney Disease (CKD); Mineral Accessibility; Phytate



Mentor(s):

Brandon Kistler (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1436**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Neocortical Mapping in Developing Long-Evans Rats

Life Sciences

Author(s):

Anna Grobengieser† (Science)

Abstract:

Because of their shared evolutionary history, as well as the presence of a 6-layered neocortex, developmental neurophysiological research commonly uses rats as a model to better understand human development. However, neurophysiological research requires knowledge of the location of different cortical areas in a developing rat's brain. Although atlases of developing rat brains already exist; they use coronal sections, which are not ideal for visualizing cortical structures. The goal of our study is to generate maps of the neocortex of infant Long-Evans rat models to serve as anatomical references for future neurophysiological experimentation. Here, we collected data on the location of primary cortical areas (including primary somatosensory, visual, and auditory cortex). These data were collected in developing rats at 4-day intervals, ranging from postnatal day (P) 8 to P24. To establish the location of these cortical areas, we euthanized rats at P8, P12, P16, P20, and P24, extracted their brains, and injected red fluorescent dye (DiI) into the cortex in a 1mm-by-1mm grid pattern relative to bregma. Samples are then flattened, stained for cytochrome oxidase, a marker of primary sensory areas, and photographed using a microscope. Multiple stained sections are then combined to generate complete maps of the locations of these cortical areas. By providing an atlas of neocortical areas across infancy, these maps will provide a valuable tool for future developmental neurophysiological research in Long-Evans rats.

Keywords: Developmental Neurophysiology; Neocortex; Cortical Mapping; Long-Evans Rats

Mentor(s):

Jimmy Dooley (Science); Alexandros Nanos (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1437**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Surface Curvature Use for the Mitigation of Thermal Grease Pump-Out

Physical Sciences

Author(s):

Nolan Gronowski† (Engineering)

Abstract:

The purpose of this study is to apply spherical surface curvatures with miniscule bow-heights to the top and bottom surfaces that surround a type of thermal interface material (TIM), thermal grease, to mitigate the degradation of this TIM over time. Thermal grease is commonly used inside electronic packages, such as CPUs and GPUs, as a TIM between the silicon die and the heat spreader, and this thermal grease will degrade over the course of 3 years, needing replacement or else suffer from lower processing capability. This study has DOWSIL-340 thermal grease applied to a heater block of aluminum 6061 that continuously cycles between 45°C and 110°C every 15 minutes for 6 days. As the aluminum block continually expands and contracts due to temperature cycling, this induces pump-out and degradation in the thermal grease that lowers its effectiveness in acting as a TIM between two surfaces. The top surface, which is composed glass lens that is either flat, concave with a radial curvature, or convex with a radial curvature, is used to both mitigate and increase the rates of pump-out in the DOW-340 TIM. Qualitative results gathered from videos have shown that a concave top surface, which represents the heat spreader in situ, will mitigate the degradation of the thermal grease while a convex top surface will promote an increase rate of degradation. This suggests that inducing a concave curvature on the top surface of a heat spreader can increase thermal grease lifespan within electronic packages.

Keywords: Thermal Interface Material; Mitigation; Pump-Out; Degradation; Electronic Package

Mentor(s):

Amy Marconnet (Engineering); Ritwik Kulkarni (Engineering); Pranay Nagrani (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1438**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Melting Opportunities

Social Sciences/Humanities/Education


Author(s):

Keira Hagen† (Agriculture)



Abstract:

This paper describes the intricate relationship between climate change and global warming and education in the Global South. It focuses on climate-related factors such as heat waves and droughts, and how climate change exacerbates barriers to education, particularly for vulnerable populations. It also highlights the need and potential for action to mend these challenges. I have examined a multitude of research studies that analyze and validate different aspects of my argument. In a variety of experiments done by Xiang Ren Tan and multiple other physiology researchers, they determined that cognitive ability, notably selective attention and executive function, was affected by heat. Ali Mohammad Abbasi and others studied the effects indoor air temperature had on cognitive function. They also discovered that working in hot temperatures had negative effects on brain processes in comparison to neutral temperatures. Homi Katrak performed a simulation to reflect the decisions of poor households during droughts in Punjab, India. The results displayed that as the income decreased, the priority of education decreased, prompting the children to be removed from school. These studies reveal the direct and indirect effects heat and drought have on children in the Global South. Miloslav Kolenatý and others inspected the role climate change education has on climate action. They found that knowledge on the subject influences youth’s willingness to act. Climate education promotes sustainable practices among individuals and fosters an attitude for action. Purdue has the opportunity to mitigate this imbalance by educating its students.



Keywords: Climate Change; Education Loss; Global Warming



Mentor(s):

Sidney Ducleroir (Liberal Arts)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1439**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## A Point-of-Care Rapid Diagnostic Test for Cervical Cancer Screening

Innovative Technology/Entrepreneurship/Design

Author(s):

Francesca Hamacher† (Engineering)

Abstract:

Cervical cancer is the fourth most common cancer in women globally and is most prevalent in low-middle income countries. This deadly cancer is mainly caused by the sexually transmitted human papillomavirus (HPV) but can be treated if detected early. An accessible rapid-diagnostic test, such as a lateral flow strip similar to a COVID-19 test, is imperative to early cervical cancer detection among communities underserved by traditional cervical cancer screening techniques. The goal of the project is to develop a rapid test that tests for four key protein biomarkers of cervical pre-cancer and cancer. Specifically, this presentation focuses on one of these proteins, topoisomerase II alpha (TOP2A). TOP2A is an enzyme involved in DNA replication affecting the structure of DNA through interaction with the double helix. In cervical cancer patients, TOP2A tends to be overexpressed. We have found that the mouse monoclonal anti-TOP2A successfully binds to the gold nanoparticles where the conjugation efficiency has been evaluated through both quality control dipstick assays and dynamic light scattering at different concentrations. When binding is present, this creates a red color on the quality control dipstick assay. By combining TOP2A detection with the three other biomarkers, we are creating a product that would lead to a more sensitive and specific screening test for early-stage cervical cancers, allowing for more timely diagnosis and ultimately, more effective treatment.

Keywords: Cervical Cancer; Rapid-Diagnostic Test; Protein Biomarker

Mentor(s):

Jacqueline Linnes (Engineering); Sayeh Dowlatshahi (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1440**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Preferences for Cognitive Effort Exertion in a Task/No-Task Paradigm

Social Sciences/Humanities/Education

Author(s):

Alexander Harman† (HHS, Science, JMHC); Roma Kamat* (HHS); Maria Armenta* (HHS)

Abstract:

The purpose of this study was to examine what motivates cognitive effort exertion when faced with the option of doing nothing. Past research suggests that people exert cognitive effort when there is a sufficient benefit to offset the effort cost. However, studies have also shown that doing nothing can be aversive, leading participants to choose alternative options over sitting and doing nothing. This study sought to further this investigation by using three different cognitive tasks offered at varying levels of difficulty. The main hypothesis was that, if cognitive effort is aversive, then higher levels of difficulties should lead to more no-task selections. If, however, doing nothing is aversive, then participants should still pick the task option regardless of the task or level of difficulty. Results provide supporting evidence that people are averse to the no-task option, suggesting that cognitive effort may be preferred if alternatives do not offer any engagement. This in turn provides insight into concepts such as boredom, in that a task that is not engaging may motivate someone to seek out any alternative stimulus. Instead of following a path of least resistance, participants chose to engage in a task when presented, and neither the level of difficulty, nor the type of task had significant effects on their preference for doing something over nothing.

Keywords: Cognitive Effort Exertion; Utility Preference

Mentor(s):

Sebastien Helie (HHS); Alyssa Randez (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1441**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**The role of practice: Does practicing reduce attentional benefits?**

Social Sciences/Humanities/Education

Author(s):

Jacob Henley† (HHS); Xinmeng Zhou† (HHS); Madhura Kawar† (Engineering)

Abstract:

Previous research is not consistent with whether practice reduces spatial attentional effects but suggests the importance of considering practice effects when studying attention. Furthermore, few studies have investigated the impact of practice on shape effects on spatial attention, with only one study suggesting no effect of practice. In this study, we aim to examine the influence of practice on spatial attention and shape effects. Our preliminary findings reveal speeding of response time (RT) across sessions, in alignment with previous literature on the topic. However, we did not observe any effects of practice on the magnitudes of either spatial facilitation or IOR. Additionally, we found few significant shape effects in either the first or second session, and practice did not seem to impact these shape effects. We found little evidence for practice effects in spatial attention perhaps due to the fact that our sessions were days apart, suggesting prior observed practice effects might be short-lived.  We did not see substantial shape effects and will discuss the implications of these findings.

Keywords: Spatial Attention; Practice; Shape Effects

Mentor(s):

Anne Sereno (HHS); Daniel Larranaga (HHS); Aditya Shanghavi (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1442**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# The Role of Protein Structure in Determining Gene Function for Bacteriophages, DoctorPepper and RootBeer

Life Sciences

Author(s):

Carl Henry† (Engineering); Katie Smith† (Engineering); Conwy Zheng† (Engineering); Alex Martin† (Engineering); Salem Hallab† (Engineering); Thanh Nguyen† (Science)

Abstract:

Bacteriophages, or phages, are viruses that infect bacteria by injecting their genetic information into the host as a mechanism of replication. During this infection process, phages and their host cells might share proteins with similar structures or functions to promote phage replication. This project intends to investigate similarities between proteins produced by the bacteriophages RootBeer and DoctorPepper and proteins produced by bacteria and other viruses. Structure and function were examined to determine the protein's role in bacterial infection and its function in other organisms. NCBI's BLAST feature identified a few genes that contain statistically significant similarity to proteins produced by higher-order organisms' genomes. To investigate these proteins, AlphaFold and PyMol were used to examine the structural features of the proteins to see how this relates to the function of the protein. To look at the protein's location, Deep TMHMM and Phobius were used. It is hypothesized that investigation of phages with similar proteins to bacteria and other viruses will help increase understanding of how viruses infect their hosts. More specifically, there may be proteins produced by a bacteriophage that have statistically significant similarity to viral proteins used in human infection. This topic is relevant to explore because studying bacteriophage proteins and gaining an understanding of how they infect their hosts can increase understanding of how viruses affect humans.

Keywords: Bacteriophage; Proteins; Bioinformatics; Virus; Bacteria

Mentor(s):

AJ Gin (Engineering); Daphne Fauber (Engineering); Harry Ashbaugh (Engineering); Adam Quinn (Agriculture); Kari Clase (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1443**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Use of a Survey-Based Application in Identifying Adverse Drug Reactions in the Community Setting

Social Sciences/Humanities/Education

Author(s):

Mia Herzog† (Pharmacy)

Abstract:

Every year, adverse drug reactions (ADRs), or unwanted reactions to drugs, contribute to $30 to 130 billion dollars in US healthcare expenses. ADRs lead to increased hospital admissions, issues with medication adherence, and decreased quality of life. Historically, ADR evaluation has relied on clinician-reported outcomes and a variety of scales and questionnaires with limited application. This research will present the results of patient-reported responses to a software application, ADDRESS (Adverse Drug Reaction/Event Screening System), developed to provide a standardized, reliable means of eliciting known ADRs in commonly used medications in the ambulatory setting. The ADDRESS survey is automated and customized by drug, permits screening of multiple drugs, and consolidates repeat questions about ADRs so they only appear once. The results of 2057 patient surveys completed on iPads with the ADDRESS software at 10 Indiana community pharmacies between 2010 and 2011 are discussed. We examine the frequency and severity of ADRs patients reported as experiencing, then calculate variables such as ADR impact (product of ADR severity and frequency), drug distress (sum of impacts for all ADRs experienced with a drug), and regimen burden (sum of impacts for drugs in a patient regimen). We also extract variables such as length of time for pharmacy staff to enter patients' drugs and for patients to complete the survey. We found evidence supporting the validity of this survey approach and some inferential evidence for the reliability of the survey results obtained, suggesting the ADDRESS survey as a means of quantifying ADRs in a practice-relevant manner.

Keywords: Adverse Drug Reactions; Survey; Community Pharmacy

Mentor(s):

Matt Murawski (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1444**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## How does mammal species diversity in a gradient of habitat features predict bobcat presence in the Central Till plains?

Life Sciences

Author(s):

Katie Hong† (Agriculture); Sierra Hunnicutt‡ (Science, JMHC); Hannah Reyes Charles‡ (Agriculture, JMHC); Zhixin Cai‡ (Science, JMHC); Ryan Feller‡ (Science, JMHC); Luca Iacobucci‡ (Agriculture); Anthony Tan‡ (Science)

Abstract:

Bobcats (Lynx rufus) are nocturnal and cryptic animals that are very rarely seen by humans. Previous research has not produced a standardized, straightforward method for estimating bobcat populations in a given area, relying on a combination of sightings, environmental DNA data, and tracks. This produces too sparse a sample size to accurately approximate from. This research utilizes camera traps and remote acoustic monitors to track a wide range of species, collecting data to predict bobcat presence in the Central Till Plains area in Indiana. By taking into account the correlation between mammal species presence and bobcat sightings, as well as the multiple habitat features that could affect bobcat populations, this method can more accurately predict bobcat presence in the area. The camera traps and remote acoustic monitors are placed in 16 sites along the Wabash River and Indian Creek, intentionally capturing a gradient of different habitat features (distance to water source, water source type, canopy density, vegetation coverage, etc.). Data is continuously collected from these cameras and monitors, and the collected data is used to create occupancy models for estimating bobcat presence in the area. By taking into account the correlation between mammal species presence and bobcat sightings, as well as the multiple habitat features that could affect bobcat populations, this method can more accurately predict bobcat presence in the area. These improved estimates can be used to better inform environment-affecting human actions and protections in the Central Till Plains.

Keywords: Bobcats; Population Estimations; Habitat Features; Central Till Plains; Camera Trapping

Mentor(s):

Kristen Bellisario (JMHC)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1445**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Optimization of Diphyllin Scaffhold as a V-ATPase inhibitor to discover lead candidates for Ebola Virus Treatment

Life Sciences

Author(s):

Oliver Hu† (Pharmacy); Liying Che* (Pharmacy)

Abstract:

Ebola Virus (EBOV) causes a highly lethal hemorrhagic fever with a fatality rate that can approach 90%. However, recent treatments, such as the development of an antibody therapy and vaccine come with logistical issues, with cold storage and hospitalization, which could risk infection spread. To mitigate these challenges, and improve access during EBOV outbreaks, we aim to pioneer the first oral treatment of EBOV infection. To achieve our aim, we will focus on targeting V-ATPase, a key protein in the acidification of the endosomes that engulf the virus, which is a key step in the infection process.

Diphyllin is a natural product that has shown high potential as a V-ATPase inhibitor, exhibiting an EC50 of 1µM in cellular assays. Moreover, it has a low toxicity profile against host cells. However, as an oral treatment, Diphyllin is not efficacious enough and falls short of the optimal oral drug properties.

Diphyllin consists of three primary components, the side chain, the 3-ring system, and the d-ring. Through computational assessments, we identified the 3-ring system as a necessary pharmacophore that necessitates little modification, and as such, we focused of efforts on modifying the d-ring. Through Structure-Activity Relationship analysis, we have discovered D33, a d-ring analog that exhibited a 15-fold increase in potency, as well as improved solubility and metabolic stability. Coupling D33 with our most potent side chains from earlier experiments, we have developed the most potent EBOV entry inhibitor, with single-digit nanomolar potency

Keywords: Diphyllin; Ebola Virus; Cross-Coupling; Chemical Synthesis; V-ATPase

Mentor(s):

Amr Elkabbany (Pharmacy); Jo Davisson (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1446**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Development of a Tilt-Rotor VTOL Aircraft for a Payload Drop Mission

Innovative Technology/Entrepreneurship/Design

Author(s):

Josh Hyatt† (Engineering); Atharv Bhatter† (Engineering); Aditya Chandra† (Engineering); Ethan Farkas† (Engineering); Evan Cahoon† (Engineering); Joseph Redle† (Engineering); Kabir Malik† (Engineering); Makeda Duey† (Engineering); Niall Moloney† (Engineering, JMHC); Yashwanth Muppidi† (Engineering)

Abstract:

Traditional aircraft have been optimized for point-to-point flight, but with the advancement of technology, aircraft have gained several different uses where this design is no longer optimal. One such mission is a payload drop, which can be used in search and rescue, delivery services, urban air mobility, and military package drops. There are many difficulties associated with payload drops, such as having to account for the initial horizontal velocity and the inherent reduced accuracy of needing to use calculations when dropping the payload. There are also risks involved with take-off and landing due to the nature of high-speed landing. To solve these issues, we decided to design a VTOL (vertical take-off and landing) system. Such a system, however, has its challenges. We designed tilt rotors to allow mid-flight transition and tested different configurations to maximize control and minimize dead weight. Furthermore, Ardupilot software was chosen to handle the transition autonomously, increasing the reliability of the process. Finally, the challenge of drag in both vertical and horizontal flight was addressed by designing an airframe that was aerodynamic for both forms of flight. Our intent in utilizing tilt-rotor technology is to showcase the flexibility in where an aircraft can take off and land and the ability to provide more accurate payload drops, all while matching the cruise efficiency of a fixed-wing setup. A successful demonstration of VTOL technology at a smaller scale will serve as proof of concept for its potential in large-scale integration.

Keywords: Vertical Take-Off; Drone; Unmanned Aerial Vehicle; Tilt-Rotor; Payload Drop

Mentor(s):

Charles D'Onofrio (Engineering); Curtis Marshall (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1447**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Research Infrastructures for Vision-Based Autonomous UAVs

Mathematical/Computation Sciences

Author(s):

Vinay Jagan† (Engineering); Colby Acton† (Engineering); Gaetano Iannotta‡ (Engineering); YiRuei Weng‡ (Engineering); Shreyas Khot‡ (Engineering); Aditi Anand‡ (Engineering); Nathan Huang‡ (Engineering); Annapoorna Prabhu‡ (Engineering); Ruth Sugiarto‡ (Engineering, JMHC); Vihaan Chinthakindi‡ (Engineering); Rahul Siddharth‡ (Science, JMHC); Wei-Cheng Lee‡ (Engineering); Yuren Chen‡ (Engineering); Saisravani Kuchibhotla‡ (Science); Pranav Konda‡ (Science); Jiefu Zhang‡ (Engineering); Michael Suo‡ (Engineering)

Abstract:

Advances in autonomous drone technology have facilitated human-machine collaboration in various fields including search and rescue, structural analysis, and disaster relief. Our team aims to explore and evaluate training approaches on a suite of tools designed to simulate vision-based autonomous drone systems in a real-world scenario. Our research is dedicated to enhancing a current computer vision technique: 3D point-cloud-based object detection. We conduct object tracking with an onboard depth camera to approximate the 3D bounding box of the target object. We propose a novel data collection pipeline that allows the immediate tagging of objects in 3D bounding boxes from our RGB+D camera. The hand-collected and annotated point-clouds from our experimental data collection pipeline is used to train an ensemble of state-of-the-art models such as FCAF3D, GroupFree 3D, and VoteNet. The models are then evaluated using standardized metrics such as mAP and IoU. We provide a meta-analysis on current 3D detection models and present a novel solution in autonomous drone technology.

Keywords: Drone; Computer Vision; Machine Learning; Artificial Intelligence; Point Cloud

Mentor(s):

Qiang Qiu (Engineering); Wei Zakharov (Libraries); Zichen Miao (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1448**

*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Pigment-Based Colored Radiative Cooling Paints for UV-Resistant Passive Cooling

Innovative Technology/Entrepreneurship/Design

Author(s):

Aakar Jain† (Engineering, JMHC)

Abstract:

In recent years, radiative cooling paints (RCPs) have been gaining traction as a potential solution to provide passive cooling, i.e., without the need to consume electricity. Although white RCPs are the most effective at cooling, it will be important to produce them in a variety of colors to make them better suited for a wider range of applications. Colored RCPs are often made with organic pigments and dyes, however, these are known to break down under UV irradiation which alters their original color and radiative cooling properties. Here, colored RCPs based on UV resistant inorganic pigments are investigated and compared to commercial paints with a similar color to determine their radiative cooling potential. First, inorganic colored pigments are experimentally measured to identify promising materials based on their absorption spectrum. Three pigments of different colors were selected and used to make RCPs. Accelerated UV weathering and outdoor testing show the potential of these paints as durable, UV-resistant, RCPs with reduced heating compared to commercial paint alternatives. These new colored RCPs can be used to achieve reduced solar heating in buildings, vehicles, and many other applications, while preserving similar durability as commercial alternatives.

Keywords: Colored Radiative Cooling Paints; Passive Cooling; UV-Resistant

Mentor(s):

Xiulin Ruan (Engineering); Daniel Carne (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1449**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Positives Amidst the Challenges: Perspectives from Adolescents in Families Experiencing Homelessness and Housing Instability**

Social Sciences/Humanities/Education

Author(s):

Mahee Jain† (Pharmacy)

Abstract:

Purpose: Adolescents in families experiencing homelessness/housing instability (FEH/HI) face a myriad of hardships related to their health and well-being. This study drew from a larger study that used photo-elicitation, a visual research technique with photography, to identify how adolescents within FEH/HI depict a sense of positivity and positive experiences in their lives. Specifically, this study explored the lived experiences of adolescents within these families offers a deeper understanding of how they cope with challenges and the role positive experiences play.

Methods: This study utilized interview data from an ongoing photo-elicitation research project. Participants aged 13-17 residing with a primary parent/caregiver over 18 and who either previously or were currently experiencing homelessness or housing instability were eligible. Participants received a camera for photos based on researcher-curated prompts and a notebook to document photographs taken. Youth also completed interviews that lasted 30-45 minutes. Interviews were transcribed utilizing Otter.ai, a transcription software, and then quality-checked by research assistants. Interview transcripts and notebooks were thematically analyzed. Photographs provided additional analytical support.

Results: Analysis revealed four themes that depicted youth positivity, including: (1) fostering a connection with nature for wellbeing, (2) upbeat experiences with family members and friends, (3) shared family decision-making and problem-solving, and (4) meaningful support through community-based initiatives.

Discussion: Findings indicate adolescents' ability within FEH/HI to experience positivity as well as their coping mechanisms amidst adversity and navigating challenges. Insights suggest a strengths-based approach to leverage existing interpersonal and community resources and individual capacity to promote adolescent wellbeing and thriving.

Keywords: Adolescents; Adolescent Wellbeing; Housing Instability; Family Experiences; Nature Connection Impact

Mentor(s):

Yumary Ruiz (HHS); Madeline Moser (HHS); Carlyn Kimiecik (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1450**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Lithium batteries for smart windows**

Innovative Technology/Entrepreneurship/Design

Author(s):

Lillian Ji† (Engineering)

Abstract:

Comprehending the complexities of composition is fundamental in determining the overall capability and rate of effectiveness in rechargeable batteries. The presence of varying lithium reactions leads to uneven electrochemical behavior and heightened physical deterioration within the battery unit. In this paper we employ operando optical microscopy as a means of investigating the spatial diversity in composition within a solid solution cathode for lithium-ion batteries. Extensive experimentation is carried out, allowing for measurements, the initial charging of the active particles. Through multiple charge and discharge cycles, we notice synchronous behavior among a particular group of particles, showcasing the relationship between lithium diffusion and interfacial reactions.

Keywords: Lithium Batteries

Mentor(s):

Kejie Zhao (Engineering); Nikhil Sharma (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1451**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Effect of Nano-silica Admixtures on Air Void Content of Concrete Used for Bridges

Innovative Technology/Entrepreneurship/Design

Author(s):

Ali Kalmagambetov† (Engineering)

Abstract:

Incorporating nanomaterials into concrete has shown to be effective in improving various mechanical and durability aspects while also influencing fresh concrete properties. Despite growing interest in the use of nanomaterial admixtures, their typical application is constrained by certain limitations, such as dispersion and problems with development of the desirable entrained air void system. Incorporating colloidal silica-based admixtures may enhance early age strength results and affect fresh concrete properties compared to plain concrete. Additionally, if the strength of a concrete mixture is increased by the use of colloidal silica-based admixture, the amount of cement can be lowered therefore decreasing the overall cost of a mix. The objective of this study is to thoroughly investigate the effects of two different colloidal silica-based admixtures on distinctive characteristics of concrete used for bridge applications. This was conducted by utilizing concrete mix designs designated for bridge construction. Concrete specimens containing these colloidal silica-based admixtures were evaluated for fresh properties (slump and air content), mechanical properties (compressive strength), and durability-related properties (rate of water absorption and formation factor). Compressive strength tests were performed on concrete cylinders measuring 4 x 8 inches at 7 and 28 days, while rate of water absorption and formation factor were assessed at 28 days. Preliminary results suggest that mixtures containing colloidal silica-based admixtures performed similarly to those without.

Keywords: Admixtures; Nanomaterials; Nano Silica; Concrete; Enhancement

Mentor(s):

Maria Miria Velay-Lizancos (Engineering); Alberto Castillo (Engineering); Jan Olek (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1452**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Pedestrian Detection for Behavior Analysis during COVID Pandemic**

Mathematical/Computation Sciences

Author(s):

Gunvanth Reddy Kandula† (Science, JMHC); Ilan Benschikovski† (Engineering); Kyung Min Ko† (Engineering); Ishaan Rath† (Engineering); Kanav Atre† (Science); Udayan Pandey† (Science)

Abstract:

COVID-19 has had a significant effect on the behavioral and movement patterns of people post-lockdown. This team aims to analyze pedestrian behavior before, during, and after the COVID-19 lockdown using intersection light images from cities across the country. Indicators such as pedestrian count and distance between individuals gain insights into behavior changes and evolving societal patterns. We started by learning and implementing the k-Nearest Neighbors and linear classification algorithms with the CIFAR-10 dataset consisting of ~60,000 images from 10 classes. We achieved a prediction accuracy of around 45 percent with the dataset using a linear classifier model and a lower accuracy with the k-Nearest Neighbors algorithm. We recently started work on building a Convolutional Neural Network and data loader for our intersection light images dataset. All of this work gives us a foundation to build a detection algorithm for our project goal. We plan on using either a Region-based Convolutional Neural Network (R-CNN) or You Only Look Once (YOLO) network to count the total number of pedestrians in the image and simultaneously locate their bounding boxes within the original image. Since each dataset includes timestamps for each image and contains many images throughout the pandemic, we can analyze changes in human behavior by comparing the total number of pedestrians and average pixel distance between bounding boxes, throughout the pandemic.

Keywords: Pedestrian Detection; Convolutional Neural Networks; R-CNNs; You Only Look Once Model; Pandemic Behavior Analysis

Mentor(s):

Edward Delp (Engineering); Carla Zoltowski (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1453**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Maximizing The Vera Rubin Observatory's Science Gain through Cross-Survey Collaboration

Physical Sciences


Author(s):

Akshith Karri† (Science); Phoebe Zhou‡ (Science); Cade Rigg‡ (Science)



Abstract:

In the coming years, time-domain astronomy will be a field soon to be revolutionized by the upcoming Vera C. Rubin Observatory conducting the Legacy Survey of Space and Time (LSST). In the planned ten years of its operation, it could detect 38 billion objects in the night sky covering the southern hemisphere's sky, and some overlap with our existing coverage of the northern hemisphere's sky. Since it is built to be a discovery machine, the Rubin Observatory has a longer cadence and thus gives us very sparse data, i.e., though it is very useful for discovering a huge number of transients, it does not give us very good lightcurves, which are important for us to perform analysis on and help make conclusions about them. However, we can take advantage of the overlap in the survey area of the sky between other surveys like the Zwicky Transient Facility (ZTF), the Panoramic Survey Telescope & Rapid Response System (Pan-STARR), and the Asteroid Terrestrial-impact Last Alert System (ATLAS) to fill in these gaps in our existing data. Hence, using semi-analytical models of supernovae and expected survey characteristics, we will simulate different supernova events and find the gain in useful data we have. This can be done with different observatories, to optimize how we can maximize our yield. This data can be used to inform Rubin and other observatories to streamline and optimize their strategies for maximizing the gain in science during Rubin's decade-long runtime.



Keywords: Supernova; LSST; Vera Rubin Observatory; Astronomy


Mentor(s):

Danny Milisavljevic (Science); Braden Garretson (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1454**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Impact of COVID-19 Rapid Testing on a Homeless Services Organization

Social Sciences/Humanities/Education


Author(s):

Jillian Kelley† (HHS)



Abstract:

Homeless populations have been disproportionately impacted by the COVID-19 pandemic, in large part due to increased spread of the disease in congregate setting such as homeless shelters. The use of rapid testing and early identification of cases has the potential to be a powerful tool in curbing the spread of COVID-19 among this vulnerable population. Funded by the NIH Rapid Acceleration of Diagnostics for Underserved Populations initiative, and leveraging an ongoing community-academic partnership, the purpose of this study was to understand the benefits and challenges presented by the implementation of rapid testing at a local homeless services center, and how testing impacted overall shelter operations. We conducted semi-structured interviews with both guests and staff of a homeless shelter, and then used thematic analysis to evaluate the overall impact of rapid testing in a shelter environment. Our analysis found that testing provided an effective way to eliminate key access barriers to testing, allowed for faster intervention when shelter guests tested positive, and provided both guests and staff peace of mind. However, testing also presented challenges to shelter operations. Lack of appropriate infrastructure and space to adequately isolate and care for guests who tested positive, maintaining guest privacy, and shelter lockdowns resulting from positive cases were some of the problems identified. Without the proper infrastructure and broader support to implement testing there are serious structural challenges that impede normal shelter functions. Highlighting these benefits and challenges will help to improve pandemic response plans for both individual homeless shelters and policymakers moving forward.



Keywords: COVID-19; Rapid Testing; Homeless Services



Mentor(s):

Natalia Rodriguez (HHS); Rebecca Ziolkowski (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1455**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## RISC-V Branch Prediction

Innovative Technology/Entrepreneurship/Design

Author(s):

Dhruv Khatri† (Engineering); Ann Zi Lau† (Engineering)

Abstract:

The project aims to improve the branch prediction performance of the RISC-V based microcontroller being developed by the System-on-Chip Extension Technologies. This project will implement a Return Address Stack (RAS) and a Two-Level Global Branch Predictor. The RAS is expected to improve the prediction of return instructions, while the Two-level Global branch predictor stores recent branch results in a global history register and is expected to enhance the accuracy of the existing Branch Target Buffer (BTB) predictor. Embench, a benchmark suite for embedded systems, will be used to evaluate the performance of the predictors by recording the misprediction rate and the instructions per cycle (IPC). Comparisons will be made against the existing Always Not Taken, Backward Taken Forward Not Taken, 1-bit BTB, and 2-bit BTB predictors.

Keywords: Branch Predictor; RAS; BTB; Global Branch Predictor

Mentor(s):

Mark Johnson (Engineering); Cole Nelson (Engineering); Ryan Montsma (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1456**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Resistor to Resistor Digital to Analog Converter (R2R DAC)

Innovative Technology/Entrepreneurship/Design


Author(s):

Seeun Kim† (Engineering)



Abstract:

In the field of signal processing, precise conversion of digital signals to analog signals is critical. This project describes the design and implementation of a high precision Resistor-to-Resistor Digital-to-Analog Converter that has been optimized for the needs of modern signal processing applications. There are several essential elements to the design process. Initially, a detailed examination of R2R system theory is carried out to understand its core principles and limitations. Following that, a new approach to resistor value optimization is proposed, with the goal of reducing the non-linear errors and increasing overall accuracy. The designed R2R DAC design has been thoroughly evaluated under a variety of usage scenarios using SoCET software. The suggested R2R DAC is a possible solution for signal processing applications that require high-resolution analog output. The findings of this study contribute to the growth of digital-to-analog conversion technology by providing insights for future research and development work.



Keywords: R2R DAC; Digital-To-Analog Converter; High Precision; Signal Processing; Simulation



Mentor(s):

John Peterson (Engineering); Dali Lai (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1457**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Investigation of 3D Printed Carbon Fiber Reinforced Thermoplastic Composite Tool Shape Stability During Heat Treatment

Physical Sciences

Author(s):

Seongyun Kim† (Polytechnic); Harry Lee‡ (Engineering, JMHC)

Abstract:

Extruder deposition additive manufacturing (EDAM) of fiber-reinforced composite tools for thermoset composite layup offers reduced cost and time especially for large scale prototyping and small production runs compared to traditional metal tooling. However, a significant challenge in additive manufacturing is residual stress due to the nature of depositing molten material in sequential layers. The internal stresses inside the tool may release and potentially cause changes in geometry during post-machining of the tool and when the tool is used for curing thermoset composite parts. This study demonstrated heat treating, or annealing, the 3D printed tool using autoclave before it is post-machined to relax internal stresses in a controlled and predictable manner. Consequently, this significantly improved the dimensional stability of the tooling during post-machining and high temperature cure cycles. The tools were 3D printed using Polyethersulfone (PESU) and Polyetherimide (PEI) reinforced with 25% carbon fiber by weight. The tool is manufactured referring to the shape of air inlet duct of NASA's X-59, quiet supersonic research aircraft. The manufactured tool size is approximately 762mm x 940 mm x 432 mm. The shapes of the tools were measured and analyzed between each step of 3D-printing, annealing, post-machining, and multiple cure cycles using a 3D laser scanner. The results exhibited promising outcomes, indicating that the dimensional stability of the printed tool did not show significant changes after annealing during post-machining and multiple elevated-temperature composite part manufacturing cycles.

Keywords: 3D Printing; Heat Treating; Annealing; Extruder Deposition Additive Manufacturing; Carbon Fiber

Mentor(s):

Garam Kim (Polytechnic); Eduardo Barocio (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1458**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Autonomous In-air Charging System for Unmanned Aerial Vehicles

Innovative Technology/Entrepreneurship/Design

Author(s):

Abhishek Kini† (Engineering); Ethan Walker† (Engineering); Nikita Dubrovskyi† (Engineering); Craig Cheung† (Engineering); Megan Collins† (Engineering); Aayush Iyengar† (Engineering, JMHC); Yooseung Choi‡ (Engineering); Clifford Gamble‡ (Engineering)

Abstract:

Unmanned Aerial Vehicles (UAVs) have immense importance across various industries due to their versatility and low cost. However, a major drawback is flight time and their frequent need to recharge, requiring them to land. This study aims to improve UAV utility using in air charging via docking two drones together via computer vision. Acquiring data from a camera is straightforward, however it is often plagued by surrounding "static," diminishing clarity. To mitigate vision noise, we’ve implemented a Butterworth filter. This enables us to identify and filter optimal frequencies for better quality. With our filtering, we found that 99.4% of the noise was eliminated, indicating successful substantial noise reduction. Our current program filters noise up to 2.25 meters, but the algorithm will be expanded to filter noise up to 5 meters. Aside from filtering, developing a charging platform that can allow easy docking is necessary. We designed an inverted funnel with magnetic charge connectors to allow easy docking and charging connections. Additionally, we designed a charger case with a servo motor to signal the charger to start/stop the charging sequence. We have 3-D printed our preliminary CAD designs and are integrating the platform for flight readiness. Overall, the current results match the expected results, and the noise filter is a good platform that can be expanded to a longer range. This concept can be applied to aid in civilian, military, and environmental use cases.

Keywords: Computer Vision; Battery Charging; Autonomous Docking; Unmanned Aerial Vehicle; Drone

Mentor(s):

Ran Dai (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1459**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Creating animal models with SCN2A Knockout in specific neurons: A Breeding Scheme Approach**

Life Sciences


Author(s):

Arnav Kumar† (HHS)



Abstract:

The study aimed to investigate deletions within the SCN2A gene cassette in mice, crucial for nerve cell function. Through PCR and gel electrophoresis, we detected deletions in the targeted region, suggesting potential alterations in neuronal excitability. To generate SCN2A knockout mice, particularly in interneurons, we devised a breeding scheme utilizing gene-trap knockout techniques. This approach allows the survival of mice with severely reduced SCN2A expression, mirroring aspects of neurodevelopmental disorders. Our findings will offer insights into SCN2A deficiency and its implications for neuronal function and behavior.



Keywords: Scn2A Deletions; Neurological Disorders; Genetic Analysis; Diagnostic Implications



Mentor(s):

Yang Yang (Pharmacy); Manasi Halurkar (Pharmacy)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1460**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Timescale Creator Online

Innovative Technology/Entrepreneurship/Design

Author(s):

Sejal Kumar† (Engineering); Paolo Gumasing† (Science); Jaehyuk Lee† (Science); Jiaqing Li† (Science); Leyton Bostre† (Engineering); Rohan Nachnani† (Science); Toby Onyekwere† (Engineering); Rebecca Rupp‡ (Engineering); Aditya Sivathanu‡ (Engineering)

Abstract:

The purpose of this project is to make the Timescale Creator software more accessible to the public and to researchers by bringing it online. This software allows geologists to plot and gather data based on certain parameters such as time periods and ages, and import each region's specific data package. The web version provides convenience as users do not need to update their software to use each new update. Currently, the web version is partially functioning at the same caliber as the original software because it lacks some of the available settings that are used in the Java program. Our goal is to create a more user-friendly interface that includes all of the

specifications needed for a user to create and modify a chart. To do so, TypeScript with React and Java are utilized to meet this goal. Ultimately, users will be able to use all of Timescale Creator's functionality on the web.

Keywords: Geology; Visualization; User Interface; Earth History

Mentor(s):

Jim Ogg (Science); Aaron Ault (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1461**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Iron-Induced Radiosensitivity in Mammary Cancer Cells (4T1)

Life Sciences

Author(s):

Dhriti Laddha† (HHS)

Abstract:

Introduction: Despite notable strides in cancer treatment, optimizing outcomes with minimal side effects remains daunting. The synergistic effects of radiation therapy and nanoparticle treatments have gained significant attention in cancer research. Here, we investigate the impact of iron nanoparticles on the radiosensitivity of mammary cancer cells (4T1), shedding light on potential mechanisms underlying DNA damage and repair inhibition. The objective is to understand the nuanced interactions between iron nanoparticles and in-depth exploration into the molecular pathways involved.

Method: Cells were subjected to varying doses of radiation (0Gy, 2Gy, 8Gy) with and without iron nanoparticle treatment (200µL and 400µL). Immediate and delayed (4 hours post-radiation) effects on DNA damage and repair were assessed through fluorescence microscopy and image analysis.

Results: Cells treated with 400µL of iron nanoparticles exhibited the highest level of DNA damage, but also severe toxicity, leading to considerable cell death and detachment. Contrastingly, those treated with 200µL of iron nanoparticles demonstrated heightened DNA damage across all radiation doses compared to untreated counterparts. Moreover, the extent of damage escalated with increasing radiation dosage. Delayed repair analysis revealed sustained DNA damage in nanoparticle-treated cells, indicating impaired repair mechanisms.

Conclusion: The study unveils the potential of iron nanoparticles to induce DNA damage and impede repair mechanisms in mammary cancer cells under radiation therapy. The findings prompt further exploration into the molecular mechanisms underlying iron nanoparticle-induced radiosensitivity. These insights underscore the need for comprehensive investigations into nanoparticle-based adjuvant therapies for enhanced cancer treatment outcomes.

Keywords: Iron Nanoparticles; DNA Damage; Nanoparticle-Mediated Radiosensitization; Radiosensitivity of Mammary Cancer Cells (4T1); DNA Repair Inhibition

Mentor(s):

Matthew Scarpelli (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1462**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Characterization of a transplastomic Photosystem II phosphosite mutant in Nicotiana tabacum

Life Sciences


Author(s):

Sarah Larsen† (Agriculture)



Abstract:

Within the thylakoid membrane of a chloroplast lies Photosystem II (PSII), a protein complex responsible for photosynthetic electron flow by utilizing the energy of photons and oxidizing water molecules. Harnessing this energy is an essential step in oxygenic photosynthesis; However, these reactions are damaging to a protein subunit known as D1, which exists as a heterodimer with an additional subunit called D2 within the PSII complex. The repair cycle of PSII requires that PSII complex be disassembled so that the damaged D1 can be degraded, synthesized, and replaced. Although this process is not fully understood, previous research has indicated that reversible phosphorylation of Thr 2 of the D2 subunit is important for disassembly of PSII. To further investigate the importance of Thr 2 in PSII disassembly, mutants with altered Thr 2 phosphorylation sites were generated in Nicotiana tabacum, thus allowing analysis in tandem with their wild-type counterparts using biochemical assays. One such mutant being investigated is a PsbD-T2A mutant which ectopically expresses a mutated PsbD gene in which Thr 2 is mutated to alanine. Characterization and confirmation of its mutation was performed, and future research will determine the role of site-specific phosphorylation in the PSII repair.



Keywords: Photosynthesis; Plant Biochemistry; Plant Physiology



Mentor(s):

Sujith Puthiyaveetil (Agriculture); Steven McKenzie (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1463**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Evaluating Naloxone Implementation Efforts in Emergency Departments within the HEALng Communities Study: A Case Study from 19 Counties in Ohio

Social Sciences/Humanities/Education


Author(s):

Elizabeth Lawson† (HHS, Liberal Arts)



Abstract:

Individuals struggling with opioid use disorder (OUD) often fail to receive adequate education on and treatment for opioid overdose. Emergency departments may be an effective solution for distributing naloxone to individuals at risk of overdose. Preliminary analysis indicated a large acceptance rate (two-thirds) for take-home naloxone within patients in emergency departments (Kestler, 2019). The purpose of this study is to identify the interventions from the HEALing Communities Study (HCS) that could best be implemented into community-based intervention programs for distributing naloxone in emergency departments, and to determine the effectiveness of these intervention efforts. Articles were located using PubMed and met inclusion criteria for topics on: (1) use of naloxone in emergency departments, (2) impact of emergency department-based naloxone, and (3) methods for implementation/education. Data from the CDC was used to triangulate OUD rates within the 19 counties in Ohio. Furthermore, data from the HCS was used to analyze the implementation of naloxone within Ohio emergency departments. This review included 6 articles: one qualitative interview, three cross sectional surveys, one randomized clinical trial, and a prospective clinical trial. Case examples of naloxone distribution in emergency departments will be provided from HCS in Ohio within the 19 counties. Case study findings will highlight results from the HCS in Ohio methods for implementing future education to providers, while reducing biases for these populations.



Keywords: Opioid Use Disorder; Naloxone; Emergency-Department Implementation; Take-Home Naloxone; Opioid Overdose Prevention



Mentor(s):

Jennifer Brown (HHS); Stephen Beegle (HHS); Luis Gomez (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1464**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Securing CI Workflows of Open Source Repositories

Mathematical/Computation Sciences

Author(s):

Chloe Lin† (Science); Samitha Ranasinghe† (Engineering); Rajit Khatri† (Engineering); Vignesh Charapalli† (Engineering)

Abstract:

The increasing adoption of GitHub Actions as a DevOps tool in the open source software community requires a robust set of security practices and tools to ensure its proper configuration in the CI/CD pipeline. Existing tools like actionlint, a static workflow linter and Argus, a framework for static taint analysis, are inadequate as they do not check for a comprehensive list of security practices and/or produce error messages that are difficult to understand and remedy.

Our objectives were to define a comprehensive set of security practices tailored for GitHub Actions workflows and develop a tool capable of evaluating a workflow’s adherence to these practices. Through reviewing relevant security research, industry standards, and code documentation, we identified several crucial security hardening measures for GitHub Actions workflows, specifically secrets and dependency management, access control and user permissions.

In addition to leveraging pre-existing code linters and other workflow security software, we developed a specialized tool, incorporating novel features capable of auditing GitHub Actions configuration files against our list of security practices. Our tool also provided user-friendly insights to open source repository maintainers, allowing them to secure their workflows and mitigate future risks.

Our project contributes to the advancement of secure software development practices within the open source software ecosystem by providing a practical solution for developers and organizations to build and maintain GitHub Actions workflows. As the usage rate of CI/CD pipelines continues to grow, the ability to recognize and prevent cyber threats in the workflows space becomes increasingly necessary.

Keywords: Software Security; CI/CD Pipelines; GitHub Actions; Platform Hardening; Static Program Analysis

Mentor(s):

Aravind Machiry (Engineering); Ritvik Stanksal (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1465**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Exploring Roots of Intercultural Competence Using BEVI

Social Sciences/Humanities/Education

Author(s):

Jerry Liu† (Science)

Abstract:

Interest in intercultural competence has greatly increased in recent years, and institutions are seeking ways to develop students who are ready for a diverse global world. For this study, we focused on the four demographic factors: gender, ethnicity, mother’s education, and father’s education. We characterized the intercultural competence of the students based on the following eight dimensions based on the Belief, Events and Values Inventory (BEVI) scale. The dimensions are basic openness, self-certitude, basic determinism, socioemotional convergence, gender traditionalism, sociocultural openness, ecological resonance, and global resonance. Pre-data for 2452 pre-college freshmen students was collected and analyzed, from which we identified demographic factors that served as predictors of each BEVI dimension via random forest classification. It was found that gender is a predictor of basic openness, basic determinism, socioemotional convergence, gender traditionalism, socio-cultural openness, and ecological and global resonance.  We also found that the level of fathers’ education predicts students' self-certitude. Post-hoc ANOVA performed on these traits found that female students showed a higher level of basic openness, basic determinism and socioemotional convergence and significantly higher levels of socio-cultural openness and ecological and global resonance compared to male students, while male students demonstrated significantly higher levels of gender traditionalism. One-way ANOVA also revealed that a high level of fathers’ education leads to higher self-certitude among students. This study’s findings contribute to a nuanced understanding of the interplay between gender, ethnicity, fathers' and mothers' education levels, and various intercultural dimensions as measured by the BEVI scale.

Keywords: Intercultural Competence; BEVI; Undergraduate Students; Worldview; Beliefs

Mentor(s):

Aparajita Jaiswal (Partnerships); Prateek Jaiswal (Texas A&M University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1466**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Magnetic-Bead Based Microrheology for Soft Matter Systems

Physical Sciences

Author(s):

Mauro Lopez-Carrillo† (Engineering); Shlok Kulkarni‡ (Engineering, JMHC)

Abstract:

Microrheology has emerged in the past few decades as an effective technique for understanding the mechanical properties of various materials and systems. Traditional rheological systems that rely on the Brownian motion of particles have proven successful for

determining mechanical properties of low viscosity systems. However, more complex environments, such as those seen in soft matter and biological matter, can greatly hinder or even stagnate the Brownian motion of observed target particles. This project seeks to develop a form of active microrheology that utilizes magnetism to induce motion of target particles. The proposed method is to use a magnetic field to induce particle motion either with electromagnets or solenoids. The magnets would be arranged such that they can be attached to a microscope, which would allow for simultaneous stimulation and

viewing of the particles in solution. A successfully designed magnetic microrheology system would have powerful implications for rheology as a whole and would create pathways for rheological testing of samples with wide ranges of viscoelastic properties.

Keywords: Active Microrheology; Soft-Matter Systems; Magnetism; Particle Tracking; Mechanical Analysis

Mentor(s):

Arezoo Ardekani (Engineering); Harsa Mitra (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1467**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# CogniPilot

Innovative Technology/Entrepreneurship/Design

Author(s):

Jonah Lovitz† (Engineering); Alex Kmetko† (Engineering); Joseph Forster† (Engineering); Anshuman Samanta† (Engineering); Aron Dutia† (Engineering); Alexander Ciccarelli† (Engineering); Akash Kumar† (Engineering); Pranav Krishnamoorthy† (Engineering); Matthew Genatempo† (Engineering); Chase Hamdan† (Engineering)

Abstract:

CogniPilot is a project constructed to build a mathematically proven aerial autopilot from the ground up. Within the code base of this project, the source code should be as minimal as possible to allow for a more reliable, maintainable, and verifiable system. Further, the estimator and controller intends to minimize the amount of branch statements when compared to previous autopilots such as PX4, ArduPilot, and BetaFlight. These controllers have thousands of branches making the verification process much more arduous. CogniPilot originated on a more simplistic system, a rover, and in the future intends to work on planes, quadcopters, and submersibles. During the semester, the team added bluetooth controller support to allow manual flight of the quad copter using the React JavaScript library in the FoxGlove extension. Additionally, the team developed a motor controller for balanced manual flight in the Gazebo Simulation. With the manual control system developed, the team intends to begin working on autonomous flight. To achieve this the team is developing Kalman filters for attitude estimation using CasADi, a python symbolic math library. The team also intends on working on path planning algorithms for flight afterwards. The overall goal to end this semester is to achieve a working autopilot on our quad copter.

Keywords: UAV; Autopilot; Ros

Mentor(s):

James Goppert (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1468**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Evaluation of doxycycline controlled exogenous expression of human Kv1.1 to recover social deficits in transgenic mice with severe Nav1.2 deficiency

Life Sciences

Author(s):

Kathryn Lund† (Science)

Abstract:

In 2020, the Centers for Disease Control and Prevention (CDC) reported that approximately 1 in 36 children in the United States were diagnosed with autism spectrum disorder (ASD). It is well-established that a significant proportion of ASD cases can be attributed to loss of function mutations in SCN2A, a gene encoding the Nav1.2 voltage-gated sodium channel. Nav1.2 plays a critical role in the initiation and propagation of action potentials. Mouse models of Scn2a-deficiency have been studied; however, heterozygous knock-out mice display mild phenotypes, making the evaluation of potential rescues challenging and complete knock out mice are not viable. To address this limitation, our laboratory has characterized a novel mouse model that allows 25% of Nav1.2 to be expressed which displays severe social deficits. This provides a robust platform for investigating potential interventions. Further investigations of our model revealed hyperexcitability in the medium spiny neurons of the striatum and a severe downregulation of potassium channels such as Kv1.1. To deepen our understanding of the role of Kv1.1 in SCN2A-related autism, we utilized an adeno-associated viral vector under doxycycline activation to overexpress the human Kv1.1 channel in wild-type and Nav1.2-deficient mice. This Tet-On system uses the tetracycline derivative, doxycycline, to bind reverse tetracycline transactivator (rtTA) to induce gene expression. Doxycycline was administered to mice through food pellets to temporally control Kv1.1 expression in a dosage dependent manner. This intervention increased the social time and number of bouts Nav1.2 deficient mice had with a novel mouse during a three-chamber assay. These findings offer a novel perspective on the potential utility of Kv1.1-based gene therapy in mitigating disease phenotypes associated with SCN2A-related ASD.

Keywords: SCN2A; Nav1.2; Kv1.1; Autism Spectrum Disorder; Gene Therapy

Mentor(s):

Yang Yang (Pharmacy); Jingliang Zhang (Pharmacy); Brody Deming (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1469**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Dopaminergic Activity, Executive Functions and Autistic/ ADHD traits: A Study of Spontaneous Eye Blink Rate

Social Sciences/Humanities/Education

Author(s):

Kailin Ma† (HHS); Anh Duong† (HHS)

Abstract:

Spontaneous eye blink rate (sEBR) is considered to be an indirect, non-invasive measure of central dopaminergic activity in the brain. Dopamine is involved in multiple behaviors and cognitive processes, including executive functions, reward-seeking, and repetitive behaviors, all of which may be different in autism and attention deficit hyperactivity disorder (ADHD). The objective of this study was to investigate the association between sEBR, an indirect measure of dopamine function, and discrete executive functions (EF) and autism and ADHD traits in neurotypical undergraduate students. Participants included 76 Purdue University undergraduate students. All participants completed three EF tasks: processing speed, working memory, and set-shifting using the NIH-Toolbox. Electroencephalography (EEG) data were acquired while participants completed three, two-minute blocks of eyes-open resting EEG. Spontaneous EBR was measured using channel- and independent component-based activity. Blinks were scored and sEBR was determined by dividing blink frequency by EEG recording duration. Autism and ADHD traits were measured by self-report questionnaires. Correlational analyses show a negative association between sEBR and set-shifting ability, suggesting the higher dopamine levels are associated with poorer set shifting. Higher ADHD traits, specifically hyperactivity, were also associated higher sEBR (i.e., higher dopamine). There is no significant correlations between sEBR and working memory, processing speed, or autism traits. Current results support the hypothesis that dopamine, as measured by sEBR, is associated with EF abilities and ADHD traits.

Keywords: Eye-Blink Rate; Executive Functions; ADHD traits; Dopamine; Frontal Theta-Band Power

Mentor(s):

Brandon Keehn (HHS); Yesol Kim (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1470**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Histidine Triad Protein Homologs: Linking Human Tumor Suppression and Novel Bacteriophage

Life Sciences


Author(s):

Brandon Mar† (Agriculture); Morgan Gyger† (Agriculture)



Abstract:

The Histidine triad (HIT) protein superfamily is found in nearly all life on Earth, spanning prokaryotes, archaea, and eukaryotes. The Fragile Histidine Triad (FHIT) and Histidine Triad Nucleotide-binding Protein (HINT) are two essential proteins involved in various cellular processes and have garnered significant attention in cancer biology research. FHIT and HINT both act as tumor suppressors and are frequently deleted or downregulated in various human cancers. These proteins modulate numerous cell cycle regulation and cell death pathways. In novel bacteriophages, discovered at Purdue University, prior genome annotation has led to the identification of bacteriophage-encoded HIT proteins. This investigation explores the homology between the human and bacteriophage variants of HIT by analyzing biochemical properties, primary sequence alignments, cellular interactomes, structural conservation, and ligand binding. This study finds that multiple bacteriophage HIT proteins show high conservation to the human variants of HINT, with noteworthy similarity in tertiary structure and ligand binding. These findings suggest that bacteriophage and human HIT proteins are homologs and engage in similar biological activity. Thus far, understanding the intricate roles of FHIT and HINT in cancer oncogenesis has provided valuable insights into developing novel therapeutic strategies. Furthermore, these bacteriophage HIT proteins could offer a platform to develop novel targeted cancer therapies by leveraging innate bacteriophage infrastructure.



Keywords: Bacteriophage; Tumor Suppression; Histidine Triad Nucleotide-Binding Protein; In-Silico Protein Analysis; Bioinformatics


Mentor(s):

Kari Clase (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1471**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## RoboMaster Auto-Aim System Tuning

Innovative Technology/Entrepreneurship/Design

Author(s):

Nicholas Martel† (Engineering); Tom O'Donnell† (Engineering); Thomas Greer† (Engineering); Yash Mehta‡ (Science)

Abstract:

The purpose of this research was to optimize Purdue RoboMaster Club’s automatic aiming system (auto-aim) with a goal to quantitatively enhance the system's targeting performance. The focus areas were determining optimal Kalman Filter parameters for state estimation and tuning a PID controller for aiming improvements. This study began with a qualitative analysis of the system’s capabilities, where we identified significant deficiencies in the current Kalman Filter’s covariance matrix parameters. The system’s damping was then analyzed to help determine closer-to-optimal covariance parameters, resulting in significant improvements to the auto-aim system’s targeting accuracy. Due to the assumption of a linear system, we concluded the state process noise covariance should optimally be larger than the measurement covariance, due to a larger degree of confidence in our 3D pose estimation relative to our kinematic predictions via the state transition matrix. Post-tuning quantitative analysis demonstrated a drastically faster convergence time for the Kalman Filter, and improved targeting behavior overall. Current analysis of the system’s PID controller demonstrated underdamped behavior, which is presently being investigated. Further work may investigate the assumptions of a linear system, and perform more rigorous comparisons between the current Kalman Filter implementation and nonlinear variations such as the Extended Kalman Filter or the Unscented Kalman Filter.

Keywords: Auto-Aim; Kalman Filter; PID; Robotics; Damping

Mentor(s):

Carla Zoltowski (Engineering); Zijian He (Engineering); Shivam Bhat (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1472**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Heterogenous Multicore for Embedded Applications

Mathematical/Computation Sciences

Author(s):

Malcolm McClymont† (Engineering); Burkay Sahin† (Engineering); Devin Singh‡ (Engineering)

Abstract:

Low power embedded systems often require short bursts of simple computation to interrupt long segments of complex computation. This heterogenous multicore design enables simple, low power applications and complex, high-speed computations to occur on separate cores simultaneously, preventing interruption between tasks. This project extends prior work towards a RISC-V heterogenous multicore processor for the AFTx series of microcontrollers from the System on a Chip Extension Technologies (SoCET) team. The design will feature one power efficient core and one high performance core to demonstrate decreased power consumption and increased computing speed. In a multicore system, memory atomicity and coherence become necessary due to multiple cores reading and writing to shared memory. To achieve coherence, we designed and tested a coherence unit to enforce MESI (Modified, Exclusive, Shared, Invalid) coherence between private CPU caches. To facilitate the atomicity of data stored in shared memory, the core was updated to support the RISC-V atomic instruction extension. This extension adds 9 new instructions that can be used to allow for synchronization between CPU cores. Of these instructions, load-reserved/store-conditional (LR/SC), will be implemented in hardware while the rest will be emulated in software. Individual components are being tested using functional testbenches written in SystemVerilog. Integration of the complete design will be verified using functional tests, and parallel micro-benchmarks will be used to characterize the performance of the design.

Keywords: Computer Architecture; Digital Design; Multicore Processors

Mentor(s):

Mark Johnson (Engineering); Cole Nelson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1473**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## How Extraversion Impacts Conformity

Social Sciences/Humanities/Education

Author(s):

Kiera Meyer† (HHS, Liberal Arts, JMHC); Faith McPhee* (Science); Autumn Bretwisch* (HHS); Grace Pearson* (HHS); Zoe Wilks* (HHS); Katelin Schwab* (Science)

Abstract:

Conformity is a behavioral process in which one changes their responses to match those of real or imagined others (Cialdini & Goldstein, 2004). Personality traits can affect the likelihood that one may conform (Laursen et al., 2022). Past research has linked conformity to the personality trait of extraversion, concluding that the more extraverted a person was, the less likely they are to conform (Gudjonsson et al., 2004; Laursen et al., 2002). Extraversion is related to novelty, excitement-seeking, and agentic pursuits, which may incentivize those higher in extraversion to not conform (DeYoung et al., 2002). The current research seeks to replicate past findings hypothesizing that extraversion will negatively predict conformity. Participants will be placed into a situation in which they could conform with other purported participants. They will be shown a green-blue color swatch and will be asked to indicate whether they believe the swatch is closer to green or blue. They will see how the other ostensible participants answer the question before they provide their answers. Conformity will be measured by how frequently the participants provide the same responses as the majority. Before the conformity task, we will administer the Goldberg Adjective Markers (Goldberg, 1992) to measure extraversion. To test our hypothesis, we will run a linear regression with extraversion as our predictor and conformity as our outcome. This research is important for expanding the literature on the relationship between personality and social influence, specifically looking at how having a more extraverted trait could lead one to conform less.

Keywords: Extraversion; Conformity; Personality; Social Influence

Mentor(s):

William Graziano (HHS); Regina Henares (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1474**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Development of Coating Method for Granular Materials

Mathematical/Computation Sciences

Author(s):

Claire Middendorf† (Engineering, Science, JMHC)

Abstract:

Granular materials are important in our daily lives, have widespread applications in numerous industries, and provide the foundation for our infrastructure. Their strength, stiffness, damping, and flow behavior determine how they can be utilized in different circumstances. Coating granular materials has the potential to alter these properties and engineer new materials with unique responses, with possible applications in structural and acoustic isolation, barrier design, and impact protection. As part of this research, a method was developed to consistently coat model granular materials (spherical glass beads 3.9 mm in diameter) with a soft silicon-based coating. Different mixtures and methods were attempted. Mass measurements performed before and after coating, and observations using optical microscopy demonstrate consistent coating of the beads, with thicknesses ranging between 4 and 17 microns depending on the duration of the treatment. Imaging of the beads is facilitated by the use of a dye.  Coating of a sufficient quantity of grains is underway so that tests can be performed on assemblies of these particles to quantify the impact of the coating on shear stiffness and damping. The knowledge demonstrated through this research will contribute to opening new paths toward creating new functional granular systems with multiple applications.

Keywords: Granular Materials; Soil Properties; Coatings

Mentor(s):

Marika Santagata (Engineering); Luis-Enrique Garzon-Sabogal (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1475**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Synergistic Effects of Cold and Competition

Life Sciences


Author(s):

Stephen Mills† (Agriculture)



Abstract:

Exposure to freezing temperatures is a significant plant abiotic stressor in temperate climates that affects species growth and distribution. To withstand freezing events, plants undergo a series of physiological changes known as cold acclimation to increase freezing tolerance. This process has recently been shown to carry an energetic cost, which has implications for growth, survival, and reproduction in the face of other common plant stressors such as competition. To understand how the cold acclimation process affects subsequent plant growth and reproduction, plants of Plantago lanceolata and Conyza canadensis were grown under conditions representative of late season germination and then subjected to an extended period of low temperature to induce cold acclimation. After this cold treatment ended, plants were moved to a heated greenhouse and grown under intraspecific competition, a common biotic stressor. Time to flower, biomass, and seed set were recorded to measure reproductive fitness, and interactions between cold treatment and competitive stress were examined. Results are discussed in the context of disrupted winter weather patterns due to climate change.



Keywords: Cold Acclimation; Competition; Plantago lanceolata; Conyza Canadensis; Climate Change



Mentor(s):

Christopher Oakley (Agriculture)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1476**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Transformer for Video Dehazing

Mathematical/Computation Sciences

Author(s):

Areej Mirani† (Engineering); Shubham Saluja Kumar Agarwal† (Engineering); Dennis Dai† (Engineering); Leo Chen† (Engineering); Zihao Ye† (Engineering); Vidisha Singhal† (Engineering); Sejal Kumar† (Engineering); Aishwarya Anand‡ (Engineering)

Abstract:

In environments characterized by dense smog and haze, it is crucial for computer vision models to effectively eliminate these visual obstructions to ensure precise decision-making. Currently, the existing solutions in the domain of video dehazing with a transformer are few and limited in scope. Through this research, we propose a novel transformer-based video dehazing algorithm, ensuring its applicability and effectiveness in diverse real-world scenarios.

Current iterations of computer vision models for dehazing are designed for processing individual images. To utilize the sequential nature of videos, we propose a neural network based on Vision Transformers. Transformers are an improvement on recurrent neural networks (RNNs), which are designed for sequential data. However, the windows (the previous data that the model remembers) of RNNs are not infinite, and therefore cannot store “long term memory” efficiently. By using a feature called attention, transformers can store an infinite amount of these dependencies. In theory, this means they should excel in video dehazing.

Our approach involves leveraging Cornell University's REVIDE dataset to create a novel computer vision model based on transformers. The implementation of transformers promises a faster and more accurate dehazing model, presenting substantial benefits for applications like search-and-rescue missions and emergency disaster situations.

Keywords: Computer Vision; Video Dehazing; Transformer; Machine Learning

Mentor(s):

Yung-Hsiang Lu (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1477**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Expression of transcription factors Meis2 and Tcf4 in the developing mouse visual system.

Life Sciences


Author(s):

Katlynn Mistina† (HHS, JMHC)



Abstract:

Amacrine cells are a diverse set of neurons in the neural retina necessary for vision. Based on their role in visual function, amacrine cells can be divided into two main types: the GABAergic and the Glycinergic amacrine cells. The purpose of this study is to identify genes necessary for the development of GABAergic and Glycinergic amacrine cells in the mouse retina. Based gene expression in adult retinas, we hypothesized transcription factors Meis2 and Tcf4 regulate the development of GABAergic and Glycinergic ACs. The expression of Meis2 and Tcf4 in the developing retina is unknown. This study uses immunohistochemistry on mouse retinal sections from 4 postnatal time points (P1, P4, P7, and P14) to assess when and where Meis2 and Tcf4 are expressed in developing amacrine cells. The results from the developmental expression will aid future studies assessing function of Meis2 and Tcf4 through genetic deletion using conditional knockout mice.



Keywords:



Mentor(s):

Pat Kerstein (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1478**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Liquid Fuel Dynamics in a Rotating Detonation Engine Using Planer Laser-induced Fluorescence and Chemiluminescence

Mathematical/Computation Sciences

Author(s):

Karina Morar† (Engineering)

Abstract:

Rotating detonation engines utilize detonation, a supersonic combustion process, to achieve propulsion. The rotating detonation process allows for more complete combustion of the fuel mixture, resulting in greater energy extraction per unit of fuel. Therefore, they have the potential to greatly enhance thermodynamic efficiency and facilitate efficient combustion within a compact and lightweight framework. This research seeks to advance the technologies of rotating detonation engines by evaluating the effects of chamber geometry, operating conditions, and coupling with post-combustion devices on detonation wave characteristics. The endeavor encompasses the development of test facilities and experimental methodologies essential for understanding the fundamental physical processes influencing operational efficiency under pertinent conditions. Specifically, the project entails the design, construction, and testing of flow facilities geared toward rotating detonation engines propulsion research. The research tools comprise optical and laser diagnostics utilized on test rigs under appropriate operating conditions. The results of varying conditions will be compared and analyzed. The comparison will inform policies on the future development of rotating detonation engines for improved efficiency and performance.

Keywords: Rotation Detonating Engine; Propulsion; Optical Diagnostics; Laser Diagnostics

Mentor(s):

Terry Meyer (Engineering); Matthew Hoeper (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1479**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# The acute effect of resistance exercise and chronotype on memory consolidation in young and middle-aged adults.

Life Sciences

Author(s):

Mark Naguib† (HHS)

Abstract:

Past research has shown the benefits of a single bout of acute aerobic exercise on memory; however, such memory-enhancing effects in response to resistance exercise (RE) remain understudied, despite the robust effect of RE on increasing lactate that is thought to play a mechanistic role in enhanced memory function. The present study employed a randomized control trial design and aimed to investigate the acute effect of RE on the consolidation process of object-based and relation-based memory in 103 healthy 18-50 year-old adults (male=59, mean age=26.78±7.91) who completed aerobic and muscular fitness tests on Day 1, and were then randomly assigned into two groups for a 42-min session of either moderate-intensity RE (n=51) or rest (n=52) performed after studying 60 paired objects and an immediate object/relation recognition test and before a 120-min delayed object/relation recognition test. Although RE increased blood lactate levels (t=17.18, p<0.01, d=2.06), no between-group difference in the intervention-induced change (e.g., delayed minus immediate) in any memory recognition performance outcome was found (ts<0.50, ps>0.62, ds<0.10). The null effect of RE on memory recognition performance did not differ between individuals with their chronotype (i.e., preferred time of a day) matching and unmatching to the time of memory testing (Fs<1.15, ps>0.32, ηp2<0.02). Although lactate has been proposed as a candidate mechanism for exercise-induced memory enhancement and this study's RE protocol can increase lactate, this physiological change may not have a reliable influence on the consolidation of memory and subsequent memory recognition performance regardless of the synchrony between chronotype and testing time.

Keywords: Chronotype; Memory; Resistance Exercise; Lactate

Mentor(s):

Alvin Kao (HHS); Nicholas Baumgartner (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1480**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Influence of Oxidative Stress on Neuron Firing: Implications for Traumatic Brain Injury**

Life Sciences

Author(s):

Khanh Ha Nguyen† (Science, JMHC)

Abstract:

The pathophysiology of Traumatic Brain Injury (TBI) is characterized by initial mechanical damage, termed primary injury, and secondary injury processes in which oxidative stress – an imbalance between production and accumulation of reactive oxygen species (ROS) – plays a key role. The latter is of particular relevance as oxidative stress can persist years post-TBI and cause progressive degeneration of adjacent healthy tissues. However, the connection between primary and secondary injury remains poorly understood. One molecule that has been widely implicated in the onset and propagation of secondary injury is acrolein, a β-unsaturated aldehyde produced from membrane lipid peroxidation following increased oxidative stress. To shed light on the role of acrolein in propagating secondary injury, we explored the short-term effects of acrolein exposure on the firing patterns of in vitro primary neuronal cultures isolated from cortical tissue and the spinal column. Firing patterns of cell populations prior to, during and after acrolein treatment were quantified using calcium imaging and analyzed with a custom MATLAB script. Our findings will further elucidate the relation between secondary injury and neuronal activity, thereby contributing significantly to a holistic understanding of clinical TBI in general.

Keywords: Traumatic Brain Injury; Oxidative Stress; Neuron Firing; Calcium Imaging

Mentor(s):

Riyi Shi (Veterinary Medicine); Casey Adam (Veterinary Medicine)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1481**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Vocabulary Acquisition in Children in Relation to Distress from the COVID-19 Pandemic

Life Sciences

Author(s):

Emma Niecikowski† (Science, JMHC)

Abstract:

Language acquisition in young children is partly influenced by linguistic and social interactions between children and caregivers. However, the COVID-19 pandemic disrupted many aspects of daily life, potentially impacting early childhood language development. Previous work by our research team observed that vocabulary development in 18-month-olds (n=82) was significantly affected by concurrent measures of child, but not caregiver distress. Moreover, this finding was consistent across children with typical language development (TD) and children with language delay (LD). This study aims to build on that work by evaluating enduring effects of the pandemic on language acquisition in the same participants one year later. Three questions are of interest: 1) how did child and caregiver distress change from 18 to 30 months, 2) do these differences predict changes in vocabulary at 30 months, and 3) are differences observed between the two groups of children (TD and LD)? To address these questions, we administered a vocabulary measure – the MacArthur-Bates Communicative Development Inventories (MBCDI, Second Edition, Fenson et al., 2006) and a COVID impact and exposure survey (CEFIS, COVID-19 Exposure and Family Impact Survey, Kazak et al., 2021) at both timepoints. Data collection is ongoing. We predict distress will decrease overall across both groups for children and caregivers as the pandemic has ended and that parents who report a reduction in child distress will have stable or improved vocabulary scores. This research may highlight the long-lasting disruptions that COVID-19 may have on language development in young children.

Keywords: Language; Vocabulary; COVID-19; Distress; Development

Mentor(s):

Claney Outzen (HHS); Michelle Erskine (HHS); Arielle Borovsky (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1482**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Purdue University Eating Habits

Social Sciences/Humanities/Education

Author(s):

David OBrien† (Exploratory Studies)

Abstract:

Purdue University offers dining halls available to students who live on-campus with a meal plan. There are also retail dining options available around the campus. Meal plans for on-campus students consist of meal swipes that renew each week. Students who live off-campus are able to purchase a meal plan. This meal plan gives a student a certain amount of meal swipes per semester. However for the most part they cook their own meals at home or get take-out. The main objective of this research project is to assess and compare the eating habits of students living on-campus with Purdue students with those who live off-campus. This study aims to identify the differences in the satisfaction of the food, differences in how much food is eaten, and the cost of a meal. Develop two different surveys that are tailored to students who have meal plans and to those who live off-campus. I have sent out surveys to both groups. It is expected that the research will reveal differences in eating habits, nutritional intake, and satisfaction between on-campus students and off-campus students. This research holds significance for Purdue University and their students. It shows the differences in eating habits between students living on-campus and students living off-campus.

Keywords: College Students; Eating Habits; On-Campus Dining; Off-Campus Dining

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1483**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Web Scraping to Assess Medication Safety

Mathematical/Computation Sciences


Author(s):

Chaewon Oh† (Science, JMHC); Samskrithi Sivakumar† (Science); Ridhi Tamirasa Kandala‡ (Science); Thomas Huss‡ (Science)



Abstract:

According to The American Academy of Pediatrics (AAP), 1 in 4 caregivers administer incorrect dosages due to the difference between prescription units and medical counseling units. This leads to confusion, and multiple dosing errors would lead to serious harm. The AAP recommends milliliters as the standard dosage unit to reduce errors and caregiver confusion. Standardizing milliliters on Children’s Hospital websites could cut accidental overdoses.This research involves scraping data from 148 children's hospital websites to evaluate their dosage information pages. The goal is to assess the literacy level of these pages using the Simple Measure of Gobbledygook (SMOG) methodology and analyze the frequency of dosage units. Seven keywords were utilized to extract dosage information, while an additional five were used for storage instructions. These keywords include milliliters, tablespoons, teaspoons, and milligrams.

The result showed that approximately 17% of children’s hospital web pages included dosage information on their websites. Teaspoons dominated despite the recommendations set by the AAP. The literacy level was from 7th to 8th grade, an acceptable level set by the AAP. In conclusion, the dosage instructions use an acceptable literacy level. However, it is important to standardize dosage units to milliliters across all Children's Hospital websites to mitigate administration errors. This research study was presented in the annual 2023 CDC PRevention of Overdoses and Treatment Errors in Children Task Force (PROTECT) meeting. Using the results from the study, the CDC contacted websites to standardize dosage units as milliliters.



Keywords: Web Scraping; Children's Hospital; Dosage Information; CDC Protect (Prevention of Overdoses and Treatment); American Academy of Pediatrics (AAP)



Mentor(s):

Deborah Spoerner (Indiana University); Khue Tran (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1484**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Testing Cytotoxicity of MYC G4 Targeting Indenoisoquinolines in Cancer Cell Lines using MTS IC50 assay

Life Sciences

Author(s):

Rio Ohtake† (Pharmacy, JMHC)

Abstract:

MYC is a transcription factor that stimulates various cellular processes such as growth, metabolism, and proliferation. Deregulation of MYC expression contributes to the majority of cancers. However, MYC protein is “undruggable” because of its disordered structure. G-quadruplexes are non-B, globular DNA secondary structures formed in G-rich sequences. G-quadruplexes formed within the MYC promoter region act as transcriptional silencers and suppress cancer cell growth upon drug-induced stabilization. Therefore, targeting MYC G-quadruplexes is an attractive anti-cancer approach. Previously, anti-cancer drug indenoisoquinolines were found to bind and stabilize MYC G-quadruplexes. Three indenoisoquinolines are in clinical trials, and new indenoisoquinoline analogues have been developed. This research project aims to test the cytotoxicity of new indenoisoquinolines in cancer cells using MTS IC50 assay. MTS assay is commonly used to measure drug cytotoxicity IC50, which is the concentration of drug needed to inhibit cell viability by 50 %. This method involves plating cells, treating cells across a drug concentration gradient, adding MTS reagents that change color depending on cell density, and analyzing cell density vs drug concentration to determine IC50. As a result, my data determined the potencies of newly developed indenoisoquinolines and revealed differential sensitivity by cell lines of several cancer types. My data will help determine the most suitable cancer types for preclinical testing of newly developed indenoisoquinoline MYC inhibitors.

Keywords: Drug Discovery; Anti-Cancer Development; MYC; G-quadruplex; Cytotoxicity Assay

Mentor(s):

Danzhou Yang (Pharmacy); Yichen Han (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1485**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Circuit design of self-powered wearable sensors: A proof of concept with a cardiovascular triboelectric sensor

Innovative Technology/Entrepreneurship/Design

Author(s):

Abigail Origer† (Engineering, JMHC)

Abstract:

Continuous healthcare monitoring allows for early detection and prevention of conditions such as cardiovascular diseases. Triboelectric sensors have been proven to serve as high-performance self-powered cardiovascular sensors. However, signals from self-powered sensors show pure analog input features mix digital and other analog noise. The purpose of this project is to develop a signal processing circuit to be used alongside self-powered triboelectric sensors to measure heart rate. Using the combination of an electronic filter and amplifier, these signals will be processed to eliminate noise and improve clarity for further analysis.

A MAX7427 elliptic lowpass filter can be used to filter high-frequency noise with a much sharper roll off than a passive filter. The filter works well with very low cutoff frequencies such as those of 5-10 Hz required by the sensors. The specific cutoff can be easily manipulated by changing the capacitance value at the clock pin of the filter. The signal can then be amplified from its original strength to prevent data loss and allow for easier reading.

A working lowpass filter has already been constructed with a cutoff frequency of 7 Hz, wherein the effect of high-frequency signals decreases by almost 70% within the span of 1 Hz. Next steps involve adding a MAX4465 preamplifier to increase the strength of the filtered signal by 10 to 100 times. Afterwards, the processed signal will be read by Bluetooth through a microcontroller. The final PCB will be modified for printing on a flexible substrate.

Keywords: Healthcare Monitoring; Circuit Design; Signal Processing; Triboelectric Sensors

Mentor(s):

Wenzhuo Wu (Engineering); Robert Ccorahua-Santo (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1486**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Feasibility of Lead Exposure Assessment in Blood Spots using Energy-Dispersive X-ray Fluorescence

Physical Sciences


Author(s):

Gladys Osakwe† (HHS)



Abstract:

Blood spot collection from newborns is a routine procedure for diagnosing various health conditions, including elevated blood lead levels. This study explores the feasibility of utilizing high-power energy-dispersive X-ray fluorescence (EDXRF) technology to accurately assess lead concentrations in blood spots. Spotted standards of known lead concentrations on filter paper were created to determine detection limits and assess variability across procedures and blood volumes. Comparison with atomic absorption spectroscopy (AAS) indicated EDXRF as a significant predictor of blood lead levels, with a detection limit comparable to AAS. The findings demonstrate the potential of EDXRF for lead exposure surveillance, even at low levels, offering a non-destructive, field-friendly alternative to conventional methods.



Keywords: EDXRF; Lead; Bloodspot; Spectroscopy; Fluorescence


Mentor(s):

Aaron Specht (HHS); Thomas Grier (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1487**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## PASylation as a promising protein modification to prolong Interleukin 27 (IL-27) half-life

Life Sciences

Author(s):

Amanda Pawlecki† (Engineering); Aryaman Dewan* (Science)

Abstract:

Protein therapy is one of the most commonly used treatment options for various diseases due to its specificity to the target and its few adverse effects. However, the short half-life of recombinant proteins increases the difficulties in both its effectiveness and administration. Several protein modifications have been examined to extend protein half-life. Among these, conjugation of poly-ethylene glycol (PEGylation) is well-established and broadly used. However, PEG can induce immunogenic responses, such as anti-PEG antibodies, which restricts its application. It has been reported that the introduction of a Pro-Ala-Ser domain (PASylation) can lengthen protein half-life and, therefore, improve its efficacy. PAS domains are hydrophilic, uncharged biological polymers that have properties comparable to PEG. Interleukin-27 (IL-27) is a cytokine that can aid in reducing tumor growth and promoting tumor regression in various cancer models. However, its short in vivo half-life limits the clinical applications of IL-27. In this study, we aim to modify IL-27 with PASylation to enhance its efficacy as well as the half-life. First, the N-terminal of mouse IL-27 was fused with functional protein, Nanoluc, for detection, naming Flex27 (non-PASylation control). PASylation was added to FLEX27 (PAS200-FLEX27) to potentially increase the half-life and effectiveness. In preliminary results, we found that FLEX27 could only be produced in Escherichia coli (E. coli) and only mammalian cells could produce PAS200-FLEX27. Bioactivity of both FLEX27 and PAS200-FLEX27 is ongoing through two cell-based assays: luciferase reporter assay and colony formation unit assay (CFU) to validate the bioactivity and function of the engineered versions of IL-27.

Keywords: Protein Modification; PEGylation; PASylation; Interleukin 27

Mentor(s):

Marxa Figueiredo (Veterinary Medicine); Raluca Ostafe (Centers & Institutes); Ying Cheng Chen (Veterinary Medicine); Omnia Ibrahium (Veterinary Medicine)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1488**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Toward Mitigating Biases in Biometric Data-driven Models**

Mathematical/Computation Sciences

Author(s):

Rachel Pfeifer† (Science)

Abstract:

[Abstract Redacted]

Keywords: Bias; Biometrics; Demographics; Fairness; Mitigation

Mentor(s):

Sudip Vhaduri (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1489**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Concrete Anchors Under Stress

Physical Sciences

Author(s):

Alexander Piet† (Engineering)

Abstract:

In areas of the world that are frequently hit by earthquakes, such as Japan or California for example, it is crucial to develop infrastructure that can withstand these seismic vibrations, ensuring that a city can stay intact after a major crust-rattling event. For this project, the researchers are working to understand how concrete support structures endure different levels of stress to develop a better understanding of how buildings are affected by earthquakes and work toward developing more stable infrastructure designed to withstand them. The PhD candidate is working in the laboratory to simulate a single beam undergoing seismic stress to approximate how a full building’s beams and support structures would react under similar conditions. His research assistant is both working on a hybrid simulation of the same scenario as well as analyzing graphical data that has been recorded from the physical experiments in the laboratory. The hybrid simulation is used to simulate and calculate the effects of the forces on the testing beam, as well as graph and analyze these calculations, without using the resources necessary to perform a bunch of physical experiments. By analyzing the data, he locates extremes and averages of the fluctuating data points that are produced by the physical simulation, and then he determines what these points mean on a larger scale. With this hybrid simulation, the researchers can more easily develop an understanding of how a building will react under seismic stress without using the resources and money of fully testing every possible scenario. So far, this has proven to be the most effective method for testing this experiment.

Keywords: Concrete Anchors; Computer Simulation; Seismic Research; Hybrid Simulation

Mentor(s):

Gaurav Chobe (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1490**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Spectroscopic Validation of ODIN-DESI LAE Catalogs

Physical Sciences

Author(s):

Ethan Pinarski† (Science)

Abstract:

Protoclusters are young, forming galaxy clusters in the distant Universe observed well before they fully collapse into a dynamically relaxed system. The details and mechanisms behind protoclusters evolving into larger galaxy clusters remain uncertain. The One-hundred-deg$^2$ DECam Narrow-Band (ODIN) survey is designed to enable the detection of the large-scale structure (LSS), the locations of protoclusters, and to trace the evolution of protoclusters over cosmic time with the use of Lyman-α emitters (LAE). The ODIN survey is sampling three redshift slices, $z \sim 2.4$, 3.1, and 4.5 (corresponding to 2.7, 2.0, and 1.3 billion years after the Big Bang), and gathering multi-band photometric and spectroscopic data from seven widely separated regions in the night sky. Spectroscopic observations by the Dark Energy Spectroscopic Instrument (DESI) have the potential to uncover the differences in chemical composition and stellar population ages in galaxies residing in protocluster environments. By combining datasets from ODIN and DESI, our project is aimed at i) confirming the targeted galaxies at these cosmic slices selected by ODIN; ii) investigating the physical properties of the galaxies as a function of the large-scale environment; and iii) validating the photometric selection techniques for discovering LAEs. Spectroscopy is important in testing the purity of these ODIN LAE catalogs, which are used in detecting the sites of protoclusters.

Keywords: Galaxies; Large-Scale Structure; Galaxy Protoclusters; ODIN Survey; Lyman-α Emitters

Mentor(s):

Kyoung-Soo Lee (Science); Vandana Ramakrishnan (Science); Nicole Firestone (Rutgers University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1491**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## CATT: Understanding the Online Behavior of Child Sex Offenders

Innovative Technology/Entrepreneurship/Design

Author(s):

Reeya Ramasamy† (Polytechnic)

Abstract:

The Chat Analysis Triage Tool (CATT) is a forensically sound investigative tool that analyzes chats between a minor or undercover law enforcement officer (UCLE) and offender. CATT assists law enforcement in prioritizing cases in which the offender is more likely to be contact-driven (high-priority) vs. fantasy-driven (solicitation only). These different online offenses all involve chats between minors/UCLE and offenders, in which the offenders engage in child sexual grooming. Child sexual grooming is the process by which an adult uses deceptive trust and friendship formation to lure a minor into engaging in sexual behaviors. The main research objective is to better understand chatting and the behavior behind offenders and minors through the various stages of this project. In Phase One of the project, the chats are being cleaned for grooming analysis (e.g., deidentifying and replacing names, location, email addresses). In Phase Two of the project, these chats are being coded to identify when risk assessment occurs by the offender. Risk assessment occurs when the offender becomes suspicious of whether the “minor” they are chatting with is a real minor or a law enforcement officer. It has been found that offenders engage in more risk assessment with UCLEs compared to real victims. In Phase Three, these chats will be coded to identify the different stages of grooming in a more contextual manner to help train CATT. Overall, these findings will help inform algorithm development for CATT and law enforcement trainings on how to avoid risk assessment by the offender during sting operations.

Keywords: Cybercrime; Sex Offender; Law Enforcement; Algorithm Development

Mentor(s):

Kathryn Seigfried-Spellar (Polytechnic); Tatiana Ringenberg (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1492**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## How does an open prairie compared to a water edge habitat affect biodiversity of an acoustic community that is considered mesocarnivore resources?

Life Sciences


Author(s):

Hannah Reyes Charles† (Agriculture, JMHC); Sierra Hunnicutt‡ (Science, JMHC); Katie Hong‡ (Agriculture); Zhixin Cai‡ (Science, JMHC); Ryan Feller‡ (Science, JMHC); Luca Iacobucci‡ (Agriculture); Anthony Tan‡ (Science)



Abstract:

Wildlife corridors, stretches of natural habitat that connect separate populations of wildlife, have been a pivotal strategy against habitat fragmentation. Developing a wildlife corridor in Indiana is our main aim, focusing on increasing habitat suitability for the survival of many native species, especially the bobcat (Lynx rufus). Although they are most common in southern and west-central Indiana, they are capable of dispersing up to 100 miles from where they were born, according to the Indiana Department of Natural Resources. To work with conservation easement properties in developing a wildlife corridor in Indiana, we aim to address bobcat presence and likeliness of passage throughout pre-established sites along the Wabash River. Acoustic monitors, AI-CNN (n = 9), have been placed to identify the acoustic community in open prairie and close to water edge habitats. With this data, we will use BirdNET, an open-source AI tool for biodiversity trend analysis of the acoustic community. This approach not only helps predict the bobcat movement but also supports broader biodiversity. This project exemplifies a model for conservation efforts, emphasizing the importance of habitat connectivity and the innovative use of technology in wildlife conservation. Through our collaboration with conservation agencies in Tippecanoe County, we can address the pressing challenges of habitat loss through fragmentation, ensuring a sustainable future for wildlife and ecosystems.



Keywords: Wildlife Corridor; Bobcats; Conservation; Biodiversity; Acoustic



Mentor(s):

Kristen Bellisario (JMHC)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1493**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Tracking the United States Court of Claims

Social Sciences/Humanities/Education

Author(s):

Shyeonna Robinson† (HHS, Liberal Arts)

Abstract:

The United States Court of Claims, a specialized jurisdiction within the federal judicial system, is not the most widely known in the field of jurisprudence. Within this court, plaintiffs bring suit against the government for a retributive aspect, typically money, of an alleged wrong committed. From copyright to patents or even Army pay, this court hears a variety of cases brought by a range of people, groups, and other entities. To date, no cohesive database exists that gives access to all the court of claims cases in the United States. The importance of creating such a database lies in better understanding the legal system. To explore this aspect of the judicial system is to expand the logic surrounding judicial independence that inevitably shapes judges, decisions, and acts from Congress.

Keywords: Claims; Judiciary; Federal; Courts

Mentor(s):

Logan Strother (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1494**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Tumor-associated antigen surface density in mechanisms of CAR T cell activation threshold-setting

Life Sciences


Author(s):

Kenneth Rodriguez-Lopez† (Science)



Abstract:

Chimeric antigen receptor (CAR) T cells are an engineered cell-based therapy that has been successful in treating blood cancers, but thus far had limited impacts on eliminating solid tumors. Triumphs have resulted from high specificity in targeting tumor-associated antigens (TAAs) that are tumor exclusive. Solid tumors like pancreatic, prostate, or metastatic breast cancer typically present a heterogeneous distribution of TAAs that can vary during tumor progression and therefore may be indistinguishable from healthy cells. Furthermore, there is heterogeneity present within a tumor as time progresses. One possible reason for this is the 3-dimensional complexity of solid tumors that blood cancers lack. Density and accessibility of TAAs throughout the tumor volume may modulate CAR T cell activation and, therefore, efficacy. To interrogate the importance of TAA expression level for CAR T cell activation, we have generated clonal populations of the metastatic breast cancer cell line MDA-MB-231 in order to have narrower distributions of folate receptor (FOLR1) expression as a model TAA. The expression of FOLR1 has been quantified using fluorescent microscopy techniques like epifluorescence (EPI) and total internal reflection fluorescence microscopy (TIRF), along with flow cytometry. Finally, we have run killing assays with MDA-MB-231 subpopulations and CARs to determine differences in killing efficiency as a function of FOLR1 density. We are also developing 3-D cancer cultures (spheroids) to quantify the differences between TAA expression of traditional 2-D cell cultures and the 3-D spheroids, and plan to run similar killing assays with the spheroids in the near future to move into a more therapeutic context. Our overall goal is to define the mechanisms for threshold setting in CAR T cells to provide actionable therapeutic insights for treatment regiments and more successful outcomes.



Keywords: CAR T cell; Metastatic Breast Cancer; Tumor Associated Antigen; Tumor Microenvironment; Receptor Expression


Mentor(s):

Shalini Low-Nam (Science); Kevin Scrudders (Science); Suriya Selvarajan (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1495**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Listening Beyond Words: the Analysis of Cultural Identity Audio Biographies

Social Sciences/Humanities/Education

Author(s):

Ana Rojas† (HHS)

Abstract:

Music therapy is a fast-growing method to improve a vast variety of medical and psychiatric conditions, specifically for children and adolescents. Given recent events and a post-COVID world, there has been an increase in Anti-Asian hate which has driven suicide to become the leading cause of death in the US for Asian and Asian American teens (CDC and Prevention, 2020). This study (Co-PIs: Dr. Stewart Chang Alexander and Dr. Pamela K. Sari) aims to provide Asian and Asian American teens an outlet to express their ethnic identity through music and creation of Cultural Identity Audio Biographies (CIAB). This experience not only encourages emotional expressions but allows us as researchers to explore the following question: How does the analysis of the CIABs give us insight into the themes and development of cultural identities for Asian and Asian American teens in the Midwest? The heart of our analysis comes after many interactions with our participants through semi-structured interviews and surveys. After gaining a base on participants' sense of identity and upbringing, we analyze their own unique musical CIABs. Both the interviews and CIABs provide deeper understanding to the complex emotional expressions of these adolescents as they think about their journey of identities.

Keywords: Music Therapy; Identity; Asian American / Asian; Cultural Identity Audio Biography; Music Analysis

Mentor(s):

Pam Sari (VP Diversity and Inclusion); Stewart Chang-Alexander (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1496**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Probing the Free Energy Landscape of Protein L

Physical Sciences


Author(s):

Ryan Rushing† (Science); Eleazar Gonzalez‡ (Science)



Abstract:

Most proteins spontaneously fold into energetically favorable 3-D structures critical to their function. Here, we use a magnetic tweezer setup to apply a constant tension to an 8-mer of the B1 domain from protein-L to observe repeated protein folding/unfolding events detected through the protein's extension to infer the protein's energy landscape along this unfolding path. Previous work on protein L found that the change in free energy between the folded and unfolded form under standard conditions is 6.5 kBT. Further, it was found that increased environmental salt concentration increases the folding unfolding rates, implying a reduction in the transition state between the two forms. We have continued the previous work on the effects of environmental salt concentrations on folding/unfolding rates. We have also upgraded the system to allow for the application of time-dependent forces during protein folding/unfolding. This upgrade will allow for dynamic measurements of folding/unfolding, which specifically probe the transition state. Preliminary results will be discussed.



Keywords: Biophysics; Single-Molecule Mechanics



Mentor(s):

Ken Ritchie (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1497**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Toward 3D General-Purpose Computational Quantum Electromagnetics Modeling

Physical Sciences

Author(s):

Felipe Sandoval† (Engineering); Naren Rachapalli† (Science); Ben Eng† (Science); Nicholas Helushka† (Engineering); Gokulkrishnan Harikrishnan† (Engineering); Truman Mohr† (Science); Nicholas Detwiler† (Science); Warat Vijitbenjaronk† (Science); Ron Bejerano† (Engineering)

Abstract:

The rapid advancement of quantum computers presents exciting opportunities for scientific and technological innovation. However, the engineering design of these revolutionary systems is in its early stages. Versatile numerical modeling tools have been instrumental in successfully designing most modern technologies; however, for quantum computers, the computational limitations of numerical design methods have prevented them from analyzing systems of useful scale. To address this limitation, this project is developing efficient and general-purpose tools for modeling the building blocks of quantum computers. Our approach involves creating a robust finite element method (FEM) implementation based on electromagnetic potentials to evaluate the electromagnetic eigenmodes of realistic 3D geometries. These eigenmodes are then used to discretize the quantum Hamiltonian that characterizes the dynamics of the quantum system. To improve the accuracy of the FEM, adaptive h-refinement and higher-order elements are being implemented. The output of the FEM analysis will be exported to Paraview to allow for simple and effective visualization. Further, numerical ordinary differential equation (ODE) solvers are being implemented and applied to model practical quantum systems that are subjected to quantum noise. The program models the open quantum system dynamics using a Monte Carlo sampling method to determine when quantum state jumps should occur. With additional development, the ODE and electromagnetic solvers will be combined to form an efficient quantum electromagnetic modeling method that can characterize the performance of modern quantum computers.

Keywords: Quantum Computer; Finite Element Method (FEM); Electromagnetic Modeling; Adaptive Mesh Refinement; Monte Carlo Sampling Quantum Noise

Mentor(s):

Thomas Roth (Engineering); Samuel Elkin (Engineering); Soomin Moon (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1498**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Thematic patterns and subtopics revealed through topic modeling methods on discussions in Reddit regarding HPV vaccines.

Social Sciences/Humanities/Education

Author(s):

Neel Sarathy† (Science, JMHC); Selina Lin* (Science, JMHC); Chris Farber* (Science, JMHC)

Abstract:

Background:

Increasing social media use has caused a shift towards debate and discussion being done more online. This has also resulted in people relying on information on the internet to influence their opinions. Vaccinations are a hot topic of discussion and one such discussed vaccine is for Human Papillomavirus (HPV). It may be important to look into the state of discussion of HPV vaccines.

Aim:

The aim is to find out what HPV-vaccine related topics appear on Reddit discussions using topic modeling methods.

Methods:

Gather data from the posts and comments from 2021 to 2024 on the reddit subreddits, r/HPV, r/DebateVaccines, r/STD, r/VaccineMyths, r/antivaccine, r/conspiracy, r/sex,and  r/vaccine. Identify keywords and salient themes using Principal Component Analysis, KMeans Clustering, and TFIDF analysis. Use Latent Dirichlet Allocation and Latent Semantic Analysis on the data to characterize topics within the data. Implement these using Python and its libraries.

Implications:

The results of this research can provide valuable insights into the prevalent themes and subtopics surrounding HPV vaccines in online discussions. Policymakers, healthcare professionals, and public health organizations can gain a better understanding of public perceptions, concerns, and misinformation regarding HPV vaccination. This information can inform targeted communication strategies, educational campaigns, and interventions aimed at promoting vaccination acceptance and combating vaccine hesitancy.

Keywords: HPV; Topic Modelling; Vaccines; Machine Learning; Data Science

Mentor(s):

Soojung Jo (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1499**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Neurobehavioral characterization of chlorpyrifos exposure on Pon-1 (-/-) rat model**

Life Sciences


Author(s):

Sofia Schumann† (HHS); Dia Jhaveri‡ (Science); Matthew Corson‡ (HHS, JMHC)



Abstract:

Chlorpyrifos (CPF) is an organophosphate pesticide (OP) that has been used globally in agriculture. Research indicates that it has had adverse impacts on human health due to inhibition of acetylcholinesterase which leads to cholinergic effects. The EPA in August 2021 announced to ban the use of CPF in food production, but the ban got reversed and is still used widely in America today. Epidemiological and laboratory investigations have established a correlation between environmental exposures and the onset of Parkinson's Disease (PD). The impact of genetic variations in PD-related genes on dopaminergic neurotoxicity has not been thoroughly investigated.

Paraoxonase 1 (Pon1) is an enzyme that plays a crucial role in the detoxification of certain xenobiotics, like the CPF oxon which is neurotoxic. Pon1 acts to break the CPF oxon down into less toxic substances, reducing its harmful effects on the nervous system. Polymorphisms in Pon1 further increases PD risk from CPF exposure. A comprehensive understanding of potential interactions between genetic factors and environmental exposures is crucial for assessing the risk posed by CPF exposure in relation to PD.

To determine the impact of Pon1 knockout (KO) on the vulnerability to PD, we conducted a pilot dose dependent study on male and female 9–11-month-old Pon-1 KO Sprague Dawley rats with dosage groups of (0.25 mg/kg), (0.50 mg/kg), (1.0 mg/kg), (2.0 mg/kg) and control (2 of each gender in each group). Neurobehavioral study included Postural Instability (PI), Vibrissae elicited forelimb placing (VEBT), and Spontaneous activity also known as the cylinder test.

The pilot study suggested non statistical results that have shown a decline in the rearing behavior of Pon-1 KO rats across both genders. Moreover, results from PI test have also shown similar results with an increase in the distance needed to place the catchup step to regain balance in accordance with its center of gravity. However, we did not see a difference in VEBT in the doses that we used. Future experiments of this project will include molecular and neurochemical analysis of the isolated brains from this study, and a comparative study with Wild type Sprague Dawley rats.



Keywords: Organophosphorus Pesticides; Chlorpyrifos; Parkinson's Disease; Pon 1 Knockout; Rat Model


Mentor(s):

Jason Cannon (HHS); Reeya Tanwar (Science); Fatema Currim (HHS); Josephine Brown-Leung (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1500**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Artificial Intelligence in Music: Robot plays Cello

Innovative Technology/Entrepreneurship/Design

Author(s):

Tanishaa Shah† (Engineering); Cheng-Hao (Ryan) Chen* (Engineering); Samantha Sudhoff* (Science); Cole Scheidler* (DSB); Yu-Hsu (Josh) Chang* (Engineering); Sai Meda* (Science)

Abstract:

The primary objective of our team is to develop a sophisticated cello-playing robot capable of passing the Turing test. This involves not only achieving exceptional mechanical proficiency but also adapting machine learning techniques to make the performance unique and organic. Through the development of our robot, we expect to produce a robot arm capable of playing a basic cello piece at the same level as a human musician. Participants of our future studies will be unable to determine the difference between our robotic musician and a human player. The methodology involves a comprehensive literature review to understand the current state of the art, followed by building the AR4 robot arm prototype. Our project also includes the use of a simulator and motion capture data from the Envision Center to help enhance the robot's movements and angles. Our robot musician has potential implications within music education, where our cello-bot could serve as a teacher. It can allow beginning musicians to focus solely on the left-hand fingerings of their instrument, as bowings are provided by the robotic arm. Additionally, our project can provide valuable insight regarding human-robot interaction. By allowing a human player to operate the left hand of the instrument, synchronizing this movement with a robotic bowing hand can promote better methods of communication between robots and humans.

Keywords: Human-Robot Interaction; Robot Musicianship; AR4 MK2; Robotics; Motion Capture

Mentor(s):

Yung-Hsiang Lu (Engineering); Kristen Yeon-Ji Yun (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1501**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Development of an Audio Synthesizer Utilizing AFTx07 Microcontroller

Innovative Technology/Entrepreneurship/Design

Author(s):

Neha Sharma† (Engineering); Mir Yim† (Engineering); Rohit Lala† (Engineering); Andrew Lykken† (Engineering)

Abstract:

This study presents the development of an audio synthesizer to showcase the capabilities of the AFTx07 RISC-V-based microcontroller, a project currently in development by the SoCET team. The synthesizer integrates various peripherals including GPIO, PWM, and SPI to showcase the functionality of the AFTx07 microcontroller and aims to generate audio output by interpreting MIDI data received from a piano keyboard. This project involves the integration of speakers for sound output, and a display to visualize the corresponding waveforms being generated. Additionally, the synthesizer will incorporate MIDI data processing to extract pitch information, enabling polyphonic synthesis for enhanced musical expression. This project demonstrates a practical application of the AFTx07 microcontroller in audio synthesis, highlighting its potential for diverse embedded systems applications.

Keywords: System on Chip; Audio Synthesizer; Embedded Systems; Microcontrollers; Software

Mentor(s):

Ryan Montsma (Engineering); Cole Nelson (Engineering); Mark Johnson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1502**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Pre- and Post-Pandemic Adolescent Physical Activity Trends and Potential Impacts on Sleep through Analyzing YRBS data (2017-2023)

Life Sciences

Author(s):

Kennedy Sheppard† (HHS); Noa Shoval† (Science)

Abstract:

Introduction: Research suggests that only 30% of US adolescents get at least 8 hours of sleep per night, and 25% of US youth get at least 1 hour of physical activity daily. We hypothesize that decreased physical activity was associated with worse sleep among adolescents across 2017 to 2021, and that the magnitude of the association may have changed during and after the COVID-19 pandemic.

Methods: We utilized the Youth Risk Behavior Surveillance System (YRBS) for our analyses. All respondents to the 2017, 2019, and 2021 national YRBS surveys were included. We used survey weighted ordinal logistic regression to explore the association of physical activity as a predictor (60+ minutes or not of moderate to vigorous activity) with school-night sleep duration as an outcome (<=5 hours, 6-7 hours, 8+ hours), and adjusting for potential confounding variables including gender, age, and race.

Results: The analytic sample included 38,531 adolescents; ages 12 to 18 years old. Across all three years of the data, each additional day of physical activity was associated with a similar increase in the odds of receiving more sleep: in 2017: 1.08 95%CI 1.05 – 1.11, in 2019: 1.09, 95%CI 1.07 – 1.12, and 2021 OR = 1.11 95%CI 1.08 – 1.15.

Conclusion: As hypothesized, increased physical activity was significantly associated with increased sleep. Although the effect size increased somewhat across the three years sequentially, this change was not statistically significant. In the future, it will be important to identify potential effect modifiers of the relationship.

Keywords: YRBS; Adolescents; Sleep; Physical Activity; COVID-19

Mentor(s):

Michelle Garrison (HHS); Saira Shah (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1503**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Image Analysis of Irrigated Crops

Life Sciences


Author(s):

Chi Hun Shin† (Agriculture)



Abstract:

Recent years, remote sensing has become a valuable tool to evaluate agronomic practices in irrigated crop systems. This study visually and statistically identifies stress and biomass accumulation across various management practices for corn and soybean cultivation. Research objectives include georeferencing raw UAS imagery using those images to compute vegetation indices for individual experimental plots, assessing vegetation indices for monitoring irrigation management and crop stress, and evaluating whether management practices result in statistically significant differences.

The experimental field site incorporated rainfed, irrigated, and fertigated (irrigated with infused fertilizer) crops (soybeans and corn) under normal and intensive management. Multispectral images were used to compute the Normalized Difference Vegetation Index (NDVI) using image analysis tools in ArcGIS Pro. The experimental plots were then extracted from the full images and NDVI divided by management practice. For each plot, resampling was used to calculate the mean NDVI values of the pixels. Then,

plot-based values were tested for statistically significant differences using Analysis of Variance (ANOVA) using R-package.

The identification of vegetation indices sensitive to the management practices being observed could contribute to providing actionable insights into optimizing crop water use efficiency, while enhancing crop productivity in corn and soybean, which are both major crops in US. These findings have the possibility to inform real-time decision-making processes aimed at efficient resource utilization in sustainable farming practices.



Keywords: Irrigation Management; Image Analysis; Vegetation Indices; Statistic Difference; NDVI



Mentor(s):

Keith Cherkauer (Agriculture); Dongseok Yang (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1504**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## A Computational Model of the Inferior Colliculus

Mathematical/Computation Sciences

Author(s):

Anushka Shome† (Science)

Abstract:

The inferior colliculus (IC) serves as a crucial structure in the auditory processing pathway. It is a center for the integration of excitatory and inhibitory auditory inputs from various sources, facilitating the processing of complex auditory information within the brain. Understanding how these inputs converge to generate IC spike patterns is crucial for elucidating auditory processing mechanisms and addressing conditions like age-related loss of temporal processing. This study employs computational modeling to simulate cellular and synaptic responses, providing insights into the factors shaping IC spike activity.

A computational model was developed using NEURON to investigate auditory processing mechanisms in the IC. Model parameters include modulation frequencies for excitatory and inhibitory inputs, aged or young, and postsynaptic receptor conductances (NMDA, AMPA, GABA). Excitatory and inhibitory inputs multiple anatomically distinct sources were applied to the neuron model, and spike times and counts were recorded for eight modulation frequencies (8, 16, 32, ...). Mean spike counts were calculated for each frequency, and the data were plotted to illustrate the relationship between spikes and modulation frequency. Vector strength was calculated and included in the graph for frequencies showing significant synchrony to the modulation envelope. Two firing models, sustained and adapted, were implemented, with adaptation modeled using a calcium-activated potassium channel.

The computational model successfully elucidates the role of inhibitory and excitatory inputs, receptor conductances, and adaptation mechanisms in shaping neural responses in the IC.

This study enhances our understanding of auditory processing mechanisms, offering insights into age-related temporal processing changes.

Keywords: Inferior Colliculus; Neuron; Auditory

Mentor(s):

Edward Bartlett (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1505**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Without a Trace: Investigating Residual Effects of Methylmercury on Neuronal Development

Life Sciences

Author(s):

Serena Shughoury† (Science)

Abstract:

Methylmercury (MeHg), a heavy metal notorious for its developmental neurotoxicity, poses a significant threat to the developing brain. Chronic (low dose) exposure to MeHg during brain development has been linked to neurological and developmental deficits, potentially increasing susceptibility to neurodegenerative diseases. Even after cessation of exposure, there are persistent developmental changes in the developing neuron. Prior experiments suggest a link between early exposure and lasting neurotoxic effects, however mercury analysis weeks after the exposure displayed detectable quantities of MeHg in the cultures. We hypothesize that trace amounts of MeHg remained in the plastic of the cell culture plates during the original developmental exposure. To explore this hypothesis, a subset of exposed cells was replated, while the remaining portion underwent no further manipulation. In this study, a human induced pluripotent stem cell (hiPSC)-derived cortical glutamatergic culture was exposed to non-cytotoxic levels of MeHg (0.1 µM) during a critical developmental window (days 7-13 of in vitro culture). Aliquots of daily media formulations, cell pellets, and media samples were collected daily, starting at the initiation of MeHg exposure, while daily brightfield microscope images documented morphological changes. In addition, MeHg concentrations were quantified using a direct mercury analyzer. This study attempts to analyze the long-term effects of MeHg stemming from early, brief exposure, distinguishing whether residual MeHg originates from the culture plates or persists within the cells. This project aims to fine-tune the research methods that investigate the prevailing effect of MeHg neurotoxicity and its implications on the developing brain.

Keywords: Neurotoxicology; Methylmercury; Developmental Exposure; Neuronal Differentiation; Induced Pluripotent Stem Cells

Mentor(s):

Aaron Bowman (HHS); Anke Tukker (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1506**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## In-Vitro Characterization of Ultrafine Particles Using Realistic Parameters to Predict Lung Deposition and Assess Health Effects

Life Sciences

Author(s):

Shiv Shukla† (Engineering)

Abstract:

The recent decades have been marked by the outbreak of several devastating airborne diseases. Most of these are transmitted not only through large respiratory droplets but also through aerosols which are < 5 µm and can remain suspended for several hours. To effectively mitigate pathogenic viruses, it is critical to detect their presence and quantity. Current methods involve using samplers to collect pathogens into sampling media and analysing these collected samples by colony/plaque counting or quantitative polymerase chain reaction (qPCR). However, these methods require the collection of sampling media and extended time for analysing the collected samples. Thus, there is an urgent need for disease diagnostics and control tracing strategies for airborne particles. As a solution, we propose to develop a highly sensitively bifunctional sensor, a visual colourimetry biosensor integrated within an EIS-based electrochemical sensor, that enables whole-cell pathogen detection. In this work, the model target will be specific to influenza viruses by targeting Hemagglutinin (HA), a major glycoprotein found on the surface of influenza that plays an important role in its infectivity by mediating the adsorption of the virus to cell surface receptors. Our method provides a critical component towards overcoming the limitations of existing technologies as it collects samples concentrating aerosols for analysis in developed aptamer functionalized electrodes. Our ultimate goal is to put forward a platform technology that could be easily customized for a variety of airborne pathogens by targeting their surface biomarkers. This system will enable a proactive, rapid-response, and intelligent disease control measure in the future.

Keywords: Environmental Aerosols; Materials Surface Science; Biosensors and Bioelectronics; Chemical Sensors; Air Quality

Mentor(s):

Lia Stanciu (Engineering); Teresa Carvajal (Engineering); Abbey Koneru (Engineering); Karen Gutierrez Parra (Pharmacy); Amit Barui (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1507**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# FAM210A Mediates Skeletal Muscle Regeneration After Injury and Promotes Myogenic Differentiation

Life Sciences

Author(s):

Erik Sillaste† (HHS, JMHC)

Abstract:

Skeletal muscle serves many critical functions for health. Resident muscle stem cells can efficiently repair muscle injury through activation, proliferation and differentiation. Yet during aging and other disease conditions, the functions of the muscle stem cell can decline, leading to blunted regeneration of skeletal muscle and therefore muscle performance, causing morbidity and mortality in humans. With findings of a positive correlation between Fam210a and master regulator of myogenesis--Myod1, we hypothesized that FAM210A may promote myogenic differentiation and skeletal muscle regeneration. To this end, we performed myoblast cell culture to examine the expression pattern of Fam210a during differentiation and used tamoxifen-inducible Cre recombinase to knock out Fam210a in mouse models to examine the regeneration process. In summary, we have determined that FAM210A level increases during muscle differentiation, paralleling other muscle differentiation markers such as MF20. We have also found that Fam210a deletion in muscle stem cells led to impaired regeneration of the muscle after chemically induced injury. These findings point to a potential for targeting FAM210A in muscle stem cells as a therapeutic target in the aging or injured muscle.

Keywords: Skeletal Muscle; FAM210A; Muscle Regeneration; Satellite Cells; Myogenic Differentiation

Mentor(s):

Shihuan Kuang (Agriculture); Jingjuan Chen (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1508**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## DMA Controller with Cache Coherence and Trigger Mechanism

Innovative Technology/Entrepreneurship/Design

Author(s):

Vidisha Singhal† (Engineering)

Abstract:

Direct memory access is a method of transferring large volumes of data to and from peripheral I/O devices without the involvement of the processor, ideally increasing system efficiency. SoCET’s current DMA controller implementation poses numerous limitations: it supports only single core functionality and is incompatible with the in-progress dual core system on chip, lacks flexibility due to hard-coded memory addresses, and doesn't support an autonomous trigger mechanism. Therefore, this project aims to develop a flexible and extensible DMA controller compatible with cache coherence. The DMA controller will be implemented and tested using SystemVerilog and will be capable of handling dual core requests. To reduce bus traffic and eliminate the need for an arbiter, cache coherence will be implemented in software. The software will be used to evict data from caches to ensure that the DMA controller operates on the most up-to-date data. A software driver for the DMA controller will also be implemented. The SystemVerilog codebase for the DMA and C codebase for the software driver will undergo unit testing with test benches. As future work for subsequent semesters, we expect to implement additional features like trigger mechanism for the DMA controller.

Keywords: DMA; Cache Coherence; Trigger Mechanism; Multi-Core; SoC

Mentor(s):

Mark Johnson (Engineering); Cole Nelson (Engineering); Ananya Srivastava (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1509**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## ECELabs.io

Innovative Technology/Entrepreneurship/Design

Author(s):

Harrison Smith† (Engineering)

Abstract:

This research project aims to develop a comprehensive remote access platform for hardware labs in Electrical and Computer Engineering (ECE) and other disciplines at Purdue University. The primary objective is to facilitate online access to essential hardware resources, enhancing the learning experience for students in digital design, embedded systems, analog electronics, and related courses.

Current initiatives include migrating the website to a new framework with a Django backend and React frontend. Additionally, hardware and software dashboards are being developed to monitor performance statistics. The hardware dashboard utilizes Python scripts and Django to collect and display data from servers and Raspberry Pi's running the website. The software dashboard integrates Google Analytics to collect information, such as site traffic. This combined data not only explains and prevents website crashes but also identifies user-related issues, contributing to an enhanced user experience.

The dashboard holds implications for the ongoing development and management of the project, providing insights and tools previously unavailable. This is particularly crucial as the new version of ECELabs.io is developed and released. The project actively expands its feature set to include a broader range of ECE labs and lays the groundwork to support other majors/classes, such as ECET. Continuous improvement in website features and reliability has the potential to profoundly impact the educational experiences of students.

Keywords: Performance Statistics Monitoring; Remote Access Platform; Hardware Lab Educational Experiences; Python, Django, React; User Experience Enhancement

Mentor(s):

Junfei Li (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1510**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Innovative Solutions for Cleaner Air Travel: Ammonia as an Alternative Jet Fuel

Innovative Technology/Entrepreneurship/Design

Author(s):

Parker Smith† (Engineering)

Abstract:

As the aviation sector seeks to mitigate its environmental impact, the exploration of alternative jet fuels gains prominence. This study investigates the feasibility of utilizing ammonia as a sustainable fuel source for aviation propulsion systems. Employing a scaled-down model mimicking a larger thruster configuration, the research assesses an ammonia-based fuel mixture's performance and emissions characteristics. The experimental setup incorporates a manifold combining ammonia with hydrogen, nitrogen, and air to create a combustible mixture. Through systematic testing of this small-scale system, parameters such as thrust output, combustion efficiency, and emissions profiles will be evaluated. Additionally, the study aims to analyze the feasibility of integrating ammonia as a practical alternative within existing aviation infrastructure. Anticipated results include insights into the combustion behavior of the ammonia-based fuel blend, as well as quantification of emissions. Furthermore, the research endeavors to elucidate any operational challenges and optimize the fuel formulation to enhance performance and environmental compatibility. By providing empirical data on the viability of ammonia as an aviation fuel, this study contributes to the ongoing efforts toward achieving cleaner and more sustainable air travel practices.

Keywords: Alternative Jet Fuels; Clean Air Travel; Sustainability Efforts; Emissions Characteristics

Mentor(s):

Venkat Athmanathan (Engineering); Terry Meyer (Engineering); Chintan Rank (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1511**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Erosion, Aesthetics, and Acceptance: A Shoreline Story in Data and Design

Social Sciences/Humanities/Education

Author(s):

Colby Smock† (Agriculture); Gabriela Nivar‡ (Agriculture); Rachael Herring‡ (Agriculture)

Abstract:

Our research explores the diversity of attitudes and perspectives of homeowners along the Indiana Lake Michigan Shoreline using survey methodology to understand the rapidly changing conditions they have observed in recent history. The shoreline of Lake Michigan in Indiana 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 areas. This has put the communities along this shoreline in a dire spot as they risk losing their beaches and homes along the lakeshore. The data collected from the survey we developed and implemented will help these communities understand how to move forward with planning and provide a foundational understanding of landowner attitudes to support informed decision-making with their shoreline management. A key part of our survey questioned residents on the effectiveness, aesthetics, access, and acceptability of six different shoreline management solutions. This led us to wonder if effectiveness, aesthetics, or access had the biggest impact on acceptability. What is driving, which solutions are deemed acceptable, and which are not? After running a regression analysis on our data, we found that aesthetics had the strongest relationship to acceptability. This highlights the importance of keeping in mind the visual aspect of shoreline management solutions . This is where data meets design to help inform the creation of aesthetically pleasing design solutions that not only are effective but also breathe beauty into the shoreline.

Keywords: Data Meets Design; Shoreline Erosion Management; Aesthetically Pleasing Design

Mentor(s):

Aaron Thompson (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1512**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Enhancing Autonomous Vehicle Perception: A Transformer-Based Approach for Aerial Road Representation

Mathematical/Computation Sciences


Author(s):

William Stevens† (Science); Vishal Urs† (Engineering); Karthik Selvaraj† (Engineering, Science); Gabriel Torres† (Engineering); Gaurish Lakhanpal† (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 works, we have implemented multi-task neural network models according to various architectures, such as YOLOv4 and DETR. These models, trained on the BDD100k dataset, produced detections and classifications of objects, as well as segmentations and classifications of lane lines, in an image. While these models were successful, they only highlighted relevant features on the images, which is not useful information to driving software. Thus, this semester we explored a new approach to lane segmentation that would produce a more useful output: an aerial representation of the road structure when given ground-level images. The design we have explored involves using an optimized neural network structure containing multiple transformers, inspired by the LaneSegNet and BEVFormer architectures. This process has involved the research, development, integration, and testing of new concepts, including Deformable Attention and Perspective Feature Transformation, in order to produce a model that can accurately and efficiently translate ground-level captures into an aerial view of the road features. This will provide autonomous driving software with more useful information and context, such as the position and direction of road lanes relative to the vehicle. This new structure will allow our model to accurately perform the important vision tasks for autonomous driving at a low computation cost, while producing information relevant to the autonomous driving pipelines used in the real world.



Keywords: Machine Learning; Computer Vision; Transformers; Autonomous Driving



Mentor(s):

Edward Delp (Engineering); Carla Zoltowski (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1513**

*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Flow of protein/colloidal solutions through a soft-porous gel matrix

Physical Sciences

Author(s):

Madeline Stevenson† (Engineering); Faith Chapman† (Engineering); Krttika Goel† (Engineering)

Abstract:

Biotherapeutic research is expanding exponentially with innovative treatments on the horizon. However, these medications require biological molecules that cannot easily pass through tissues. Molecular transport has been a limiting factor of therapeutic efficacies or bioavailability. The current study elucidates flow of colloidal solutions through hydrogel and understands the relationship of hydraulic permeability, to eventually improve efficacy of drug delivery. There is a scarcity in studies involving the flow of suspended fluids through collagen hydrogel. The hydrogel is synthesized using collagen type 1 and varying ratios of hyaluronic acid to resemble tissue microenvironment. Pressure gauges measure the inlet and outlet pressure of fluid through the gel. Given pressure data, the flow rate of the colloidal solution within the hydrogel can be calculated and compared to other particles. Initial iterations implemented water trials to ensure accurate pressure measurements. The preliminary system lacked the necessary cross-sectional area for successful fluid mobility resulting in severe shearing of the hydrogel. The modified system requires a greater volume of hydrogel and yields a higher success rate of flow through the porous gel. Future work includes increasing the variety of particles used in experiments. The target particle diameter is in the magnitude of proteins. Hydrogel concentrations and particle size will be varied to more accurately model colloidal flow through soft materials.

Keywords: Collagen Hydrogels; Permeability; Colloidal Solutions; Drug Delivery; Porous Media

Mentor(s):

Arezoo Ardekani (Engineering); Harsa Mitra (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1514**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Evaluating the Relationship of an Arthrobacteriophage's gene with Streptococcus Bacterium**

Life Sciences

Author(s):

Gianna Stinsa† (Engineering); Kate Stanton† (Engineering); Joyce Yu† (Pharmacy); Alyssa Hudgins† (Engineering); Jingyi Ji† (Science, JMHC); Morgan Laskowski† (Science)

Abstract:

Bacteriophages are viruses that can infect and replicate within a bacterial cell, infecting certain host ranges. With the increase of antibiotic-resistant bacteria, bacteriophages provide promising new treatment methods to improve patient outcomes but have a lack of known research. The specific bacteriophage researched in this study, Pitbull, is an Arthrobacteriophage that specifically infects Arthrobacteria. Pitbull was recently discovered and sequenced at Purdue University. Within the genome of the novel Arthrobacteriophage a specific gene located from base pair region 25985-26140, had a strong sequence similarity for a gene within the Streptococcus bacterium via HHPred. Since this gene has a similar sequence to a gene in Streptococcus bacterium into its genome, a potential horizontal gene transfer may have occurred due to its common phenomenon in nature. To understand more about the relationship between the gene products in Streptococcus bacterium and Pitbull, the different functions and uses of the respective gene products were investigated. This research aims to evaluate the implications of the genetic relationships between bacteria and their specific phages to fill in gaps in clinical knowledge. To demonstrate this relationship better, Pymol was used to model the two gene products. This research investigated not only the function and form of the gene products across the phage and Streptococcus, it aimed to understand more about how the relationship can influence clinical outcomes.

Keywords: Bacteriophage; Streptococcus Bacterium; Arthrobacter; Clinical Therapeutics

Mentor(s):

Harry Ashbaugh (Engineering); Kari Clase (Engineering); Daphne Fauber (Engineering); Adam Quinn (Agriculture); AJ Gin (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1515**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Investigating the Impact of Voltage on Protein Stability in Electrostatic Spray Drying for Pharmaceuticals

Life Sciences

Author(s):

Drake Strait† (Agriculture, JMHC)

Abstract:

Polarity significantly impacts protein structural integrity. Even slight alterations in their microenvironment can disrupt their tertiary structure, leading to detrimental effects on the quality of products that incorporate biological materials. Electrostatic spray drying (ESD) emerges as a novel technique and offers a promising formulation alternative for proteins and peptides. ESD converts liquid solutions into solid particles by synergizing spray drying conditions, heat, and electrical voltage to potentially enhance protein stability. Yet, the precise influence of voltage on protein stability during spray drying remains underexplored. This study determines the activity differences between spray-dried and non-spray-dried solutions, aiming to assess ESD's impact on protein structural integrity. We focus on characterizing the ESD-generated particles in terms of size, distribution, stability, and evaluate their applicability for inhalable pharmaceuticals targeting lung deposition. Catalase was used to evaluate potential changes in activity post-ESD. Catalase's reaction with H2O2 provided a baseline, with absorbance signifying 100% activity. Stored for a week under refrigerated and frozen conditions, control samples maintained 50% activity. In contrast, spray-dried catalase at various voltages, stored under the same conditions, demonstrated 80% activity, indicating ESD's potential in preserving protein integrity, particularly with voltage optimization. These findings suggest that the ESD process, particularly when optimized with specific voltage settings, can preserve the structural integrity of proteins, eliminating the uncertainty against environmental stressors during spray drying. Achieving this milestone will provide critical insights that will inform the subsequent phase of our project related to the particle properties in the environment that affect the lung.

Keywords: Electrostatic Spray Drying; Voltage; Protein Stability; Environmental Stressor; Inhalable Pharmaceuticals

Mentor(s):

Teresa Carvajal (Agriculture); Karen Gutierrez Parra (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1516**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Facilitating Enzyme Deposition for Imaging of N-linked glycans using a Mini-humidifier**

Physical Sciences

Author(s):

Erik Sveen† (Science)

Abstract:

N-linked glycans are widely used for the diagnosis of cancers, diabetes, and other diseases. Mass spectrometry imaging (MSI) is a powerful technique for studying the spatial localization of N-linked glycans in biological tissues. Analyzing N-linked glycans requires the deposition of an enzyme onto a biological tissue section to release them from proteins. However, current instrumentation for enzyme deposition is expensive and not readily accessible to laboratories employing liquid-extraction MSI methods. Here, we utilized a mini-humidifier to apply peptide N-glycosidase F (PNGase F) for MSI analysis of N-linked glycans present within mouse brain tissue sections. Furthermore, we combined enzyme application with on-tissue chemical derivatization to enhance the sensitivity of MSI towards N-linked glycans. Our results demonstrate that the mini-humidifer is a cost-effective and efficient option for PNGase F deposition enabling N-linked glycans analysis by MSI. Additionally, hydrazide reagents were employed to increase the hydrophobicity of N-linked glycans, enhancing their ionization efficiency and detection during MSI analysis. This work presents an alternative approach for enzyme application on biological samples to study the spatial localization of N-linked glycans using MSI.

Keywords: N-Linked Glycans; Mass Spectrometry; Chemical Derivatization; Electrospray Ionization; Mass Spectrometry Imaging

Mentor(s):

Julia Laskin (Science); Miranda Weigand (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1517**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## How does a machine learning image classifier improve the workflow of a wildlife monitoring project?

Mathematical/Computation Sciences


Author(s):

Anthony Tan† (Science); Sierra Hunnicutt‡ (Science, JMHC); Hannah Reyes Charles‡ (Agriculture, JMHC); Katie Hong‡ (Agriculture); Zhixin Cai‡ (Science, JMHC); Ryan Feller‡ (Science, JMHC); Luca Iacobucci‡ (Agriculture)



Abstract:

Wildlife monitoring projects often rely on manual methods for species identification and population estimation, posing significant challenges in terms of time, cost, and accuracy. Integrating machine learning image classifiers such as Microsoft's MegaDetector offers a promising solution to streamline and enhance these workflows. Many wildlife monitoring projects deploy motion-activated remote cameras (camera traps) for long periods of time to automatically take pictures and videos of animals in a non-invasive manner. This generates hundreds of pictures and hours of video which takes researchers significant time to manually review and annotate. MegaDetector is a free, openly available object detection model created specifically for processing and labeling camera trap data. This revolutionary model has a precision rate of 82% for animal detection, reducing the average time required for manual processed by 8.4 times assessed by Fennell et al, 2022. While this model delivers promising results, there exists gaps in its capabilities: few datasets and trained models exist on mammals specific to Indiana. We aim to create datasets of animal images captured on cameras traps in Indiana and train MegaDetector to accurately classify these animals. We will train the classifier using four categories: deer, small mammals, mesocarnivores, bobcat, and birds. We collected images from camera trap sensors (n=16) over a period of five months (September 2023 to March 2024) and captured 18,000 images. We manually labeled the captured images to serve as ground truth for the model output. We predict that the new model will assist in camera trap workflows to accelerate research.



Keywords: Artificial Intelligence; Wildlife Monitoring; Computer Vision; Species Classification; Object Detection



Mentor(s):

Kristen Bellisario (JMHC)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1518**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Self-Navigated Unpowered Dart

Innovative Technology/Entrepreneurship/Design


Author(s):

Emma Teng† (Engineering); Rongbo Hu† (Engineering); Nicholas Martel† (Engineering); Connie Kang† (Engineering); Mary Earp‡ (Engineering, JMHC); Kalea Gin‡ (Engineering)



Abstract:

While the remote-control plane and glider have been prevailing for years, the idea of combining them is rare to see. Our research aims to develop an unpowered dart with an autopilot system implemented. With a specialized launcher, the dart will be launched at high speed. Then, using the camera, it will track the target light and maneuver attitude to hit the target light. Because of the high speed and short distance, the time required to track the target must be short, and the accuracy of attitude control must be high.

This project is broken down into several parts: modeling, target identification, and attitude control. To prevent the dart from rolling, we designed it in a completely symmetric shape and also kept the inside parts as symmetric as possible to prevent the center of gravity from deviating from the centerline. With the speed it will be launched, we can predict the dominant flow will be turbulent. In order to maintain its longitudinal and directional stability, we maximize the wingspan, which also provides to higher lift coefficient.

For target recognition and control, we plan to use a miniature FPGA in conjunction with two OV2640 cameras to achieve image recognition. The FPGA will automatically detect the target (a green LED target is 55mm and 10cd) within the camera's frame and control the flight attitude of the dart. We chose FPGA because its parallel computing capabilities can quickly make judgments and adjust the dart's posture within an extremely short flight time.



Keywords: Self-Navigated; Engineering; Image Recognition; Aerospace


Mentor(s):

Abolfazl Hashemi (Engineering); Shivam Bhat (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1519**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Interoperability Failures in Deep Learning Model Converters: A Case Study in the ONNX Ecosystem

Mathematical/Computation Sciences

Author(s):

Arav Tewari† (Science)

Abstract:

Many software engineers develop, fine-tune, and deploy deep learning (DL) models. They use DL models in a variety of development frameworks and deploy to a range of runtime environments. In this diverse ecosystem, engineers use DL model converters to move models from frameworks to runtime environments. Conversion errors compromise model quality and disrupt deployment. However, failure modes and patterns of DL model converters are unknown. This knowledge gap adds engineering risk in DL interoperability technologies. We conduct the first failure analysis on DL model converters. Specifically, we characterize failures in model converters associated with ONNX (Open Neural Network eXchange). We analyze failures in the ONNX converters for two major DL frameworks, PyTorch and TensorFlow. The symptoms, causes, and locations of failures are reported for N=200 issues. We also evaluate why models fail by converting 5,149 models, both real-world and synthetically generated instances. Through the course of our testing, we find 11 defects (5 new) across torch.onnx, tf2onnx, and the ONNX Runtime. We evaluated two hypotheses about the relationship between model operators and converter failures, falsifying one and with equivocal results on the other. We describe and note weaknesses in the current testing strategies for model converters. Our results motivate future research on making DL software simpler to maintain, extend, and validate.

Keywords: Machine Learning; Artificial Intelligence; Failures; Software Engineering; Computer Science

Mentor(s):

James Davis (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1520**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Influences of AI in the Medical Field

Mathematical/Computation Sciences

Author(s):

Andy Trinh† (Polytechnic)

Abstract:

The integration of Artificial Intelligence (AI) across various academic disciplines has yielded transformative advancements in contemporary society. This paper offers a comprehensive examination of AI's profound influence, particularly emphasizing its pivotal role in medical sciences, while also addressing practical challenges and limitations associated with its deployment. Drawing upon multiple sources and research, the argument synthesizes AI's critical role in shaping research ventures in genetic engineering, medical imaging, and disease detection, underscoring its adaptability across diverse contexts and its capacity to deliver unprecedented outcomes. Research has conclusively demonstrated that AI-powered systems significantly outperform traditional approaches across various domains. In genetic engineering and genome editing, AI implementation notably enhances the precision of CRISPR technology, improving on-target efficiency while minimizing off-target effects in guiding RNA. Similarly, AI-driven analyses utilizing advanced medical imaging modalities such as PET, MRI, and CT scans have led to substantial advancements in predictive accuracy and diagnostic precision across a range of diseases. Furthermore, this paper highlights AI's recent and compelling application in predicting the presence of COVID-19 in humans with an accuracy of 99.76%. These findings underscore AI's remarkable potential as a critical driving force behind the innovation of genetic engineering, radiology, and disease detection within the medical field, while also acknowledging the challenges researchers must overcome in its implementation.

Keywords: AI; CRISPR; Medical Imaging; Disease Detection; Machine Learning

Mentor(s):

Sidney Ducleroir (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1521**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Multifunctional Materials in Aerospace and Applications to Quadcopter Drones

Innovative Technology/Entrepreneurship/Design

Author(s):

Steven Turnbull† (Engineering); Lisa Li† (Engineering, JMHC); Cheyenne Huang† (Engineering); Ananya Prasad† (Engineering); Tatiana Varela† (Engineering, JMHC); Pranav Singh† (Engineering, JMHC)

Abstract:

Multifunctional materials have the ability to infuse additional functions into the material, potentially reducing mass while increasing functionality. This is of great interest in aerospace applications such as quadcopter drones. This research seeks to develop, model, and implement a variety of multifunctional materials on a representative quadcopter architecture. First, material that can sense its own deformation can be used to detect damage or movement. Therefore, the use-case of creating a filament for additive manufacturing of this material becomes apparent. Such self-sensing materials can be created by adding in a conductive filler to a preproduced flexible filament to create a microscopic matrix that changes material resistivity based on deformation. Second, materials can be modified with piezoelectric ceramics to be used in energy harvesting. Piezoelectric materials generate a voltage when under mechanical stress, which can be used to convert kinetic energy into electrical energy to charge batteries, capacitors, etc. Third, modifying a material with multiple nanofillers that impart different properties can result in synergistic effects. Particularly, adding both carbon nanotubes (an electrical nanofiller) and iron nanoparticles (a magnetic nanofiller) to a polymer matrix composite can result in larger changes in electromagnetic properties than those achieved by incorporating either nanofiller alone. Fourth, the domains of multifunctional materials can be modeled using commercial finite element meshing software such as Trelis. Given voltage measurements, these models can detect damages by determining the conductivity distribution of the domain. Components manufactured from these materials will be employed on a commercial quadcopter to demonstrate and verify their capabilities.

Keywords: Multifunctional Materials; Quadcopter Drones; Additive Manufacturing; Energy Harvesting; Finite Element Method

Mentor(s):

Tyler Tallman (Engineering); Saranya Ravva (Engineering); Estheru Talasila (Engineering); Kelsey De La Trinidad (Engineering); Andrew Nguyen (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1522**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Widening Concrete Elements Using Chemical Anchoring Systems

Innovative Technology/Entrepreneurship/Design

Author(s):

Vanessa Grace Uy† (Engineering); Sharma Kashish* (Engineering)

Abstract:

Bridges are engineered to facilitate traffic flow. However, rising populations have caused the initial limits of these bridges to be exceeded, leading to traffic congestion. Bridge widening was suggested to accommodate increasing demand, but current widening methods recast the bridge, a costly and time-consuming operation. The study develops design provisions for post-installed chemical anchoring systems to the existing structure. In this method, recasting is not needed. A hole is drilled into the existing structure, cleaned, and filled with epoxy. Then a rebar is installed into the hole to be used as an anchor to the extension. To develop design provisions for this method, 30x14x18-inch slabs of concrete are used to simulate the existing structure and its limitations in a series of tests. The chemical anchoring method was performed on the slab, whose rebar is then attached to a jack and gradually loaded until failure occurs. Preliminary tests of the setup failed at a load of 40 kips with a post-installed rebar embedment depth of 9 inches. The widths and locations of the cracks formed during testing were recorded using a series of potentiometers on the specimen. Parameters explored include rebar embedment depth and sizing and also transverse and longitudinal reinforcement. Further study on this topic can investigate other parameters like the contact splice of the pre-existing rebar in the structure and the newly added rebar.

Keywords: Bridge Widening; Post-Installed Rebar; Chemical Anchoring Systems

Mentor(s):

Akanshu Sharma (Engineering); Dheeraj Waghmare (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1523**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# The Relationships between Sources of Support, Stressor Types, and Level of Psychological Stress among Latine Youth from Rural and Agricultural Families

Social Sciences/Humanities/Education

Author(s):

Daniela Valencia† (HHS)

Abstract:

Psychological stress can contribute to mental health challenges in Latine youth. Social support can buffer against psychological stress. Although researchers have identified multiple stressors youth face daily, how they seek social support in the face of different stressors is unclear. This study explored social support among Latine youth and the associations of these supports to stressor types and levels of psychological stress. This study used first-wave data from a longitudinal mixed-methods study. Forty-three Latine adolescents (Mage = 11.72 SD = 1.40; 50% males, and 48.8% born outside of the U.S.) from rural and agricultural families completed an interview and survey. Thematically extracted codes were compared with psychological stress scores. Participants experienced stress levels ranging from never to always (M= .92).  Youth shared feeling stressed about school (e.g., grades, homework), family (e.g., housework, family troubles), and other stressors (e.g., being alone, never winning a game). When experiencing stressors, youth sought help from multiple sources, including family members (e.g., aunts, mother), peers (e.g., friends, classmates), and teachers. Crosstab analysis revealed that family and peers were the most commonly sought-after sources of support and those who sought support from family and peers experienced lower levels of psychological stress. Findings highlight the important role families and peers play in fostering Latine youth's mental health. The study provides insights about social support as an interpersonal coping strategy against stressing stress, but further research is needed to explore the dynamic interplay between stressors, sources of support, and well-being longitudinally.

Keywords: Social Support; Psychological Stress; Latine Youth; Rural; Agricultural

Mentor(s):

Yumary Ruiz (HHS); Xue Jiang (HHS); Zoe Taylor (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1524**

*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Straw Cover Increases Garden Soil Microbial Biodiversity**

Life Sciences

Author(s):

Emory Walker† (Science); Mara Welty† (Science, JMHC); Emma Creviston† (Science)

Abstract:

Gardens are essential as a low-cost source of vital nutrients. Diverse garden soil microbiomes are vital for cycling nutrients which improve plant health and production yield. This project studied the impact of straw cover on a garden soil's microbiome. The soil samples for sites with straw coverage and sites without straw coverage were collected from the Erie Street GrowLocal community garden in Lafayette, IN. We examined functional biodiversity using carbon source utilization analysis (EcoPlate). Results were used to calculate Shannon Diversity Index, Evenness, and Richness values. Genetic biodiversity of the soil's bacteria species was determined by genomic DNA extraction followed by 16S ribosomal RNA sequencing. Sequences were processed and analyzed with Nephele DADA2 and QIIME2.0 pipelines. Finally, the soil moisture content and pH were evaluated, as they have been shown to impact soil microbial biodiversity. Interestingly, straw cover increased moisture content, which previously has been shown to help plant-specific growth and production yield in gardens. The bacteria in the straw covered soil showed an increase in carbohydrate preference, decrease in carboxylic acid preference, and a significant increase in Shannon Diversity Index and Richness values via the carbon source utilization data. Finally, the 16S ribosomal RNA sequencing showed a significant increase in Evenness for soil with straw cover. In summary, straw coverage improved the soil's microbial biodiversity and moisture content. These findings indicate a possible benefit of straw coverage use in garden spaces, with the goal of providing more high-quality food products to communities.

Keywords: Soil Microbiome; Community Engagement; Garden Production Yield; Carbon Utilization; Straw Coverage

Mentor(s):

Jacob Adler (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1525**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Systematic Analysis of Appointing Party Preference of the Experiential Profiles of US Circuit Court Judges Over Time**

Fine Arts

Author(s):

Julia Weeden† (Liberal Arts); Priyadevi McNamara† (Science)

Abstract:

While the judicial branch is seen as more distanced from the everyday political power struggles of the other two branches, it still has immense power, and when the other branches have the opportunity to use it to further their political agendas, they take it. One specific way in which the political parties try to gain power is through the process of nominating judges. Thus, our research aims to determine if there is a correlation between the political party affiliation of the appointing president, and the professional experience of the people they appoint. We also track this relationship over time, from 1900 until today, to see if there is a change in the desired professional experiences of these judges. In order to understand this relationship, we are utilizing data sets provided by the Federal Judicial Center. These data sets include information on the professional experiences of the 3,925 who sat on the US circuit bench between 1900 and the present. This research will provide insight into what presidents are looking for in their appointments of Circuit Court judges and how their party affiliation plays into these choices.

Keywords: US Circuit Court Judges; Experiential Profiles; Political Parties

Mentor(s):

Eric Waltenburg (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1526**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Comparative analysis of bacteriophages in related clusters encoding pyrophosphatases.

Life Sciences

Author(s):

Tristen West† (Science); Zion Hackett* (Engineering); Lucas Urquiaga* (Agriculture); Umbert Creighton Caseres* (Liberal Arts); Dane Phillips* (Science); Ryan Lee* (Pharmacy)

Abstract:

Bacteriophages (phages) are viruses that infect and replicate within a bacterial host. With increasing prevalence of antimicrobial resistance in bacteria, they provide a promising alternative to modern antibiotics. The bacteriophage Pitbull was recently isolated from West Lafayette, Indiana using the bacteria, Arthrobacter globiformis. The phage’s genome included a gene product coded from base pairs 33633-34013 which produces a pyrophosphatase enzyme. Based on previous literature, bacteriophages including pyrophosphatases are seemingly rare and little is known about their role in phages themselves. The function of the enzyme is to hydrolyze pyrophosphates, provide phosphate as a reagent in many cellular processes, increase metabolic efficiency, and aid in nucleic acid metabolism. This function was determined via genomic comparative analysis using bioinformatic tools including HHPred and various protein BLAST programs. These bioinformatic tools work by comparing similar gene products and genomic structure, which are then grouped together into clusters of genomic similarity. This review will consist of a comparative analysis of phages from different clusters to identify the prevalence of pyrophosphatase enzymes in phages in order to determine the function of these enzymes in the bacteriophage Pitbull.

Keywords: Bioinformatics; Bacteriophage; Pyrophosphatase; Comparative Analysis; Biotechnology

Mentor(s):

Harry Ashbaugh (Engineering); Daphne Fauber (Engineering); AJ Gin (Engineering); Adam Quinn (Agriculture); Kari Clase (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1527**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Heat Sink Design for Metal Additive Mnaufacturing

Innovative Technology/Entrepreneurship/Design

Author(s):

Mark Wise† (Polytechnic); Akshay Padmanabhuni‡ (Polytechnic); Lance Berendes‡ (Polytechnic)

Abstract:

This research project focuses on enhancing the performance of heat sinks manufactured through additive methods. By leveraging additive manufacturing techniques, we aim to develop heat sinks which minimize metal powder usage and maximize heat transfer. Our approach involves subjecting candidate heat sinks to forced convection in a specialized wind tunnel. Heat is introduced to the heat sink via four cartridge heaters, transferred through the heat sink, and dissipated by convection and radiation. Through a systematic investigation we assess various heat sink designs, with emphasis on creating complex geometries and simulating airflow through them using computational fluid dynamics. The heat sink designs that demonstrate the greatest Figure of Merit (FOM), based on mass of the heat sink and heat transfer rate, will be selected for further development and experimental testing.

Keywords: Heat Sink; Additive Manufacturing; Forced Convection; Thermal Management; Thermal Optimization

Mentor(s):

Jason Ostanek (Polytechnic); Bill Hutzel (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1528**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

# Using Crystal Sizes in Volcanic Rocks from the Deccan Traps Large Igneous Province to Determine Lava Cooling Rates

Physical Sciences


Author(s):

Cayden Woolery† (Science)



Abstract:

The Deccan Traps, located in western India, is one of the most consequential Large Igneous

Provinces in the world because of the large volume of lava extruded and because of its relation to the Cretaceous – Paleogene boundary extinction of the non-avian dinosaurs.  One way to date the tempo of eruptions in the Deccan Traps lava flows is to measure noble gasses produced in the tops of the lava flows when they were exposed to cosmic rays, before being buried by the next lava flow. However, burial by the next hot lava flow may also cause some of those noble gasses to be lost, so it is important to determine how quickly the lava flows cool. To accomplish this, I analyzed thin sections of Deccan Traps volcanic rocks under a polarizing microscope. I counted and measured the size of hundreds to thousands of plagioclase crystals in representative regions of the thin section. I will use the crystal size distributions of the plagioclase crystals I observe to determine the rate of cooling. The rates of cooling I determine will inform models of cosmogenic noble gas loss from the lava flows targeted for dating, and ultimately enable us to more accurately determine the tempo of volcanic eruptions in the Deccan Traps.



Keywords: Volcanic Rock; Lava Cooling Rates; Crystal Size; Deccan Traps



Mentor(s):

Marissa Tremblay (Science); Nick Meszaros (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1529**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Evaluating Big Tech's "Commitment" to Human Rights

Social Sciences/Humanities/Education

Author(s):

Madeleine Yang† (Engineering); Enice Zhu† (Liberal Arts); Maggie Collins† (Liberal Arts)

Abstract:

What do human rights mean to tech companies? New European regulations mandate very large online platforms such as Facebook and Google to conduct human rights-centered assessments to identify and mitigate systemic risks. Some companies already include disclosures relating to valuing human rights such as freedom of expression and civil and political rights in their transparency reports. Fewer still have adopted specific human rights policies accompanied by bureaucracies.  How do companies view their human rights obligations? This poster uses an original database on corporate transparency reports constructed by the International Politics and Responsible Tech (iPART) lab at Purdue to conduct qualitative content analysis and reveal contested meanings of "human rights" in platform public discourse. The preliminary analysis draws upon Apple, Meta (Facebook, Instagram), and Microsoft in the text corpus, but extends the implications to technology corporations more broadly as the industry scrambles to respond to increasing demands for human rights responsiveness. Specifically, the analysis foregrounds how very large online platforms (1) interpret the scope of their international human rights obligations; and (2) mobilize international human rights discourse to legitimate their self-regulation. The research also explores the power implications of Big Tech's "good faith" use versus cooptation of international human rights law and principles for global governance.

Keywords: Technology; Regulation; Human Rights; Content Analysis; Global Corporations

Mentor(s):

Swati Srivastava (Liberal Arts); Alexander Wilhelm (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1530**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

**Optimizing Data Center Software for Energy Efficiency Using LLMs**

Mathematical/Computation Sciences

Author(s):

Fa Yan† (Engineering); Arjun Gupte† (Engineering); Bryan Lee† (Science)

Abstract:

One driver of increased energy usage in the US is a growing reliance on computing in data centers. Researchers have improved traditional performance characteristics of data centers (lower latency, higher throughput, greater parallelism) but we know less about improving their energy efficiency. This research aims to create a framework to leverage Large Language Models (LLMs) to enhance the energy efficiency of software in data centers. In the first phase of this framework, large codebases of data center applications are fed into an LLM to optimize for energy efficiency, utilizing Retrieval Augmented Generation (RAG) to address the token limit and to enhance contextualization. To further enhance the quality of the generated code over multiple iterations, we introduce an automated feedback mechanism consisting of an LLM for improved code generation and another for evaluation. The code output from the generator is combined with an estimate of its energy usage, and this combined information is fed to the evaluator LLM. The evaluator analyzes the energy usage data and provides natural language feedback to the generator, prompting it to perform further optimizations if necessary.

Keywords: Large Language Models (LLMs); Data Center Software Optimization; Software Energy Usage; Prompt Engineering; Retrieval Augmented Generation (RAG)

Mentor(s):

James Davis (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1531**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## New Materials for Accelerated and Eco-Friendly Photonic Integrated Circuits

Mathematical/Computation Sciences


Author(s):

Kevin Yu† (Engineering)



Abstract:

Research Head:

- Dr. Peter Bermel (Electrical and Computer Engineering Professor, Purdue University)

Research Peers:

- Mr. Jie Zhu (Electrical and Computer Engineering Graduate Student, Purdue University)

- Mr. Ruihan Chen (Electrical and Computer Engineering Graduate Student, Purdue University)

ABSTRACT

The experience of devices slowing down and heating up under high computing loads is all too familiar, and this may only grow more problematic as AI moves from the cloud to personal devices. A primary reason for these issues is the energy needed to send and receive signals between sub-chips on heterogenously integrated circuits. Photonic interconnects, which send digital signals using photons rather than wires, are a promising option for reducing the energy demand and communication bottleneck between circuits in system-on-chip (SoC) designs. While photonic interconnects are the norm for optic-fiber communication, a materials system that can modulate optical signals at a micron scale is not yet available in commercial foundries. This work analyzes materials that can encode optical signals using micron-scale nonlinear electro-optic modulators. Designs from related work in recent studies are modeled in finite-difference time-domain (FDTD) simulation using MIT Electromagnetic Equation Propagation (MEEP) software. Analysis of simulation results will provide insight into how material choice and geometric arrangement affect mode profile, effective index, and transmission loss spectra. Higher-level conclusions from this analysis can create an intuition for which materials and structures can most effectively communicate signals in 3D Advanced Packages. These findings may aid further photonics and heterogeneous integration research, design, and fabrication.



Keywords: Photonic Interconnects; FDTD; Nonlinear Optics; Advanced Packaging; Heterogenous Integration



Mentor(s):

Peter Bermel (Engineering); Jie Zhu (Engineering); Ruihan Chen (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1532**
*Presentation Time: April 9 in Session 3: 12:00pm-1:00pm*

## Synthesis and Evaluation of Fluorescent Chemical Probes for Utilization in High-throughput Screening

Physical Sciences

Author(s):

Irina Zhilinskaya† (Science); Evan Hanson‡ (Agriculture)

Abstract:

Antimicrobial resistance is recognized as one of the top global public health threats today and an estimated 4.95 million deaths are attributed to antimicrobial resistance each year. Tuberculosis (TB) is a major contributor to antimicrobial resistance and in 2022, 3.3% of new TB cases were among those with multidrug-resistant TB justifying the need for novel therapeutics. A potentially novel drug target, CdnP, has attracted our interest due to its role in attenuating host-immune response in those affected with TB. We aim to conduct a high-throughput screening (HTS) to find novel inhibitors of CdnP, however, our current methods are prone to false positives. Herein, we describe the synthesis of fluorescent chemical probes that can detect the native ligand of CdnP for use in an alternative HTS method. We have utilized these fluorescent probes for HTS to identify two small molecule inhibitors of Cdnp. Further efforts on this project will be aimed towards developing these small molecules as drug candidates for tuberculosis.

Keywords: Tuberculosis; High-Throughput Screening; Organic Synthesis; Fluorescent Probe; Cyclic Dinucleotide

Mentor(s):

Herman Sintim (Science); Chris Vennard (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1600**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Investigating the Effects of Chemogenetic Manipulation of the Lateral Habenula (LHb) on Social Behavior in Scn2a-Deficient Mice

Life Sciences

Author(s):

Akila Abeyaratna† (Agriculture, JMHC); Rineet Ranga‡ (HHS)

Abstract:

Autism Spectrum Disorder (ASD) is a widespread neurological and developmental disorder that affects about 1 in 36 children according to the Centers for Disease Control and Prevention (CDC). Patients with ASD have been found to have structural and functional defects in multiple brain regions such as the Ventral Tegmental Area, Dorsal Raphe Nucleus (DRN), and the lateral habenula (LHb). The LHb distinctly sends and receives projections to monoaminergic brain regions like the DRN and has been shown to modulate social activity, a characteristic impairment in ASD patients. Recent whole-exome sequencing has identified mutations in SCN2A, a gene that encodes a voltage-gated sodium ion channel (NaV 1.2), as one of the leading monogenetic causes of ASD. In this study, we evaluated the chemogenetic activation and inactivation of the LHb in Scn2a-deficient mice using Designer Receptors Activated by Designer Drugs (DREADDs). Our findings show that activation of this brain region increases in Scn2a-deficient mice during the Three-Chamber Assay and Stranger Interaction Test. Our study illustrates both that serotonin plays a significant role in the regulation of social behavior and that the DRN is the main serotonergic hub of the brain. Additionally, we evaluated if activation of neurons from the DRN to LHb could rescue the deficiencies seen in Scn2a-deficient mice and found that activation of these projections also increases the sociability of Scn2a-deficient mice. Our results suggest that the LHb and serotonergic projections from the DRN to the LHb play a crucial role in modulating social behavior in Scn2a-deficient mice.

Keywords: SCN2A; Autism; Lateral Habenula; DREADDs; Dorsal Raphe

Mentor(s):

Yang Yang (Pharmacy); Brody Deming (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1601**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## The Causes of the Housing Crisis at US Big 10 Colleges

Social Sciences/Humanities/Education

Author(s):

Cornelius Adeola† (HHS)

Abstract:

Colleges nationwide are having difficulties housing their students both on and off campus(Yglesias, 2023). Even at Purdue University, the housing crisis and concerns with housing insecurities have continued to rise over the last few years. In this exploratory research project, my objective is to investigate the housing crisis occurring at various colleges and compare their situations to one other. To that end, I focus on 10 colleges across the US: 5 BIG Ten universities, an HBCU, an Ivy League institution, and colleges located on the East and West Coast. Additionally, I will draw on secondary research, questionnaires, and interviews to better understand how these colleges compare to Purdue University. This research is important because college student housing stability is probably one of the most important to all college students. Having sustainable housing is also a Win-win for both college students and college as well.

Keywords: Cause; Effect; Housing; Stats; Ongoing Issues

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1602**

*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Brain Tumor Detection

Innovative Technology/Entrepreneurship/Design


Author(s):

Teja Akella† (Engineering); Divya Manvikar† (Engineering); Laasya Thiagarajan† (Engineering); Ishank Shekhar† (DSB)



Abstract:

In recent years, a large increase has been seen in the number of people diagnosed with brain tumors. To combat this rise, the amount of medical imaging data and the number of diagnostic tools for Magnetic Resonance Imaging (MRI) scans has also increased. This study explores the capability of convolutional neural networks to locate brain tumors captured in MRI scans.

To achieve this, the study utilizes Harvard Medical's brain tumor dataset, which classifies 4 different categories of tumors. The dataset offers images from the brain's Sagittal (x-z view) plane. This dataset was utilized to train and test the deep-learning algorithm that was developed. The dataset was first divided into a 70-30% split, where training data utilizes 70% of the dataset and testing data uses 30%. Once the dataset was obtained and segmented, each MRI scan was down-sampled to reduce the amount of image information that requires processing. These new images were then passed into a convolutional neural network (CNN) to train the algorithm. The CNN that was utilized was of the U-Net architecture, which is a convolutional network architecture for fast and precise segmentation of images, using convolution, ReLU, and max pooling. The trained model is then tested on the remaining images to determine the accuracy with which it can detect and categorize tumors

This algorithm allows for the automation of the analysis of MRI images, leading to higher accuracy rates in brain tumor detection and faster diagnoses for patients using findings from MRI scans.



Keywords: Brain Tumors; Artificial Intelligence; Machine Learning; Neural Networks


Mentor(s):

Carla Zoltowski (Engineering); Edward Delp (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1603**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Comparison of different sample preparation methods for proteomic analysis

Life Sciences


Author(s):

Morgan Albertson† (Science)



Abstract:

Proteomics is the study of a cell or organism's total proteome that allows researchers to investigate the structure, abundances, functions and signaling of cellular proteins, utilizing liquid chromatography-tandem mass spectrometry techniques. Efficient sample preparation, the most critical part of any successful proteomic experiment, requires protein extraction followed by disulfide bond reduction, cysteine alkylation, and digestion of proteins into peptides using specific proteases, such as trypsin. Many sample preparation methods are used for proteomics research, with varying results in terms of number of proteins identified, sequence coverage and digestion efficiency.  To survey which methods will provide the best results, there is a need to study and systematically compare them with one another. To achieve this purpose, we compared four different digestion methods using mouse liver tissue. These different digestion methods include overnight in-solution digestion, high-pressure digestion using a Barocycler, S-Trap digestion, and in-gel digestion. Digested protein samples were run through an Orbitrap Exploris 480 mass spectrometer, and peptide identification, quantification and analysis were done using MaxQuant software. The digestion methods were evaluated based on the number of peptides and proteins they yielded and the quality of the sample preparation. The S-Trap method provided the highest peptide count, and the high-pressure digestion method was the most time efficient. Overall, S-Trap may be the most promising method for its quality and yield. Further research will be required to more accurately evaluate these methods.



Keywords: Proteomics; Mass Spectrometry; Method Optimization; LC-MS/MS


Mentor(s):

Uma Aryal (Veterinary Medicine)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1604**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Autonomous Asteroid Navigation with Optical Images

Physical Sciences

Author(s):

Aditya Arjun Anibha† (Engineering)

Abstract:

This project presents an innovative approach to autonomous asteroid Simultaneous Localization and Mapping (SLAM), aimed at enhancing and generalizing satellite navigation and mapping capabilities in asteroid proximities to create a more universally applicable asteroid navigation algorithm. It uses the Augmented Normalized Hill Three-Body Problem (ANH3BP) for the dynamics system, alongside synthetic image generation and processing using the Christian-Robinson Optical Navigation Algorithm (OpNav) as the observation. An Extended Kalman Filter (EKF) is integrated with optical navigation inputs and tailored to improve position estimation while considering artificial noise added to the system from gravitational perturbations and noisy images. The novel contributions include developing a robust autonomous navigation system, verified through extensive testing with the asteroid Bennu as a sample. The OpNav algorithm's robustness across varying distances and lighting angles is simulated to determine its performance and optimal operating conditions. Further work involves developing potential areas for advancement, such as the adaptation of the EKF for extreme navigational challenges, the refinement of optical navigation for non-spherical celestial bodies, and the dynamic integration of asteroid radius and shape estimation within the EKF framework. It explores using multi-sphere or shape-averaging approaches to extend OpNav, complemented by gravitational measurements, to evolve the current SLAM algorithm. This research demonstrates significant advancements in position estimation accuracy and computational efficiency for real-time applications. It lays a solid foundation for future explorations in autonomous asteroid navigation, offering substantial implications for deep space exploration and the broader field of aerospace engineering.

Keywords: Asteroid Navigation; Autonomy; Optical Navigation; Extended Kalman Filter; Simultaneous Localization and Mapping

Mentor(s):

Ken Oguri (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1605**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**The Effect of Cover Crop Inclusion on Soil Nitrogen Bioavailability**

Life Sciences

Author(s):

Rebeca Appelmann† (Agriculture)

Abstract:

Planting cover crops in-between cash crops can help retain nutrients in the soil from the previous cash crop season to provide for the next season. Recent studies have concluded that certain cover crop species may be more effective than others at nutrient retention. The objectives for this study were to: 1) compare the ability of different cover crop species to enhance soil N levels; and 2) simulate the growth stages of corn and evaluate the concentrations of soil ammonium (NH4+-N) and nitrate (NO3--N) in the growing season. In this incubation study, the cover crops used were cereal rye (Secale cereal L.) and balansa clover (Trifolium michelianum). The control consisted of soils without cover crops. The soil samples were collected from the Southeastern Purdue Agronomy Center (SEPAC), in Butlerville, IN. Results observed from a prior incubation conducted in 2022 showed that balansa clover had the potential to reduce nitrogen fertilizer application rates and produced a larger biomass than cereal rye. The balansa clover was also found to have greater levels of ammonium at emergence because it has a low C:N ratio, leading to its rapid residue decomposition. Throughout the simulated growing season, NH4+ concentrations decreased from VE to V6, then increased from V6 to R6. Increases of ammonium concentration can be attributed from a second wave of microbial activity mineralizing organic matter. Similarly, nitrate concentrations throughout the simulation were significantly greater in the balansa clover treatments at each growth stage compared to cereal rye treatments. Future research should investigate how different cover crop species and other conservative practices can help reduce nutrient losses and fertilizer inputs while maintaining or increasing cash crop yields.

Keywords: Ammonium; Soil; Nitrogen; Cover Crop; Nitrate

Mentor(s):

Rebecca Appelmann (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1606**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Artificial Intelligence in Music - Evaluator

Innovative Technology/Entrepreneurship/Design


Author(s):

Gurtej Bagga† (Science); Shrinand Perumal† (Science); Anthony Wang† (Science); Brian Qi† (Science); Josh Kamphuis* (Engineering)



Abstract:

The purpose of this study is to create a tool that enables musicians to not only correct the music they play, but also the posture with which they play their music. This enables them to both enhance their musical ability and reduce injuries caused by incorrect posture. Presented as an app, the Evaluator records a string musician playing their instrument; detects deviations in rhythm, intonations, dynamics, and posture; and provides personalized feedback on correcting these deviations in real time. Deviations in audio are detected by comparing musicians' audio data with the expected output that is generated by parsing the sheet music for the piece they are playing. This is achieved by using Librosa and Music21, two music processing libraries written for the Python programming language. New scores are then generated periodically in real time, with incorrect, sharp, flat, and out-of-tune notes tinted with individual colors. With the recorded video data, body-pose detection is done using Google's MediaPipe framework and instrument-component detection is done using YOLO, a real-time object detection algorithm. Deviations in posture are detected by comparing this data with sample performers' postures in video training data.

A recent online survey revealed that only 1/57 musicians uses any AI technology regularly. Most musicians are not aware of any technology that may be helpful to their work. The completion of this project can imply whether AI technology is ready to transform the work environment of musical performers and the extent to which musicians will accept AI technology in their practice/performance.



Keywords: Signal Processing; Computer Vision; Audio Processing; Music Analysis; Object Detection


Mentor(s):

Kristen Yeon-Ji Yun (Liberal Arts); Yung-Hsiang Lu (Engineering); Benjamin Shiue-Hal Chou (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1607**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Global Lexicon & Treatise: A Window into the Past

Innovative Technology/Entrepreneurship/Design

Author(s):

Samyukta Balaji† (Engineering); Ava Fasano† (DSB); Aditya Sivathanu‡ (Engineering)

Abstract:

The Global Lexicon is an extensive database to facilitate the exploration and understanding of geological formations around the world. The associated websites allow users to access detailed geological information along with visual representations of various formations using models of ancient Earth. A user-friendly homepage with a clickable map connects all the lexicons with their graphical interfaces and provides an About page. Our system provides access to geological locations across the world including Africa, Niger, Qatar, South America, China, the Middle East, Thailand, Vietnam, Belgium, and Panama (and more to come).

The Paleontology Treatise website is a comprehensive platform providing extensive information on fossil invertebrates worldwide. Users can effortlessly access data based on genus, family, and geography, while also being able to manipulate Excel files and create/clear drop tables.

Both the Global Lexicon and the Paleontology Treatise websites are powerful resources that empower users to gain a deeper appreciation for our planet's fascinating history.  Both are collaborations with geoscientists from around the world.

Keywords: Treatise; Database; Drop Tables; User-Friendly; Paleontology

Mentor(s):

Jim Ogg (Science); Aaron Ault (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1608**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Autonomous Vehicles and their impact on the economy**

Innovative Technology/Entrepreneurship/Design

Author(s):

Joe Basti† (DSB); Mario Arenas† (DSB); Grant Capps† (DSB); Max Kerkhove† (DSB); Rushil Khandelwal† (DSB); Eric Wang* (DSB)

Abstract:

The purpose of this study is to understand what affect autonomous vehicles will have on the world and economy once implemented. Through research on consumer willingness to purchase autonomous vehicles, cost of production of these vehicles, infrastructure around major cities, the shift to electric vehicles, and a cost-benefit analysis on the owners of these vehicles now vs the future, several key insights have emerged. When researching consumers and their willingness to purchase autonomous vehicles, we found that car prices are finally stable since the turmoil during the pandemic, but this stability comes at a price about 15% higher than before the pandemic. However, even though prices have jumped, American consumers still bought 15.6 million new vehicles in 2023, 12% more than in 2022. With the implementation of autonomous vehicles there comes industrial challenges with it. For example, there would need to be a smaller amount of parking garages in cities if all of them are autonomous. This is just one example of the several changes that could come from autonomous vehicles. To better understand the changes that would come with the implementation of autonomous vehicles, we need to figure out if all AVs will be electric cars. According to the road test, nearly 4 million cars driven by Avs had almost zero car accident injuries, and property damage claims were reduced by 76% compared to cars driven by people. This study concludes that the future of autonomous vehicles will promise a transformative shift in the infrastructure and economy of the world.

Keywords: Economy; Infrastructure; Change; Cost; Autonomous Vehicle

Mentor(s):

Shreya Ghosh (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1609**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Continued Progress Towards the Development of Targeted Therapies for Multiple Myeloma**

Physical Sciences

Author(s):

Emma Benefiel† (Science); Jeanelle Castro† (Science)

Abstract:

Multiple Myeloma (MM) is a type of blood cancer where hypersomatic mutations in plasma cells of the immune system lead to the clonal expansion of these mutated plasma cells that secrete aberrant antibodies. The disease begins in the bone marrow and eventually progresses to extramedullary indications. Further disease progression leads to kidney failure, anemia, osteolytic lesions and ultimately death. To date, there is no known cure for Multiple Myeloma. Current treatment is designed to reduce the number of malignant plasma cells, symptom management and palliative care in patients.

One of the challenges in formulating effective treatments for MM is the highly immunosuppressive bone marrow (BM) microenvironment in MM. The BM microenvironment is primarily responsible for the short-lived effects of current MM therapies and the high rate of relapse and refractory MM. The BM microenvironment in MM has a high concentration of Adenosine (ADO). ADO is the product of an ecto-enzymatic cascade on the stromal and plasma cells in the BM. One of the ecto-enzymes is CD38, also known as cyclic ADP ribose hydrolase. CD38 has hydrolase and cyclase activity wherein nictotine-adenine dinucleotide (NAD+), it's primary substrate is converted to NAD gylcohydrase or cyclic adenosine monophosphate (cAMP) respectively. Both enzymatic products are then converted downstream to ADO.

Interestingly, CD38 is primarily expressed on plasma cells (4-6x more than in normal cells) and data shows that the overexpression increases by another 2 to 3-fold on plasma cells in MM. In effect, CD38 is a highly specific surface receptor that can be exploited for the design of targeted therapeutics against MM. This project aims to develop highly potent and selective targeting ligands for CD38 to aid in the development of imaging agents, radiotherapy, and immunotherapy against MM.

Keywords: Multiple Myeloma; CD38; Plasma Cells; Therapy; Expression

Mentor(s):

Philip Low (Science); Reuben Dass (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1610**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Literature Review of Rotating Detonation Engine (RDE) Diagnostics Methods**

Physical Sciences

Author(s):

Daniel Berggren† (Engineering)

Abstract:

For decades, deflagration-based combustion engines, in which a flame propagates through a reactant mixture at speeds on the order of cm/s to m/s, have been optimized for propulsion and power generation systems. However, as deflagration combustion engines have become more advanced, further developments have only resulted in marginal increases in efficiency. As a result, utilizing another form of combustion – i.e., detonation, where the flame-front propagates at supersonic speeds – has received increased attention for applications to propulsion systems. Novel research into detonation-based pressure-gain combustion engines, specifically rotating detonation engines (RDEs), has the potential to revolutionize propulsion through increased thermodynamic efficiency and reduced engine complexity and mass. Despite these major benefits, RDEs have not come without major challenges. When compared with a deflagration engine, the internal dynamics of an RDE are significantly more complex, requiring advanced optical diagnostic methods to fully understand the behavior of the flow field and combustion dynamics. Techniques such as laser absorption spectroscopy (LAS), coherent anti-Stokes Raman scattering (CARS), particle image velocimetry (PIV), and planar laser-induced fluorescence (PLIF) are all laser-based diagnostics that offer spatially and/or temporally resolved measurements of flow field features within the combustor non-intrusively, as opposed to physical probes which may alter the flow field near the measurement location(s). This literature review seeks to catalog the currently available diagnostic methods for RDEs and highlight potential methods that could be used in the future to guide future research areas.

Keywords: Combustion; Rotating Detonation Engine; Laser Diagnostics; Thermodynamics; Propulsion

Mentor(s):

Terry Meyer (Engineering); Robert (Bebe) Wang (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1611**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Efficient simulation of degenerate optical parametric oscillator networks for combinatorial optimization

Mathematical/Computation Sciences


Author(s):

Spencer Bowles† (Engineering, JMHC); Vidisha Singhal† (Engineering)



Abstract:

A wide range of combinatorial optimization problems, such as the traveling salesman problem, are time-consuming to solve using existing computers. Therefore, improved algorithms and hardware are needed to address these challenges. Fortunately, a growing interest into computational systems known as Ising machines have shown to be a promising tool for combinatorial optimization. The physical construction of these machines with networks of degenerate optical parametric oscillators (OPOs) allows for efficient solutions finding the lowest energy states of these systems. However, there are numerous engineering challenges associated with the detailed simulation and fabrication of such machines. To investigate the simulated behavior of OPO networks, we utilize the Kraymer-Moyal representation of an OPO network and apply the Euler-Maruyama numerical stochastic integration algorithm to simulate the injection of noise into the network. This study investigates current implementations of stochastic solvers; however, they are programmed in high-level languages, introducing significant overhead. As such, we have utilized the C programming language as well as multiprocessing to achieve an approximate 500x speedup over our tests with high-level languages. Results for the modeling of a stochastic 100,000 node OPO network have been shown to agree with previous findings, taking a tenable two days on average to complete simulation. Future development to create a Python API for the simulator is being investigated as well. Efficient simulation of OPO networks would prove an effective method for determining the possible sizes and effectiveness of physical combinatorial optimizers.



Keywords: Optimization; Probabilistic Computing; Stochastic Algorithms; Physical Computing; Simulation



Mentor(s):

Peter Bermel (Engineering); Jie Zhu (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1613**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Headphones and Colleges Students: Factors which Increase Consumer Preference for Sustainable Products

Innovative Technology/Entrepreneurship/Design

Author(s):

Adrian Calderon† (Polytechnic)

Abstract:

Sustainability and environmental awareness continue to become a major facet of today's society. Despite increased awareness, consumers continue to hesitate when purchasing sustainable products over environmentally harmful ones (Luchs, Brower, Chitturi, 2012). Previous studies indicate three primary factors affect this choice specifically with regards to food products - confidence in product functionality, cost to self, and social responsibility or guilt (Goldsmith, Roux, and Wilson 2019). The following study seeks to examine potential to reduce electronic waste by determining the extent a consumer will prefer an environmentally sustainable product. Undergraduate students of Purdue University aged 18-29 were evaluated through use of a survey. The survey includes a description of conceptual products along with different thresholds of functionality, price, and environmental impact. Students can rate on a scale of 1 to 5 how likely they are to purchase the product. Based upon the survey, the study seeks to determine which specific, numeric thresholds of these factors lead to highest consumer preference for conceptual headphone products, which in turn can be applied to a broader range of electrical products.

Keywords: Sustainability; Consumer Preference; Headphones; E-Waste

Mentor(s):

Gaurav Nanda (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1614**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Hydrogel Microneedle Patch for Small Molecule Uptake

Physical Sciences

Author(s):

Samantha Campbell† (Engineering)

Abstract:

Monitoring diseases requires measuring biomarkers within the body. Knowing the biomarker concentrations can give insights into the health status of the patient such as using glucose for diabetes monitoring and cortisol for measuring stress levels. Effective biomarkers for specific diseases are analytes, which typically diffuse through capillaries into the interstitial fluid (ISF). Microneedles (MNs), small, minimally invasive needles, have been used for both drug delivery and easy ISF extraction. To establish an easy to use at home collection of analytes to monitor diseases, this work analyzes the mechanical strength of two different hydrogel microneedle patches, Methacrylated Hyaluronic Acid (MeHA) and Poly(ethylene glycol) (PEG)-crosslinked Poly(methyl-vinyl ether-co-maleic anhydride) (PMVE/MA). These MN patches must puncture the outer layer of the skin without breaking, and successfully be extracted. To evaluate the mechanical strength of the hydrogel microneedles, each will undergo compression testing where varying amounts of force will be applied to determine how much the MNs can endure. Microscopic analysis will allow the MNs to be analyzed for breakage or flattening of the tips and changes in the height and width of the individual needles. To quantify the insertion depth capabilities of the MN patches, insertion experiments into a skin model made of parafilm will be used. The results of the two experiments will quantify the strength and durability of the MNs. Since previous data supports the MNs' uptake efficiency of analytes, this mechanical testing will determine if the MNs can reach ISF in the skin and remain intact for analyte level reading.

Keywords: Hydrogel; Microneedle; MeHA; PMVE/MA PEG; Interstitial Fluid

Mentor(s):

Jacqueline Linnes (Engineering); Emilee Madsen (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1615**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Intra- and Interpersonal Factors that Contribute to the Delay of Sexual Debut Among Rural Latino/a Adolescents

Social Sciences/Humanities/Education


Author(s):

Carmela Campbell† (Science)



Abstract:

Background: Sexual health disparities are evident in Latino/a adolescents; for some, these risks are compounded by rurality. Thus, the present inquiry sought to identify the extent to which intra- and interpersonal factors contribute to the delay of sexual intercourse in rural Latino/a adolescents. Methods: The present review involved literature search via the artificial intelligence supported platform Research Rabbit. Qualifying studies were initially identified based on a source material and database search using terms targeting Latino/a adolescents and sexual debut. The inclusion criteria for this study were restricted to (1) full text, original research publications dated from 2014-2024; (2) study population of U.S. Latino/a adolescents; (3) involving one or more intra- and/or interpersonal factors; and (4) where outcomes specifically examined sexual debut/intention; resulting in a final sample of 14 studies. Results: The extent to which sexual debut was influenced by parents was dependent on communication, particularly the context, content, timing, and adolescent's perceived value of the messaging. Moreover, parental practices and family cohesion were found to impact adolescent's perception of sexual behavior. Interpretation was moderated by age, gender, sexual attitudes, and the cultural values of the adolescent. Notably, only one study assessed a rural population. Discussion: A complicated interaction of intra- and interpersonal factors influence Latino/a adolescent sexual debut. This study underscores the necessity for future research that emphasizes rural Latino/a adolescent sexual debut- ultimately informing opportunities for sexual health intervention.



Keywords: Latino/a; Sexual Debut; Adolescent; Rural; Intra/Interpersonal Factors



Mentor(s):

Yumary Ruiz (HHS); Madeline Moser (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1616**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Comparing M-dwarf Flare Candidates Through Simultaneous Space Telescope Observations

Physical Sciences

Author(s):

Dylan Caudill† (Science); Thomas Slamecka‡ (Science)

Abstract:

One of the most common locations in the Milky Way Galaxy to find planets outside of our solar system is orbiting M-dwarf stars since they make up over 70% of the stars observed. Because of the large number of these relatively cold, small, and dim stars, it is important for astronomers and planetary scientists alike to determine the properties of these extrasolar systems. Despite their size, M-dwarfs are capable of producing powerful flares that can impact the habitability of the planets that orbit them. To better understand these flaring events, our group made use of archival space telescope data from the Kepler Space Telescope (K2) and Transiting Exoplanet Survey Satellite (TESS) missions, which are two datasets often used to study these objects and determine flaring rates. We chose to study a set of stars that had been observed simultaneously by both missions to determine whether or not both missions are similarly identifying flares. Specially designed coding packages for accessing data and statistical analysis were used to determine flare candidates in our dataset. The results yielded a possible discrepancy in the detection of flares between telescopes. This led to a deeper analysis and investigation into the processing methods for these telescopes to explain this result. We find that the data from the K2 mission for this set of stars is not well suited for finding flares for various reasons. However, in the TESS dataset, we are able to identify 13 stars with flare candidates.

Keywords: Astrophysics; Stars; Flares; K2; TESS

Mentor(s):

Jeffrey Gerber (Science)

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**Poster Presentation Abstract Number: 1617**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# QDILink

Mathematical/Computation Sciences


Author(s):

Jacob Chappell† (Engineering); Harnoor Cheema† (Engineering)



Abstract:

One of the methods for continuing scaling post-Moore’s Law is by combining multiple silicon chiplets into one unit. QDILink is intended to serve as a communication pathway between these dies. Most of the current solutions that are used employ a synchronous communication protocol, however QDILink has a quasi-delay insensitive protocol that is not effected by timing differences across the link.

By using a QDI protocol, there is no need for any analog circuit design for the link to function, which is important as analog circuits are very process dependent, potentially requiring a significant amount of design work for each different chiplet that is connected to the system. QDILink can also perform processing while the data is in transit by adding calculation stages into its internal pipeline. This moves part of the routing and data transmission logic into the link itself, increasing the flexibility of implementations to have different data transmission requirements. Beyond this, QDILink does not require either chiplet to be a synchronous system, enabling the use of a wider set of chiplets compared to the synchronous protocols.

The verification process of QDILink is underway, with the design mostly finalized. Within the semester, full schematics for each component will be created, after which chip integration can start. The systems that will use QDILink will be a version of the SoCET Team’s AFTx line of system on chips, along with other projects that require a simple, reliable, and flexible communication protocol.



Keywords: Heterogenous Integration; Computer Architecture; Chiplets; SoCET


Mentor(s):

Mark Johnson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1618**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Color design and infographics of the RGB and HSB Color Systems

Fine Arts

Author(s):

Coco Chen† (Liberal Arts); Rae Fu† (Polytechnic); Jackson Novak† (Liberal Arts)

Abstract:

Visual arts and design students work with colors on the computer screen based on two fundamental systems: The RGB and the HSB color models. They are scientific models representing the dimensions of color and are the most common methods for creating and selecting colors for art and design applications. For this design-based project, Wilke interns are assisting in designing informational graphics, including 2D designs, digital animations, and AR interactive color visualization tools. The informational graphics aim to organize and present digital color information and theory based on a visual method to facilitate the understanding of color concepts. Infographics help students recognize color attributes and select and create colors digitally. The following informational graphics and illustrations are being developed: Digital color wheel exercise which was designed to help students sort everyday objects into their correct hues; HSB cylinder, a 3D model of color attributes based on hue, saturation and brightness; HSB color planes visualization based on the RGB/CMY digital color wheel; Nature-based RGB color wheel representation; 3D model animation of the RGB Cube; Slide tray animation of the RGB Cube; Digital color atlas based on 30 hue planes. These informational graphics and Augmented Reality applications will be integrated into Prof. Bendito's book, the RGB/CMY Digital Color Wheel Study Guide.

Keywords: Color Systems; Augmented Reality; Color Wheel; Design; Digital

Mentor(s):

Petronio Bendito (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1619**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## XOR: SIMT-Scalar architecture for Control Flow Divergence

Innovative Technology/Entrepreneurship/Design

Author(s):

Sooraj Chetput† (Engineering); Johnathan Hong† (Engineering); Alex Chitsazzadeh† (Engineering); FangLing (Victor) Zhang† (Engineering); Khoi Pham† (Engineering); Zengxiang (Tim) Han† (Engineering); Justin Cambridge† (Engineering); Htet Yan† (Engineering); Spencer Bowles‡ (Engineering)

Abstract:

In contemporary server architectures, scalar cores (usually with massively multithreaded CPUs) traditionally process all incoming requests, treating each as an individual task. With the rise of microservices, the nature of these requests has evolved, becoming inherently parallelizable and offering an opportunity for optimization. To harness such parallelism, we have proposed further improvements via a more capable scalar core and additional speedup mechanisms to our existing design.

Similar to the previous iteration, we propose a coupled vector and scalar core: the vector core introduces task level parallelism, whilst the scalar core introduces latency sensitivity into the system, which is crucial for microservices. The system is built on top of the Vortex Open-Source GPU utilizing the open-source RISC-V ISA.

With our second iteration, we are exploring shared cache that more tightly couples the compute data between the vector and scalar cores. Threads sent to the vector core are also evaluated for priority and migrated to the scalar core with logic similar to that of an interrupt controller (i.e. interrupt return instruction). A design where the cache is shared would curtail the memory footprint. We also seek to add additional architecture to speed up the cores with the addition of an always-not-taken branch predictor. Benchmarks and metrics (e.g. Power, Performance, and Area) have been used to evaluate our initial iteration of our scalar-vector core integration show tangible improvements in typical microservice workloads.

Keywords: GPU; Microservices; RISC-V; Open-Source; Vortex

Mentor(s):

Tim Rogers (Engineering); Mark Johnson (Engineering); Gagan Gundala (Engineering); Anusuya Nallathambi (Engineering)

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**Poster Presentation Abstract Number: 1620**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## FDTD and Circuit Simulations for Microresonator-Based Wavelength Division Multiplexers in Silicon Photonics

Mathematical/Computation Sciences


Author(s):

Ethan Chiao† (Engineering); Luke Zhang† (Engineering)



Abstract:

Our research explores the significance of Finite-Difference Time-Domain (FDTD) and circuit-based simulation models in the design and optimization of microring-based demultiplexing systems for both classical and quantum integrated photonics applications. Microrings are ubiquitous in on-chip wavelength-division multiplexing (WDM) systems for classical and quantum optical communications by prodiving a compact, tunable, and wavelength selective means for add-drop filtering. FDTD simulations will provide a detailed understanding of the device-level electromagnetic behavior within the microring resonator, while circuit simulations will enable larger-scale microring systems to be studied. Our work will enhance the performance prediction of such systems and inform the future design of silicon photonic chips such that efficient systems can be fabricated.



Keywords: Finite-Difference Time-Domain; Integrated Photonics Applications; Microring-Based Demultiplexing Systems



Mentor(s):

Lucas Cohen (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1621**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Machine learning-assisted rapid clustering and mechanism exploration of single photon emitters

Physical Sciences

Author(s):

Geetika Chitturi† (Engineering, JMHC); Trang Do† (Engineering)

Abstract:

Single-photon emitters (SPEs) represent fundamental components crucial for various scalable quantum information technologies, such as linear optical quantum computing and secure quantum communication. It is noteworthy that SPEs have been identified across diverse material systems, including Aluminum Nitride (AlN), a pivotal semiconductor in applications involving high-power electronics and elevated temperatures. Despite the documented occurrences of defect-related emissions in AlN, a comprehensive investigation into single-photon characteristics and spectral properties, especially in the as-grown state and after-Zr ion-implantation state, is lacking. Leveraging machine learning as a robust analytical tool, we aimed to build a model to scrutinize the optical attributes of AlN SPEs, realizing rapid clustering and thereby advancing our understanding of the underlying physical mechanisms of SPE generation. We determined that AlN emissions can be grouped through clustering by features of their photoluminescence spectra. Moving forward, we aim to resolve the particular characteristics by which the spectra can be grouped in order to identify SPE generation.

Keywords: Quantum Computing; Nanophotonics; Machine Learning; Single Photon-Emitter

Mentor(s):

Alexandra Boltasseva (Engineering); Vladimir Shalaev (Engineering); Yuheng Chen (Engineering); Blake Wilson (Engineering); Alexander Senichev (Engineering)

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**Poster Presentation Abstract Number: 1622**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## UVM-Based Verification of Platform-Level Interrupt Controllers

Innovative Technology/Entrepreneurship/Design

Author(s):

Indrayudh Chowdhury† (Engineering)

Abstract:

In this project, I undertook the verification of a Platform-Level Interrupt Controller (PLIC) using the Universal Verification Methodology (UVM). I developed a comprehensive test plan and test architecture to define the roles of the monitors, drivers, and interfaces in relation to the Device Under Test (DUT). The ensuing UVM test environment, alongside carefully designed sequences and tests, allowed a thorough assessment of the PLIC's operational integrity and resilience under various scenarios. This endeavor not only improves the dependability of the PLIC in managing interrupts but also underscores the criticality of rigorous verification in advancing the reliability and performance of hardware infrastructures.

Keywords: Platform-Level Interrupt Controller; Universal Verification Methodology; Test Architecture; Reliability; Performance

Mentor(s):

Mark Johnson (Engineering); Jude Pinto (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1623**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Investigation of patching effect using carbon fiber reinforced polymer on damaged composite material.**

Innovative Technology/Entrepreneurship/Design

Author(s):

Min Yong Chun† (Polytechnic)

Abstract:

Carbon Fiber Reinforced Polymer (CFRP) is an advanced composite material known for its high strength-to-weight ratio and excellent rigidity, making it a preferred choice for a wide range of applications across industries such as aerospace, automotive, and civil engineering. CFRP consists of a polymer matrix reinforced with carbon fibers, which provides the material with its superior mechanical properties. This unique composition allows CFRP to offer significant advantages over traditional materials, including resistance to corrosion, high tensile strength, and reduced weight.

The use of CFRP for patching damaged composite structures has emerged as an effective repair technique, addressing the limitations of conventional repair methods. The process involves the application of CFRP patches to the damaged area, which can restore or even enhance the structural integrity and performance of the original composite material. This method is particularly beneficial for repairing critical structural components that require high strength and durability, as well as for applications where weight savings are essential.

Patching with CFRP offers a non-invasive, cost-effective solution that can be tailored to the specific requirements of the damaged structure, including its geometric and loading conditions. The bonded CFRP patches provide a seamless repair that minimizes stress concentrations, effectively distributing loads across the repaired area and preventing further propagation of damage. Moreover, the versatility and adaptability of CFRP patching make it suitable for a wide variety of composite materials, enhancing the longevity and reliability of the components.

Keywords: Advanced Composite; Manufacturing; Patching; Composite Repair; Sustainability

Mentor(s):

Garam Kim (Polytechnic); Sung Jun Choi (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1624**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Unraveling the Mechanism for Decreased Mouse Survival in a Novel Pancreatic Cancer Model with PP2A-B56a Activation

Life Sciences

Author(s):

Sydney Clifford† (Science, JMHC)

Abstract:

Pancreatic Ductal Adenocarcinoma (PDAC) stands as the fourth leading cause of cancer-related deaths in the United States, boasting a meager five-year survival rate of just 13%. Despite over 90% of PDAC patients bearing mutated KRAS, targeted therapies, particularly against the prevalent KRAS-G12D mutation, have yet to receive FDA approval. This gap in therapeutic options underscores the urgency for alternative strategies, with a potential focus on cellular pathways governing KRAS activity.

Amidst potential avenues, Protein Phosphatase 2A (PP2A) emerges as a promising tumor suppressor, negatively regulating key downstream effectors of KRAS. However, while PP2A's role is well-recognized, there exists a notable research gap in understanding the specific complexes it forms. The PP2A-B56a subunit, recognized as a tumor suppressor in various cancers, remains unexplored in the context of PDAC.

Surprisingly, a PDAC mouse model with a genetic knockout of CIP2A, an endogenous PP2A-B56 inhibitor, revealed reduced survival, unveiling a previously unknown facet of PP2A-B56a in the generation of oncogenic phenotypes. Armed with this insight, we have obtained ex vivo cell lines from this mouse model, aiming to elucidate whether similar mechanisms are at play as have been observed in human PDAC cell lines. These ongoing studies promise to deepen our understanding of PP2A-B56a's role in PDAC, paving the way for future investigations in this critical area of research.

Keywords: Pancreatic Cancer; Protein Phosphatases

Mentor(s):

Brittany Allen-Petersen (Science); Claire Pfeffer (Science); Jukka Westermarck (University of Turku, Turun yliopisto, Finland); Jennifer Morton (University of Glasgow)

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**Poster Presentation Abstract Number: 1625**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Childhood Emotional Abuse and Sibling Relationships

Social Sciences/Humanities/Education


Author(s):

Kendall Conaway† (HHS)



Abstract:

Abuse of children is a chronic, pervasive problem with approximately five children dying everyday (National Child Maltreatment Statistics). Abuse is detrimental in a variety of ways, but can particularly impact future relationships with close others, such as parents or romantic partners (Child Welfare Information Gateway, 2019). This study investigates whether childhood abuse impacts sibling relationships, particularly frequency in contact and feeling understood in twin relationships. To investigate this question, the Midlife in the United States (MIDUS 1) data from 1995-1996 will be utilized. MIDUS is a longitudinal study investigating a variety of mental and physical health outcomes in midlife adults. Participants were administered a host of batteries querying about mental and physical health processes. This study will focus on a subset of items collected: items which ask about maternal and paternal emotional abuse, twin frequency of contact (weekly), and questions regarding whether one feels understood by their twin. Data will be analyzed using a linear regression, regressing paternal and maternal emotional abuse upon a) frequency of weekly contact and b) feeling understood in twin sibling relationships. This study hypothesizes that more emotional abuse from the mother and father will significantly predict feeling understood by one's twin sibling. The second hypothesis is that more emotional abuse from the mother and father will significantly predict less frequency in weekly contact between twin siblings. The results of this study could lead to a new area of focus when it comes to treating abuse victims.



Keywords: Sibling Relationships; Emotional Abuse; Parental Abuse; MIDUS; Childhood Abuse



Mentor(s):

Susan South (HHS); Samantha Dashineau (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1626**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Probing the Formation of Reactive Oxygen Species at the Surface of Charged Microdroplets

Physical Sciences

Author(s):

Ronald Cutler† (Science)

Abstract:

Reaction acceleration at interfaces may be used to promote chemical reactions that are slow or do not occur in the bulk solution. Accelerated reactions in charged microdroplets have been attributed to the strong electric field generated in the droplet and the increased air-solution interface where many reactions occur. Previous studies have indicated that these extreme conditions promote the formation of OH radicals and hydrogen peroxide on the surface of a microdroplet. The presence of OH radicals and other reactive oxygen species on the surface of the microdroplet may be responsible for reaction acceleration and the formation of unique reaction products in microdroplet chemistry. In this work, we used terephthalic acid (TA) as a selective probe for OH radicals and dihydroethidium (DHE) as a selective probe for superoxide formed at the droplet interface. Both molecules have been shown to undergo the addition of an alcohol group (net addition of one oxygen atom) in the presence of their respective reactive oxygen species. In our experiments, microdroplets containing TA or DHE are prepared using electrospray ionization. This is achieved by applying a high voltage (4000 kV) to the analyte solution being propelled into a mass spectrometer for analysis of the reaction products. The presence of reaction products is confirmed by accurate mass assignments and their structures are examined using tandem mass spectrometry (MS2). Collectively, the results of this project will help elucidate the role of reactive oxygen species in microdroplet reaction acceleration.

Keywords: Mass Spectrometry; Microdroplet Chemistry; Hydrogen Peroxide Probes

Mentor(s):

Julia Laskin (Science); Hugo Samayoa-Oviedo (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1627**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Improving Efficiency of Track Particle Clustering using Hybrid Classical-Quantum Computing for Future Detectors

Mathematical/Computation Sciences

Author(s):

Gino Daniels† (Science); Sean Wall† (Science); Cole Murphy† (Science); Ishan Goel† (Science); Bornik Nag† (Science); Ayusha Patra† (Science); Fabiana Correa† (Science)

Abstract:

The Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC) uses clustering algorithms on particle jets to reconstruct the positions of the primary vertices—the point at which a collision occurs and short-lived particles hadronize. This process is crucial for identifying particles produced and is thus an active area of research. Currently, CMS employs classically-implemented clustering algorithms such as the “anti-k_t” algorithm. However, clustering based on a QUBO through quantum annealing—a form of quantum computing that relies on adiabatic evolution of qubits to the lowest energy state—may result in a more computationally efficient solution. In this paper, we design a hybrid (classical & quantum) procedure that can cluster along z and θ using measured momenta and distances of particle jets. We then compare this procedure’s accuracy and run-time to various classical implementations of clustering algorithms and present our results.

Keywords: Clustering; Quantum Annealing; Quantum Computing; CMS

Mentor(s):

Andreas Jung (Science); Robin Carpenter (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1628**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Morocco Wellness Gateway

Innovative Technology/Entrepreneurship/Design

Author(s):

Noelle Dennis† (Agriculture)

Abstract:

Morocco Wellness Gateway proposes a two-phase project involving a linear fitness park and an adjacent rail-trail development to enhance community health, boost rural economic growth, and strengthen connectivity between residents and their native landscape in Morocco, Indiana. The town of roughly 1,000 residents lies within Newton County, featuring significant ecoregions like Kankakee Marsh, Illinois/Indiana Prairie, and Sand Area. Addressing the pressing need for improved wellness in Morocco and Newton County, the project responds to the area's low health rankings, placing it in the bottom 25% of Indiana's counties for factors crucial to longer and healthier lives, including access to exercise opportunities and obesity index.

To understand the local context, the research question, "How can shared path development contribute to improvements in community health, local economy, and harmony with local ecology?" guided the analysis of data from ArcGIS Pro, academic journals, and case studies focusing on open space access, economic status, ecoregions, and IN DNR/USA Parks access. Findings revealed lower open space access in Newton County compared to the state average (18% vs. 77%), and case studies indicated increased physical activity in communities with shared paths. An academic study reported direct and indirect economic benefits of shared paths.

Evaluation models, utilizing GIS data layers, highlighted Morocco's ideal location for a connective rail-trail toward Efroymson Restoration at Kankakee Sands. The proposed fitness and rest stations alongside the trail aim to provide wellness and recreation opportunities, positioning the trail as a county-wide catalyst for physical and economic wellness.

Keywords: Wellness; Connectivity to Open Space; Nature Observation Access; Sense of Place; Community Engagement

Mentor(s):

Aaron Thompson (Agriculture); Deb Arseneau (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1629**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Intercultural Competence in Pre-Freshman Study Abroad**

Social Sciences/Humanities/Education

Author(s):

Atin Dewan† (Engineering, JMHC)

Abstract:

In today's technology-focused, interconnected society, intercultural competence is necessary for an individual's academic success, personal growth, and future professional adaptability. Intentionally structured study abroad programs have been effective in nurturing these competencies. This research investigates the effectiveness of an intentionally structured study abroad programs for pre-freshman college students in developing intercultural competency. Study also discusses educational practices and policies to design such programs.

The participants for this study are 15 pre-freshman students from a large midwestern university, who went on study abroad program. The Intercultural Development Inventory (IDI) assessment was used pre and post to assess the intercultural learning gains for the students. Moreover students were required to maintain a guided reflective journal throughout the program. A mixed-methods approach was used to assess the learning gains of the students. Students showed a significant increase in their intercultural competence from pre to post on IDI. Further the themes for cultural adaptation, identity preservation, learning preferences, educational challenges, interpersonal relationships, and intercultural communication emerged from the qualitative analysis of the reflective journals. These themes shed light on the multifaceted aspects of the students' experiences and perceptions during their study abroad experience.The results of the study revealed that intentionally structured study-abroad programs can be beneficial for the intercultural growth of students. The study also underlines the usefulness of reflective practices in improving students' learning experiences and importance of promoting global awareness in policy creation. Ultimately, these findings aim to prepare students not only for academic success but also for active, informed participation in a diverse and interconnected world.

Keywords: Intercultural Competence Development; Pre-Freshman; Study Abroad; Cultural Adaptation; Learning Preferences

Mentor(s):

Aparajita Jaiswal (Partnerships); Sakhi Aggrawal (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1630**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Student Perceptions of the Relationship Between Social Media Algorithms and Democratic Participation

Social Sciences/Humanities/Education

Author(s):

Nancy Dooley† (Liberal Arts); Grace Vavra† (HHS); Quinn Loughran† (Liberal Arts); Abigail Finney* (Science); Noelia Alvarez* (Liberal Arts); Maggie Collins* (Liberal Arts)

Abstract:

Impacts of social media's rapidly expanding algorithm technologies present unique challenges to information literacy, interpersonal relationships, and societal functions. As democratic practices transition to digital spaces, perceptions of the effects of social media algorithms become intertwined with existing social norms, interpersonal beliefs and values, and the rapid expansion of technology. In this study, the results of qualitative research conducted through in-person interviews enable the identification of the various student perceptions of the relationship between social media algorithms and democratic participation, defined as any interaction that one has with or about democratic processes. Through a series of open-ended questions, participants shared their own personal experiences, opinions, and insights, allowing for a comprehensive exploration of the complex dynamics at the intersection of technology and democratic participation. The transcripts of the interviews were then analyzed to reveal four key themes from student responses: algorithms influencing change, control, conflict, and disappointment. These themes unite the notable events, hidden influences, disparities, and more that students acknowledged in their social media and civic participation. With a more rounded understanding of the individual experiences with social media algorithms on democracy, information literacy education can become more effective and efficient in combating the negative effects of these rapidly expanding information technologies.

Keywords: Algorithms; Social Media; Democratic Participation; Information Literacy

Mentor(s):

Clarence Maybee (Libraries); Rachel Fundator (Libraries); Secret Permenter (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1631**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Design of In Situ Thermal Stage for X-ray Computed Tomography (XCT) of Semiconductor Packages

Innovative Technology/Entrepreneurship/Design

Author(s):

Avik Dutta† (Engineering)

Abstract:

Semiconductor packages undergo thermal cycles throughout their lifespan, which can lead to potential defects in the interconnects and subsequent reliability issues. Traditional defect characterization techniques, such as serial sectioning and scanning electron/optical microscopy, are often destructive, labor-intensive, limited to 2D observations, and time-consuming. In contrast, X-ray Computed Tomography (XCT) provides a non-destructive 3D method for in-situ analysis of defect evolution. In this study, we have developed a novel thermal stage to be used within an X-ray microscope (XRM) for assessing the evolution of interconnect defects under cyclic thermal loads. The design, shown in Figure 1, features a 3D printed Nylon 12 shell for rigidity and thermal resistance, a low-vibration Noctua CPU fan for active cooling, and a Thermoelectric Cooler (TEC) with a copper heat sink for efficient thermal dissipation and temperature control. The thermal stage is designed to be compatible with contemporary lab-scale XRM systems, ensuring minimal interference with the XCT scanning process. The development of this thermal stage is anticipated to significantly enhance our ability to understand and mitigate the effects of thermal cycling on semiconductor package reliability. Future work will focus on validating the effectiveness of the updated TEC cooling system and incorporating a microcontroller to fine-tune temperature ranges for precise thermal cycling experiments.

Keywords: Semiconductor; X-Ray Computed Tomography; Thermal Cycling

Mentor(s):

Nikhilesh Chawla (Engineering); Eshan Ganju (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1632**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Exploring the Relationship Between Students with Disabilities and Greek Life: A Campus Perspective

Social Sciences/Humanities/Education

Author(s):

Ayden Fahey† (Science, JMHC)

Abstract:

This preliminary research study addresses the relationship between students with disabilities and Greek Life on campus. There is a lack of knowledge in Purdue students' everyday life about this concept, so I went to find those components by looking for the social integration, academic success, and reasons of how they are or are not creating a sense of normalcy. This was done through interviews and questionnaires to a member of the Fraternity, Sorority and Cooperative Life staff, to an authoritative person on the DRC staff, and to people with high officer roles of Greek Life organizations on campus. Then, I sent a questionnaire through the officers to their members. I found there were few examples of Greek Life specifically incorporating within the organizations and outside where they involve students with disabilities. There were also quite unsure answers because of the lack of involvement. This research provides insight into how inclusive Greek Life organizations are for students with disabilities and everyone else. The gap seen in the results provides an eye-opening result for those surrounding Greek Life.

Keywords: Preliminary Research; Students with Disabilities; Greek Life; Relationship; Social

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1633**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## What is it like to access legal abortion care under Indiana law? A study protocol

Social Sciences/Humanities/Education


Author(s):

Kiki Finlayson† (HHS); Emma Gordon‡ (HHS); Alana Powell‡ (HHS)



Abstract:

Background: Abortion in the state of Indiana is outlawed with few exceptions: if necessary to prevent severe risk to health or life of the pregnant person, the fetus is diagnosed with a lethal anomaly, or the pregnancy is a result of rape or incest. The law imposes gestational limits on exemptions depending on the reason for abortion (i.e., 12 weeks' for rape and incest; 22 weeks' gestation for fetal anomaly). However, we do not know how abortion seekers qualify for exemptions under the law and what the process is like to obtain care. This project aims to address this gap.

Methods: The one site in Indiana that provides legal abortion will share study information with all patients so potential participants can follow up directly with our study team. We will conduct semi-structured, in-depth interviews via telephone or Zoom with patients who qualify for an exemption under the Indiana law and receive abortion care in-state (n=25). We will audio-record all interviews, take notes, engage in a reflexive memoing process, and carry out content and thematic analysis.

Anticipated contribution: Lawmakers are divided about the circumstances that qualify for an exemption under the state law which suggests and opportunity to more robustly develop the exemption system in the state in a way that is patient centered. Elucidating the true burden of access care and we anticipate these findings will be of interest to patients, the public, and policymakers



Keywords: Qualitative Methods; Sexual Health; Reproductive Health; Health Policy; Abortion


Mentor(s):

Kathryn LaRoche (HHS); Scotty Secrist (VP Diversity and Inclusion)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1634**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Determination of Threshold for Salmonella Growth to Allow Enumeration of Samples After Transportation

Life Sciences

Author(s):

Athanasios Flessas† (Agriculture); Carson Rockwell† (Science); Bailey Williams† (Agriculture); Hayley Wong-Liong† (Agriculture, JMHC)

Abstract:

Salmonella is one of the leading causes of foodborne illness in the United States, with an estimated 3.7 billion dollar impact annually. The USDA Food Safety Inspection Service (FSIS) analyzes a vast number of samples from numerous meat products for the presence or absence of Salmonella. However, there is a need to shift from qualitative analysis to enumeration of the organism. The standard FSIS protocol for Salmonella analysis includes packaging the sample in containers with cold packs for sample transportation via unrefrigerated (4°C) air and ground freight. However, during transit the samples may experience temperature fluctuations allowing growth of the bacteria, thus affecting quantification. Therefore, the goal of this research is to investigate the threshold temperature at which Salmonella growth occurs so analysts can determine the acceptability of the sample via the sample's temperature prior to processing. To ascertain the threshold growth temperature, Salmonella enterica serotype Minnesota was inoculated in the transportation media (neutralizing buffered peptone water, nBPW) and incubated at 5°C, 7°C, 8°C, 9°C, and 10°C. Samples were taken daily and enumerated, and temperatures were monitored constantly throughout the experiment. Growth was only observed at temperatures above 8°C, indicating that the shipping environment must be maintained at or below 8°C to ensure enumeration accuracy. Future experiments will analyze contaminated solids and other strains of Salmonella enterica and STEC Escherichia coli to determine if this temperature distinction is conserved across strains.

Keywords: Salmonella; Sample Transportation; Growth Temperatures

Mentor(s):

Bruce Applegate (Agriculture); Kal Holder (Science); Keyshla Narváez-Dávila (Agriculture); Trevor Lim (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1635**

*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Exploration of IL-27 Gene Therapy in Treatment for Acute Respiratory Distress Syndrome

Life Sciences


Author(s):

Viviana Galindo† (Liberal Arts, Science, JMHC)



Abstract:

Acute Respiratory Distress Syndrome (ARDS) is a severe form of lung injury characterized by an accumulation of fluid in the alveoli of the lungs. With the growing presence of respiratory illnesses like COVID-19, the rise in incidences of sepsis and pneumonia significantly amplifies the predisposition to ARDS. Alarmingly, despite its profound implications, ARDS is often under recognized, an oversight of serious concern given the reported high mortality rates (~20-40% in the past few decades in the U.S.). Current treatments are limited to mechanical ventilation, which fails to address the root of the problem. ARDS often upregulates pro-inflammatory cytokines such as IL-8, IL-1, and IL-17, which aggravate patient symptoms by creating a cytokine imbalance. Our group is interested in the use of Interleukin-27 (IL-27), a versatile cytokine that presents anti-inflammatory, tissue repairing capabilities, and potential to rebalance innate and adaptive immunity. We hypothesize that human adipose stromal cells (hASC) modified to express IL-27 will be able to reduce inflammation and restore cytokine balance when IL-27 hASC are present in the lung microenvironment. Our results showed down regulation of pro-inflammatory cytokines in LPS-induced lung epithelial (A549 and BEAS-2B) and monocyte (THP-1) cell lines with treatment of IL-27 hASC conditioned media. Currently, we are working on testing our hypothesis in an LPS-induced in vivo model of ARDS. By demonstrating the therapeutic potential of IL-27 in the context of ARDS, our research aspires to provide novel insights and therapeutic strategies to confront this challenging, and pressing clinical condition.



Keywords: Acute Respiratory Distress Syndrome; Gene Delivery; Cytokines; Inflammation; Lung Microenvironment


Mentor(s):

Marxa Figueiredo (Veterinary Medicine); Grace Mulia (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1636**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## The Function of Gamete Expressed-Endopeptidases in Double Fertilization

Life Sciences

Author(s):

Alaina Gartner† (Agriculture, Engineering); Keila Jellings‡ (Agriculture, Science)

Abstract:

The interaction between male and female gametes during double fertilization is critical for successful seed development. Recently, two egg cell secreted endopeptidases in Arabidopsis thaliana, ECS1/ECS2, were found to be involved in the regulation of pollen tube reception and gamete fusion. We hypothesized that other endopeptidase members may have additional functions in regulating localization, activation or elimination of proteins at the surface of gametes. To test this hypothesis, we examined transcriptomic profiles of sperm and egg cells and identified several gamete-specific candidates on different endopeptidase families. To identify their specific roles in processes of recognition and fusion of gametes, we examined single mutants and generated high-order mutants by crossing homologous gene members. The isolated mutant lines were examined for pollen, embryo sac cellular morphology, pollen tube growth and ovule targeting and fertility defects. This work is expected to contribute to the discovery of new gamete factors controlling double fertilization and seed development or unveiling fertilization anomalies leading to parthenogenesis or polyspermy.

Keywords: Plant Reproduction; Protein Identification; Double Fertilization

Mentor(s):

Leonor Boavida (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1637**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## To What Extent Does Phone Dependency Negatively Impact College Student's Memory and Attention?

Social Sciences/Humanities/Education

Author(s):

Antonio Gil† (Polytechnic)

Abstract:

Cellphones have become an integral part of the daily lives of many college students. They have become our calendars, watches, alarm clocks, to-do lists, and so many other things and are only growing in use as they continue to become more advanced. This research paper focuses on the role that cellphones have on our learning, specifically how phone dependency affects Purdue Student's attention and memory. This study uses existing research and literature to investigate how phone dependency affects the learning, academics, and other such factors of college students' lives. The primary effect of phone dependency on memory is decreased retention of information while the effects on attention are distraction and inability to focus for extended periods of time. These findings help show how detrimental phone dependency can be for students but it should be noted that the level of dependency is also important to consider as higher dependency has increased effects on memory and attention compared to lower dependency. The implications of these findings are most prevalent to professors, administrators, and students, exercising the point that a balanced approach to cellphone usage can be important in order to avoid the pitfalls of high phone dependency while still being able to achieve the benefits of cellphones.

Keywords: Cellphones; Memory; Attention; Phone Dependency; College Students

Mentor(s):

Sidney Ducleroir (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1638**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## A Meteorological Investigation of a Tornado-Producing, 'Hybrid' Supercell-Multicell Storm near Delphi, Indiana on 8 May 2023

Physical Sciences


Author(s):

Evelyn Girardi† (Science)



Abstract:

Supercells, storms which contain a rotating updraft called a mesocyclone, are a particularly potent storm type responsible for a vast majority of severe weather, including tornadoes, in the United States. Most tornadoes are produced by supercells, but a different storm type (multicell) occasionally produces tornadoes called "landspouts" or non-mesocyclonic tornadoes. In the case of the Delphi, Indiana "landspout" tornado on 8 May 2023, the general lack of consensus on many aspects of supercell identification has led to an uncertainty regarding whether this unusual tornado was mesocyclonic or non-mesocyclonic in origin. We review identifying characteristics of supercells and apply them to investigate the nature of the Delphi landspout tornado. For the purpose of categorizing the Delphi tornado, we examined whether radar data from the X-band Teaching and Research Radar (XTRRA) of Purdue University detected greater azimuthal shear than KIND (the nearest National Weather Service radar) over the complete time series before, during, and after the tornado. This investigation serves to not only test supercell identification criteria, but it also provides crucial insights into the unique characteristics of the Delphi landspout tornado, ultimately enhancing our ability to accurately classify and predict tornado events in the future.



Keywords: Meteorology; Azimuthal Shear; Tornado; Mesocyclone; Atmospheric Science



Mentor(s):

Robin Tanamachi (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1639**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## "Mapping Research Impact: Insights from Bibliometric Analysis of Academic Libraries' Publishing Trends"

Mathematical/Computation Sciences


Author(s):

Greenley Goedde† (Agriculture)



Abstract:

The academic reputation of institutions, departments, and individual faculty hinges significantly on their publications and citations. This data is evaluated using platforms like Web of Science and InCites or Scopus and SciVal, but generation of affiliation-level data is complicated and prone to error. This study delves into Purdue University Libraries faculty's publishing trends over the past decade, examining citation rates, research topics, interdisciplinary collaborations, and data accuracy. Additionally, it will extend to other university libraries such as Indiana University, University of Arizona and The Ohio State University. By employing bibliometric analysis and visualization techniques, the project will generate insights that could inform strategic decisions such as journal selection and research focus. Project outputs will include detailed methodology on how to gather and clean affiliation-level bibliometric data, internal reports to help faculty to maximize their research impact, and a peer-reviewed article on publishing trends in academic research libraries. Long term, the project methodology can be extended to other departments, institutes, or universities.



Keywords: Publications; Citations; Bibliometric Analysis; Academic Research Libraries; Research Impact



Mentor(s):

Pete Pascuzzi (Libraries); Jason B. Reed (Libraries)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1640**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**How can simulated NPCs react in realistic ways to various weather conditions while pursuing behavioral goals?**

Mathematical/Computation Sciences


Author(s):

Ata Ulas Guler† (Engineering); Alicia Zhou† (Science, JMHC); Zilu (Johnny) Jin† (Science); Jadden Picardal* (Engineering, JMHC); Saandiya KPS Mohan* (Engineering); Leo Chen* (Engineering); Adarsh Veerapaneni* (Science); Amy Tong* (Engineering); Jin Hyun Kim* (Engineering)



Abstract:

Current game environments often lack NPC behavior that realistically reflects dynamic weather changes, hindering player immersion and engagement. This research investigates how to close this gap by creating NPCs that react authentically to various weather conditions while pursuing predefined goals.

The study proposes a novel approach utilizing weather preference scores at varying intensities assigned to each NPC as a unique “persona” per simulated actor. These intensities, following standard deviation weight curves from an average score, influence NPC behavior based on their "comfort zone" and "discomfort zone" towards different weather conditions. For instance, a sun-loving NPC may bask initially but gradually seek shade as discomfort surpasses their threshold. In contrast, an NPC less tolerant of the sun may seek shade more quickly, responding to their discomfort more promptly. This logic extends to other weather conditions as well, such as rain or snow. This system ensures authentic NPC reactions to dynamic weather changes, obstacles, and environmental elements.

The research anticipates enhanced NPC behavior realism with dynamic adjustments based on weather changes and preference scores. Additionally, the study proposes the Real-Time Weather Adaptation System (RTWAS) to further enhance immersion by incorporating real-world weather data feeds for real-time adaptation. The findings hold promise for enriching the gaming experience with more believable and engaging NPC interactions and for realistic architectural simulations demonstrating use of designed spaces.



Keywords: Dynamic Weather Changes; Unique Diverse Personas; AI Non Player Character; Environmental Query System; Real-Time Weather Adaptation System


Mentor(s):

Dave Barbarash (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1641**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Self-Evolutionary Large Language Models for Team Design and Task Allocation in Multi-Human Multi-Robot Teams

Mathematical/Computation Sciences

Author(s):

Arjun Gupte† (Engineering)

Abstract:

Multi-human multi-robot (MH-MR) teams possess significant potential for tackling complex and large-scale tasks by leveraging collaboration between humans and robots, each bringing unique capabilities and expertise. Maximizing the value of this collaboration necessitates strategic team design and advanced initial task allocation (ITA) strategies that account for the diverse physical and cognitive characteristics of team members and tasks. However, previous works have primarily focused on task allocation within a pre-defined MH-MR team, neglecting the critical step of initial candidate selection for team formation. Additionally, existing allocation methods often require extensive training and lack contextual understanding, limiting their generalizability. Moreover, these approaches lack built-in support for specifying user preferences regarding the task, necessitating substantial modifications.

To address these gaps, we propose a comprehensive framework for MH-MR team design and task allocation utilizing self-evolutionary Large Language Models (LLMs) for rule-based learning. We train two LLMs to optimally perform team design and task allocation given various user preferences and simultaneously learn a corresponding set of rules to guide their decision-making. Both LLMs undergo self-evolution as the rules are continually refined based on the performance of the generated team design and task allocation plans when evaluated in simulation. This closed-loop system features a sample-efficient training architecture while adhering to the few-shot learning paradigm. To further enhance inferencing performance, we introduce a mechanism that leverages Retrieval Augmented Generation (RAG)-fusion to extract relevant knowledge from prior training. We evaluate the effectiveness of our approach in a large-scale simulated surveillance case study.

Keywords: Multi-Human Multi-Robot Collaboration; Human-Robot Team Design; Initial Task Allocation; Large Language Models; Retrieval Augmented Generation

Mentor(s):

Byung-Cheol Min (Polytechnic); Ruiqi Wang (Polytechnic); Vishnunandan Venkatesh (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1642**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Do girls with Attention-Deficit/Hyperactivity Disorder (ADHD) present with more sleep problems?**

Social Sciences/Humanities/Education

Author(s):

Carlos Guzman Garcia† (HHS)

Abstract:

Background: Sleep problems are more common in children with Attention-Deficit/Hyperactivity Disorder (ADHD), and may impact their development (Fisher et al., 2017). Problems include difficulty falling asleep, night wakings, bedtime resistance, sleep anxiety, and daytime sleepiness. Like with most areas of ADHD research, our knowledge base for girls is less but some previous studies document higher rates of parent-reported sleep problems in girls (e.g., Becker et al, 2017). Following this work, we hypothesize parents of girls will report more sleep problems.

Objective: This study compared parent-reported sleep problems for boys and girls with ADHD.

Methods: A total of 160 males and 72 females with ADHD were assessed, with an average age of 9.51 years (1.54) and 9.47 (1.51), respectively.

Participating parents reported child sleep problems via the Children's Sleep Habits Questionnaire (CSHQ). CSHQ total and subscale scores (bedtime resistance, sleep onset delay, duration, sleep anxiety, night wakings, parasomnias, sleep disordered breathing, and daytime sleepiness) were compared using ANOVA.

Results. Parents of boys and girls endorsed similar patterns of sleep problems, with two exceptions (Table 1). Parents of girls with ADHD reported more bedtime resistance, $F(1, 230) = 5.84$, $p = .02$ and general problems.

Discussion: Findings from this study highlight bedtime resistance as a potential target for gender-informed sleep interventions for girls with ADHD. Overall, both boys and girls had elevated rates of sleep problems across domains (when compared to previous samples of children without ADHD); therefore, sleep should remain a consistent area of assessment and intervention for children with ADHD.

Keywords: ADHD and Sleep Problems; Gender Differences in ADHD; Bedtime Resistance in Girls; Parent-Reported Sleep Habits; Children's Sleep Habits Questionnaire

Mentor(s):

A.J. Schwichtenberg (HHS); Amy Janis (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1643**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Impact of Colostrum Feeding on Mammary Gland Cell Proliferation**

Life Sciences


Author(s):

Emerson Haines† (Agriculture); Evy Tobolski‡ (Agriculture)



Abstract:

Female piglets that consume more colostrum after birth have higher fertility rates and produce

more milk as sows than those with low colostrum intake. The number of cells in the mammary gland relates to the amount of milk produced, thus we hypothesized that intake of higher colostrum levels would increase the number of proliferating cells in mammary parenchymal tissue compared to formula fed piglets. At birth, 57 female piglets were assigned to 1 of 6 treatment groups: colostrum fed at 20% of birth body weight, colostrum fed at 10% of birth body weight, formula fed at 20% birth body weight, formula fed at 10% of birth body weight, piglets that suckled ad libitum colostrum, or zero hour which did not receive a dietary treatment to serve as the negative control. Piglets received their respective diets for 24 hours, after which, they were euthanized and the mammary gland was excised and fixed in 10% buffered formalin. Mammary tissue was embedded in paraffin, sectioned with a microtome, placed on a glass slide and stained using immunohistochemistry with Ki67, a marker of cell proliferation. A 4X and 20X image of the whole gland and parenchymal tissue, respectively, was captured using the Echo Revolution microscope. ImageJ was used to count the number of proliferating versus non proliferating epithelial and stromal cells in the mammary gland. Analysis is ongoing, but once counts are complete, data will be analyzed using SAS to determine if treatments significantly affect proliferation rates of cell populations in mammary parenchyma.



Keywords: Colostrum; Mammary Gland; Cell Proliferation; Parenchymal Tissue



Mentor(s):

Theresa Casey (Agriculture); Linda Beckett (Agriculture); Wonders Ogundare (Agriculture); Aridany Suarez-Trujillo (Berry University)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1644**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Purdue SoCET: Semiconductor Post-Layout Verification and Simulation**

Physical Sciences

Author(s):

Timothy Hein† (Engineering)

Abstract:

The purpose of our research is to provide solid verification that Purdue SoCET's experimental processor is ready for fabrication. Purdue SoCET has been developing a RISCV microcontroller for embedded applications called AFTx07. In preparation for fabricating AFTx07, our designs must be synthesized into a layout and undergo a series of verification tasks in a process called post-layout verification. Our work centers around LVS, or "Layout Versus Schematic", which draws a comparison between the physical representation, the layout, and the function representation, the schematic, of our processor. Using LVS we are able to derive an analog model of the chip that accounts for both its physical and functional characteristics, including factors such as resistance and capacitance, with which we can simulate how the processor will behave once fabricated. Our simulations serve as evidence that our processor will perform optimally and as intended once put into production.

Keywords: Semiconductor; Microcontroller; Verification; RISCV

Mentor(s):

Mark Johnson (Engineering); Conor Green (Engineering); Swapnil Bansal (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1645**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Tin Alloying of Barium Zirconium Sulfide

Physical Sciences


Author(s):

Opal Heltzel† (Engineering)



Abstract:

Chalcogenide Perovskites, an emerging class of chalcogenide materials with exciting optoelectronic properties comprising earth-abundant, low-toxicity elements, are being studied for various optoelectronic applications with a major focus on solar cells. The rudimentary high-temperature synthesis had previously limited the exploration of chalcogenide perovskites, but recent efforts have drastically lowered the synthesis temperatures. Barium Zirconium Sulfide (BaZrS3) is the most studied chalcogenide perovskite owing to its optimum bandgap for tandem solar cell applications and relatively low-temperature synthesis compared to other chalcogenide perovskites. However, its high bandgap is not ideal for single-junction solar cell applications. Hence, this study focused on the alloying of tin at the Zr-site in BaZrS3. Initially, we used solution-processing, a low-temperature, material-efficient route for synthesizing chalcogenide semiconductors, with amine-thiol solvent chemistry to dissolve organometallic precursors of Ba, Zr, and Sn and form soluble metal thiolates. The solution was then blade-coated onto alumina-coated glass, which was annealed on a hotplate at 350 °C. It was then annealed again at 600 °C in a sulfur environment. At no percentage Sn was Ba(Zr1-n, Snn)S3 able to be formed at low temperatures. To confirm, in absence of impurities from solutions, we performed a solid-state reaction, combining BaS, Sn, ZrS2, and S and heating to 600 °C. Once again, Ba(Zr1-n, Snn)S3 was unable to be synthesized.



Keywords: Chalcogenide Perovskite; Solar Cell; Renewable Energy; Optoelectronic Materials



Mentor(s):

Rakesh Agrawal (Engineering); Shubhanshu Agarwal (Engineering); Kiruba Catherine Vincent (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1646**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Dune Harbor Park: Reclaiming a Natural Oasis for Our Community

Physical Sciences

Author(s):

Rachael Herring† (Agriculture)

Abstract:

The transformation of a former sand quarry into Dune Harbor Park presents a unique opportunity to restore over 300 acres of diverse ecosystems along the Lake Michigan coast while providing a peaceful retreat for the community. The park's design integrates trails, overlooks, a kayak launch, a rain garden, a community pavilion, improved facilities, and Lake Michigan access, offering a range of recreational opportunities for residents and visitors alike.

With a focus on meeting the community's need for natural spaces, the design process involved gathering feedback on desired programming and intensities. Community input informed the selection of amenities, ensuring that the park reflects the preferences and values of the surrounding neighborhoods, including a local elementary school, residential areas, factory workers, and small retail shop owners.

Special considerations were given to protecting the steep slopes of critical dunes, with careful placement of facilities and trail routes to minimize impact on the fragile ecosystem. The park's design includes an ADA-accessible overlook, a bird viewing station, a kayak launch area, and boardwalks connecting to the Lake Michigan beach, all nestled within native plantings to enhance the natural experience.

Dune Harbor Park not only restores a vital ecosystem but also serves as a catalyst for community engagement, providing a place for quiet reflection and outdoor recreation for generations to come.

Keywords: Diverse Ecosystems; Community Engagement; Restoring Vital Ecosystems; Outdoor Recreation; Design as Research

Mentor(s):

Aaron Thompson (Agriculture); Patrick Lydon (National Park Service)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1647**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**VIP AMP Multipurpose Wire Management Tool**

Innovative Technology/Entrepreneurship/Design

Author(s):

Jasper Hochbaum† (DSB); John Min† (Engineering); Ella Goodrich† (Engineering); Alex Hartman† (Engineering); Mohammed Khan† (Engineering); Grace Gellatly† (Engineering)

Abstract:

Adaptable and multipurpose technologies accommodate greater flexibility in manufacturing and have become widely used in industries such as construction, automotive design, military, and security. With the growing popularity of multipurpose devices, functional and simple organizational tools play a crucial role in user interaction within more complex technologies. The design of this organizational tool was expected to meet a series of basic qualifications: durability, practicality, and ease-of-use were paramount to the design. The functionality of the device was dependent being user-friendly and straightforward - allowing the simplification of exponentially more complex devices.  Early renditions highlighted a need for greater flexibility to fit situations that spanned across multiple planes, as well as the need to add or subtract components easily to allow for broader implications. The use of synthetic rubber proved the most complete material as it exceeding the fliexbilty, durability, and practicality qualifications. Since rubber is not electrically conductive, has a high abrasion resistance, and good elasticity resulting in a fast and cost-effective production method. Additionally, the ultimate strength, elastic modulus, and fatigue resistance were also determined. The combination of cheaper manufacturing and improved durability due to the synthetic rubber will not only fuel the increasing demand of multi-functional technology, but also broaden the application of organizational technologies for harsher environments.

Keywords: VIP; Mechanics; Design

Mentor(s):

Shreya Ghosh (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1648**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Understanding the stability and fragmentation of gas-phase host-guest complexes of cyclodextrins and methyl viologen

Physical Sciences


Author(s):

Daniel Hristov† (Science, JMHC)



Abstract:

Cyclodextrins are polymeric sugar rings suitable for the stabilization of chemical species (guests) that have low aqueous solubility and a high affinity towards the hydrophobic interior cavity of the cyclodextrin (host), requiring an understanding of intrinsic host-guest interactions. Mass spectrometry (MS) is a unique gas-phase technique that detects ionic analytes based on their mass-to-charge (m/z) ratio. Because MS studies are conducted under vacuum, they provide insights into the strength of host-guest interactions in the absence of solvent molecules or counterions. We studied the stability of host-guest complexes of cyclodextrins with methyl viologen, which are species of interest for the preparation of electrochromic devices. We specifically used α, β, and γ-cylodextrin (cyclodextrin rings of 6, 7, and 8 monosaccharide  (sugar) units) to study the effect of the size of the cavity on the stability of the complex. We conducted collision induced dissociation (CID) experiments, which provide insights into the fragmentation pathways of the host-guest complexes, useful in determining which host-guest interactions are the stronger in the complex. We performed CID on a thermoLTQ-XL linear ion trap mass spectrometer (LTQ) and an Agilent 6560 quadrupole Time-of-Flight mass spectrometer (qTOF). We observed that sugar losses from cyclodextrin are predominant fragmentation pathways on the LTQ instrument, while the qTOF instrument showed dissociation of the complex as the main fragmentation pathway. A comparison of the fragmentation channels indicates that sugar losses are thermodynamically favorable processes happening at lower energies and that the dissociation of the host-guest complex is entropically driven and promoted at higher energies.



Keywords: Mass Spectrometry; Cyclodextrins; Host-Guest Chemistry; Collision-Induced Dissociation


Mentor(s):

Julia Laskin (Science); Hugo Samayoa-Oviedo (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1649**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Enhancing Social-Emotional Learning for English Learning Students: Addressing Challenges and Crafting Solutions

Social Sciences/Humanities/Education

Author(s):

Elaine Huang† (Education)

Abstract:

The cultural and linguistic diversity in the American education system has propelled English Learning (EL) students into the spotlight, necessitating a closer examination of their unique social-emotional needs. EL students encounter various social and emotional challenges, including acculturation stress, communication apprehension, self-esteem issues, and difficulties in building intercultural relationships. Despite the acknowledged benefits of Social-Emotional Learning (SEL) programs, there is a lack of them tailored to EL students. This study investigates existing SEL programs within EL classrooms, identifies their limitations, and proposes solutions to enhance SEL initiatives for EL students. The research employs a mixed-methods approach, combining literature review, qualitative interviews, and surveys with educators, parents, and EL students. Thematic analysis of qualitative data and quantitative triangulation will elucidate the social and emotional needs of EL students and assess the efficacy of current SEL programs. The study aims to understand specific challenges faced by EL students, evaluate perceptions of SEL effectiveness, and identify areas for improvement. Participants from diverse backgrounds will contribute to a comprehensive understanding of social and emotional adaptation in educational settings. Ethical guidelines will be strictly followed to ensure participant confidentiality and informed consent. By bridging the gap in SEL research for EL students, this study strives to promote their social and emotional well-being, facilitating academic success in diverse educational environments.

Keywords: Social-Emotional Learning; English Learning Students; Education; School Diversity

Mentor(s):

Youli Mantzicopoulos (Education)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1650**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Contribution of the choroid plexus on Alzheimer’s disease and neurodegenerative diseases

Life Sciences

Author(s):

Vivian Hurn† (HHS, JMHC)

Abstract:

Alzheimer's Disease (AD) affects 7 million Americans annually, with imbalanced β-amyloid levels in the brain extracellular fluid being a recognized factor contributing to amyloid plaques in AD brains. The choroid plexus (ChP), located within brain ventricles, acts as a barrier between blood and cerebrospinal fluid (CSF), playing a crucial role in maintaining brain homeostasis. Despite its known significance, the extent of ChP involvement in AD etiology remains unclear. This project sought to explore the clinical relevance and therapeutic potential of the ChP in AD through a comprehensive literature survey. Recent MRI studies have revealed a correlation between changes in ChP volume and declining Mini Mental State Examination scores, often observed in individuals with mild cognitive impairments. Additionally, AD brain exhibits atrophic ChP alterations, dysregulated inflammation pathways within the ChP, augmented β-amyloid fiber formations impacting CSF proteins, and abnormal expressions of NPC2 and TTR in ChP epithelium. Therapeutic interventions including ChP transplantation, gene therapy, and immunotherapy have been explored to address ChP pathology. Notably, an AD mouse model with Tumor Necrosis Factor Receptor-1 (TNF-R11) ablation demonstrated significant improvements in epithelial morphology, reduced ChP Inflammation, and restoration of barrier integrity. Moreover, implantation of ChP epithelial cells following β-amyloid injection showed localized enhancement in neurogenesis and antioxidant activity, suggesting a promising therapeutic avenue to mitigate ChP pathology and thereby combat AD. These findings underscore the significant role of ChP in AD etiopathology and highlight its potential as a target for drug development and environmental toxicological inquiries

Keywords: Choroid Plexus; Alzheimer's; Neurodegenerative; Cerebrospinal Fluid; β-amyloid

Mentor(s):

Wei Zheng (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1651**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Domains of Connectedness that Impact Latino/a Youths' Perceptions of Health

Social Sciences/Humanities/Education


Author(s):

Paige Ittig† (HHS)



Abstract:

Sense of connectedness has been linked to positive youths' health perceptions, which has been found to contribute to future orientation and reduce engagement in risky behaviors. Latino/a youth face unique challenges that negatively affect their health perceptions. Considering the influence of sense of connectedness on promoting health perceptions, there is a compelling need to understand sense of connectedness in the context of Latino/a youth. This study examined how connectedness across multiple domains (family, peer, community, and school) impacts Latino/a youths' health perceptions and how these perceptions impact their health and well-being. Using keywords, research articles were found through the National Institute of Health database. Next, ResearchRabbit, an artificial intelligence online research tool, was used to find similar research. Eligibility criteria included Latino/a youth, connectedness, health, and published within the last decade. Strong connections to family, community, and peers were found to improve health perceptions, thus promoting youths' self-esteem and reducing risky behaviors such as substance abuse. School and community connectedness were found to decrease depressive symptoms in Latino/a youth with school connectedness decreasing these symptoms at a higher rate. Strong sense of school and peer connectedness in Latino/a youth enhanced academic achievement; where more were likely to graduate from high school and pursue post-secondary education. Findings demonstrated that multi-domain connectedness in Latino/a youth positively impacts their health perceptions consequently contributing to positive health outcomes. Among the domains, family connectedness had a notably significant influence on health behaviors and future-orientation. Results can inform future research and health programming.



Keywords: Connectedness; Latino/a Youth; Health Perceptions; Risky Behaviors; Future-Orientation



Mentor(s):

Yumary Ruiz (HHS); Madeline Moser (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1652**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Columbus Park: Creating an Austin Neighborhood Connection**

Physical Sciences


Author(s):

Jaylen Jackson† (Agriculture)



Abstract:

The Historical Park near Chicago, with its majority golf course has long struggled with a cultural division that separates surrounding neighborhoods. To remedy this disconnect a redesign which aims to bridge the gap and revitalizing neglected areas while preserving historical roots. Utilizing GIS data, interviews, and thorough research, the redesign focuses on creating a connective park for all.

GIS data analysis identified areas for redesign, emphasizing neglected spaces and potential points of interest. Interviews collaborated  a lack of cohesion throughout the park, leading to the incorporation of various elements appealing to nearby communities. The design introduces an interactive historic trail with stop areas, fostering a shared understanding of the park's heritage. A lagoon overlook area enhances scenic beauty, offering a tranquil space for community gatherings and bird watching.

To reconcile the divide between communities, a nature playground for all abilities and an undetermined field program were added, promoting inclusivity and diverse activities within the park. This comprehensive approach aims to create common ground, symbolizing unity through shared experiences. By preserving historical elements and implementing community-driven initiatives, the redesigned Historical Park becomes a dynamic space that creates a greater sense of community and mutual appreciation, ultimately acting as a connective junction for the surrounding neighborhoods.



Keywords: Historic Park; Cohesive; Nature Playground; Interactive Historic Trail; Cultural Division



Mentor(s):

Aaron Thompson (Agriculture)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1653**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Developing Positive Pre-Service Teacher-Student Relationships through Field Experiences

Social Sciences/Humanities/Education


Author(s):

Jacob Jenkins† (Education); Emma Jones‡ (Education, JMHC)



Abstract:

Providing opportunities for pre-service teachers to develop positive school relationships with their students and their students' families is vital (Solone et al., 2020; Willemse et al., 2018). Students who feel a part of their school community are more likely to have higher academic achievement and attendance rates (Garcie, 2004; Willemse et al., 2018). This is especially true for students with disabilities who are at a greater risk for negative school outcomes (Murray, 2007). This presentation will describe a qualitative study of pre-service teacher perspectives as they acquire new knowledge through hands-on engagement in real classroom settings. Over the course of their field experiences, pre-service teachers engaged in several activities to develop positive relationships with their students and their students' families. One activity, an initial "Get to Know You" presentation, in which students introduce themselves to the students and/or their students' families. Following these activities, the pre-service teachers were asked to write reflections on their experiences. For this study, reflections written by 36 pre-service teachers across teacher education programs about their experiences in their classrooms were analyzed. The content of each participant's reflection was systematically coded by the research team and analyzed for themes. Preliminary results will be presented, as data analysis is still ongoing. Throughout this presentation, themes that emerged through data analysis, such as new knowledge gained and the learning of other aspects of teaching, will be discussed.



Keywords: Pre-Service Teacher; New Knowledge; Positive Relationships; Students with Disabilities



Mentor(s):

Jasmine Begeske (Education); Jennifer Smith (Education)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1654**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Contribution of PICKLE-related ATP-dependent Remodelers to Chromatin Assembly

Life Sciences

Author(s):

Joshua Kaluf† (Agriculture)

Abstract:

[Abstract Redacted]

Keywords: Chromatin; Remodeler; Epigenetics

Mentor(s):

Joe Ogas (Agriculture); Jiaxin Long (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1655**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Resistor Identification Android Application

Mathematical/Computation Sciences


Author(s):

Chaeeun Kim† (Engineering); Nikhita Anantha Madhavan† (Engineering); Joseph Huang† (Engineering); Shivam Rastogi† (Science, JMHC); Emily Loiselle† (Engineering, JMHC)



Abstract:

Resistors are essential components used in almost all electronic circuits to control the flow of electric current based on their resistance. Resistors are color coded so that by looking at the color bands on a resistor, one can determine its resistance. Automatic determination of a resistor's value based on its image would significantly reduce human errors and increase task efficiency.

In our project, we created an Android app to automatically determine the resistance of a resistor. The user interface of our application has a built-in camera function which allows the user to capture an image of the resistor. The user is then able to crop the image to fit the width of the resistor. The cropped image is 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 our algorithm on the uploaded image. First, our algorithm uses a convolutional neural network to verify that the uploaded image is indeed a resistor. Once verified, the algorithm uses nearest neighbors to identify the color bands on the resistor. The resistance of the resistor is calculated based on the identified color bands. The calculated resistance is then sent back to the app to be displayed to the user. Our app can quickly and automatically determine the resistance of a resistor, demonstrating that image processing systems can effectively aid in the task of resistor identification.



Keywords: Machine Learning; Mobile Application; Image Classification; Android; Computer Vision


Mentor(s):

Edward Delp (Engineering); Carla Zoltowski (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1656**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Developing a Selective Irreversible Peptidic Inhibitor for CBX2

Life Sciences


Author(s):

Sam King† (Pharmacy, JMHC); Gabby Conjelko‡ (HHS)



Abstract:

In the U.S., prostate cancer is a leading cause of cancer and the second leading cause of death in men. While prostate cancers respond well to anti-androgen therapies, they eventually develop various forms of resistance, which are believed to be driven heavily by epigenetic factors. We found that the chromodomain-containing subunit of PRC1 that binds to histone methylation, CBX2, is highly upregulated in treatment-resistant Neuroendocrine Prostate Cancer (NEPC) compared to androgen-sensitive prostate cancer. We previously developed peptide-like inhibitors for CBX2; however, membrane permeabilization and high conservation within the CBX family make inhibition challenging. Here, we describe a modified version of a peptide inhibitor with an acrylamide warhead to target CBX2's nonconserved cysteine residue using a structure-based design approach from a ligand-bound CBX2 crystal structure. Various techniques have evaluated the inhibitor's efficacy, including bioorthogonal biotin labeling and fluorescence polarization. This inhibitor has also led to new insights about CBX2's function in prostate cancer as well as other cancer types such as breast cancer. The results reveal the inhibitor's efficacy and allow comparison to its non-covalent counterpart. This inhibitor allows for more selective targeting of the CBX2 protein over other CBX paralogs and other benefits, such as increased effectiveness. This project is an advance in creating a first-in-class clinically effective CBX2 inhibitor.



Keywords: Drug Discovery; Pharmacology; Epigenetics; Cancer


Mentor(s):

Emily Dykhuizen (Pharmacy); Sandra Ordonez (Pharmacy); Sijie Wang (Stanford University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1657**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Active Two Degree of Freedom Prosthetic Ankle

Innovative Technology/Entrepreneurship/Design

Author(s):

Katie-Jane Klembarsky† (Engineering, JMHC)

Abstract:

The HIRo Lab aims to revolutionize below-the-knee prosthetics by designing a device that more naturally emulates the human gait cycle. Generally, prosthetic users endure muscular degeneration and weakness. For patients to move naturally and without injury, prosthetics tend to be lighter than the replaced body part. This long term project has involved previous design iterations that relied on heavy motors, prompting the pursuit of a lighter design that can simulate human motion more naturally.

The primary objective of this research revolves around optimizing prosthetic geometry to minimize motor torque requirements, enabling the utilization of smaller motors in prototyping and subsequent design iterations. A Simulink model was developed to explore the prosthetic's geometric configuration. MATLAB scripting facilitated the exploration of various parameters, including locations of attachment points, spring stiffness, and spring loading. The team will implement the lowest torque requirement geometry into a new design to approximate torque exertions than those of a healthy individual during a standard gait cycle.

The results indicate that including a spring with a stiffness coefficient of 250 N/m, attached 0.15 m above the universal joint and pre-compressed to 75% of its natural length, yielded the lowest motor torque requirement. Remarkably, the optimized geometry necessitated less torque than the ankle torque of a healthy individual of the same weight. The team can now develop an active prototype that uses less robust, lighter motors which reduces the weight of the prosthetic, to provide greater comfort and functionality for patients.

Keywords: Prosthetic; Torque Requirements; Optimization; Torque Reduction; Geometric Analysis

Mentor(s):

Mo Rastgaar (Polytechnic); Gabriel Andres Torres Rivera (Engineering); Ahmed Soliman (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1658**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Prioritizing Student Health: Investigating Purdue's Commitment to Their Students**

Life Sciences

Author(s):

Haleigh Kolosso† (HHS)

Abstract:

A healthful lifestyle has proven benefits in positivity, performance, and overall happiness (Deshpande, 2009; Sogari, 2018). College meal plans are known to be difficult to navigate as the choices are not always nutritious or appealing. This exploratory research project focuses on Purdue and the ways that campus dining provides foundational support and access for students to lead healthful lives. To investigate this issue further, I have collected data via a survey that was sent out to a sample of Purdue students to gather their insight on the effectiveness, variability, and overall satisfaction with the dining plans offered on campus. From this data set, I compared the answers between students currently using Purdue dining and those that aren't in order to identify any trends or major differences between perceptions. By focusing my research on Purdue's dining plan, I am providing insight into the ways that students perceive the choices that are made available to them. As shown in the data, I've discovered that students have less of an attraction towards the health benefits of food, and are more drawn to the taste aspect. This research project provides future researchers with potential insights into how to get college students more interested in overall nutritional health. Additionally, this research speaks to why colleges should care about the health practices that they promote through the food choices that they provide.

Keywords: Student Support; College Dining; Health; Nutrition

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1659**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Fused Deposition Manufacturing of Elastomer Fibers via Single Chamber Co-Axial Extrusion

Innovative Technology/Entrepreneurship/Design

Author(s):

Hayden Krisko† (Engineering)

Abstract:

Responsive soft material fibers are pivotal to the next generation of biomedical and soft robotics innovation, yet they face immense challenges with their fabrication ability. Thermal-based extrusion, the most prominent method of producing Dielectric Elastomer Fibers (DEF), traditionally utilizes a multistage custom nozzle to produce the coaxial structure of the fibers. The structure of the nozzles often requires specialized manufacturing and excessive costs for a single fiber diameter. The melting technique inhibits the fabricator from adjusting the fiber dimensions once the printing apparatus has been created. Developing a more cost-effective fabrication technique capable of adjusting the fiber diameter readily while maintaining the evenly distributed coaxial cross-section of the fiber would significantly enhance the capacity of researchers to assess the varying properties of different fiber diameters and compositions. Multiple iterations of extruder designs will be generated with variable layer ratios and extruded fiber diameters. The resultant fibers will then be subjected to mechanical and electrical strain testing and analysis of their cross-sectional quality. Beyond the quality of the DEF, further testing of the resilience of the extruder and heater elements will be required for continuous production. The single-chambered technique could usher more capabilities for mass production of DEFs at varying scales for soft-bodied robotics and biomedical applications.

Keywords: Dielectric Elastomer; Co-Axial; FDM; Extrusion; Single Chamber

Mentor(s):

Alex Chortos (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1660**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Using inertial measurement units to compare gait in outdoor and indoor environments**

Life Sciences

Author(s):

Shlok Kulkarni† (Engineering, JMHC); Gabi Layman‡ (Engineering, JMHC); Elsa Davis* (HHS, JMHC); Hala Haddad* (HHS); Braden Stock* (Engineering); Amanda Martin* (HHS); Mithran Periassamy* (HHS, JMHC)

Abstract:

Pedestrian walking habits have evolved significantly over time due in large part to the increased use of headphones, earbuds, and other listening devices during walking. As such, it is important to quantify the potential changes in gait characteristics for pedestrians who walk with diminished hearing, especially in outdoor settings. In this study, gait patterns are measured and compared through the use of small, wearable sensors called inertial measurement units (IMUs). For each trial, participants (n=8) walked across designated indoor and outdoor paths with IMUs placed on each ankle and trunk to capture changes in linear acceleration and orientation. Participants completed two sets of these trials, with one involving the use of an earplug and construction earmuffs to simulate asymmetric hearing loss. The study is currently in the data collection phase, and the results will be measured using overlapping stride analysis. These results will assist with understanding how impaired hearing affects gait in everyday outdoor settings and can provide more insight into the future of pedestrian safety.

Keywords: Gait Characteristics; Pedestrian Safety; Asymmetric Hearing Loss; Outdoor Settings; Inertial Measurement Units

Mentor(s):

Jeffrey Haddad (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1661**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## FEMTA Suborbital Flight Experiment

Innovative Technology/Entrepreneurship/Design

Author(s):

Yahor Lechanka† (Engineering); Matt Wheeler† (Engineering); Mason Whittington† (Engineering); Rohan Iyer† (Engineering, JMHC); Angus Wai† (Engineering); Aubrey Gatewood† (Engineering)

Abstract:

The Film-Evaporation MEMS Tunable Array (FEMTA) is an innovative small-scale thruster intended for small satellites allowing them to perform attitude control maneuvers in orbit. The main goal of this research is to test the FEMTA thruster and propellant management system in a zero-gravity environment. The manufacturing team is tasked with designing a suborbital flight experiment to test the current iteration of the FEMTA thruster. Currently, the manufacturing team is working to improve and finish the flight components for the propellant tank, base plate, collection chamber, and thrust stand, marking a key milestone for the project. The software team is tasked with designing a method of controlling the experimental payload during the suborbital flight test. Currently, the software team is working to test various separate modules, before integrating them into a cohesive in-flight control program. A highlight of the software is the ability to discern various flight stages without capsule telemetry, allowing for experiments to be prepared and run at the proper time without external input. Pressure, temperature, and acceleration sensors are used to determine the flight phase and trigger the operation of each experiment at the appropriate time. The experiment will gather data on propellant flow rate, pressure, and temperature; and measure the thrust output of the FEMTA microthruster. This poster presentation highlights the integration of hardware and software to perform complete system testing.

Keywords: Propulsion; Space; CubeSat; Microtechnology; Microgravity

Mentor(s):

Jesus Meza (Engineering); Steven Pugia (Engineering); Anthony Cofer (Engineering); Alina Alexeenko (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1662**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Gamification of Pediatric Rehabilitation Exercise

Innovative Technology/Entrepreneurship/Design


Author(s):

Elena Lehner† (Engineering, JMHC); Julie Kim† (Engineering); Dalton Aaker‡ (Engineering, DSB); Twinkal Barai‡ (Engineering); Khushi Choksi‡ (Engineering); Shreya Krishnan‡ (Engineering); Simran Nadig‡ (Engineering); Akarsh Ojha‡ (Science); Abigail Origer‡ (Engineering, JMHC); Jean Paul Pertuit‡ (Engineering); Sage Turner‡ (Engineering); Ethan Weiss‡ (Engineering, JMHC); Sugru Yahaya‡ (Engineering)



Abstract:

Children often struggle to adhere to muscular rehabilitation programs, making adherence one of the most common reasons for less effective or prolonged treatment. Roughly 60% of children starting physical therapy terminate treatment within the first few sessions, with a later 20-40% of these children dropping out of treatment upon entering the follow-up period. Pediatric physical therapy covers a range of mobility-related conditions such as: cerebral palsy, Duchenne's, and down syndrome. Children often find repetitive exercises to be demotivating or boring. Current methods of incentivization include puzzles, games, etc. To create a positive experience while undergoing treatment, our team gamified rehabilitation exercises through muscle movement controlled games. The aim of this project is to support the treatment of children affected with muscular dystrophic diseases by increasing their adherence to their rehabilitation protocol via gamifying the treatment itself. To this end, we used a Raspberry Pi Pico W leveraging its WiFi capabilities and small size to send EMG data to an offsite at Amazon Web Services (AWS) database. A WebSocket API integration request was set up on a React server to allow users to use movement as input for a simple 2D analog game. Future improvements include further testing, more complex games, implementing more secure data privacy, as well as a more comfortable design that facilitates accurate and responsive data collection for a more rewarding gaming experience.



Keywords: Pediatric Physical Therapy; Rehabilitation Exercises; Muscle Computer Interface; EMG; Wearable Sensors


Mentor(s):

Aaron Lottes (Engineering); Neal Patel (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1663**

*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Impact of serum advanced glycation end-products and RAGE inhibitor administration on patellar tendon healing in a mouse model

Life Sciences

Author(s):

Rebecca Lewis† (HHS)

Abstract:

We propose excess serum advanced glycation end products (AGEs) via activation of the receptor for AGEs (RAGE) is a novel mechanism contributing to poor tendon healing in diabetic individuals. AGEs accumulate in the serum of diabetic individuals via overnutrition and impaired clearance mechanisms. We determined if elevated serum AGEs would limit the recovery of tendon biomechanical properties. Further, we determined if administration of a RAGE inhibitor [Azeliragon (AZ)] could improve tendon mechanics. Ten-week-old mice were injected daily with bovine serum albumin (BSA-only, n=6), BSA and 100µg/day AZ (BSA-AZ, n=5), 200 µg/mL glycated BSA (AGE-BSA, n=4), or AGE-BSA with AZ (AGE-AZ, n=6). A circular defect was created in both patellar tendons. After three weeks, the patellar tendon of one limb was extracted and tested for biomechanical characteristics. Tendon stiffness and modulus were lower in AGE-treated mice (p<0.05, 10.8□1.4 N/mm and 28.0□7.0 MPa) compared to BSA-only (17.6□1.3 N/mm and 63.5□9.0 MPa). Further, tendon stiffness and modulus in AGE-treated mice given AZ were not different from AGE-BSA (p>0.05, 12.7□1.8 N/mm and 47.6□10.4 MPa). We found no statistically significant difference between groups in maximum load, stress, strain, or toughness (p>0.0). In this initial pilot cohort, we demonstrate that increasing serum AGEs in healthy mice impairs recovery of tendon biomechanical properties after injury. Treatment with AZ in the presence of elevated AGEs tended to improve tendon modulus (p=0.139). This data links serum AGEs to impaired tendon healing and supports our hypothesis that elevated serum AGEs, as seen with diabetes, could contribute to delayed tendon healing.

Keywords: Advanced Glycation End Products; Tendon Healing; Biomechanical Characteristics; RAGE Inhibitor; Mice

Mentor(s):

Chad Carroll (HHS); Harrison Cottingham (HHS); Camila Reyes (HHS); Nathan Campbell (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1664**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Behavior and Performance of Concrete Anchors under Tension Loading

Innovative Technology/Entrepreneurship/Design

Author(s):

Van Tha Bik Lian† (Engineering)

Abstract:

Concrete is the second most used material in the world, only next to water. The usage of concrete ranges from bridges to buildings to roads. As such, the production of concrete contributes greatly to climate change. However, the continued rate of concrete usage is not sustainable as concrete is not recyclable and generates waste. Recently, research in anchorages hinted at a future of reusability and adaptability of existing concrete structures. However, traditional usage of anchors in concrete suffers from brittle failure, resulting in limited use. This paper delves into the research done by Suthar, who seeks to improve the strength and ductility of anchorages with the usage of anchor reinforcement. The strength of the anchor reinforcement is measured by performing a displacement control test using potentiometers, support beams, and an actuator. The support beams hold down the concrete specimen to the strong floor and the potentiometers measure displacement. The actuator pulls on the anchor group, resulting in a direct tensile force acting vertically. This causes a concrete cone breakout, which activates the reinforcement. Other failure types, such as rebar yielding and bond failure, are also studied to observe the source of failure for the sample. The data shows that reinforced anchor groups have higher strength and ductility than those without. Based on this data, reinforcement is highly recommended for anchorages and anchor groups to improve both functionality and safety. With these improvements, anchors could lengthen the life of concrete structures by allowing for modification and expansion of existing concrete structures, thus making concrete more sustainable.

Keywords: Anchorages; Concrete; Anchor; Sustainability; Reinforcement

Mentor(s):

Akanshu Sharma (Engineering); Deepak Suthar (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1665**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Conservation of A. globiformis Genetics in the Genomes of Bacteriophages DoctorPepper and RootBeer.

Life Sciences

Author(s):

Manasvi Lingampally† (Agriculture); Ashley Cumbee† (Engineering); Grace Troyer† (Science); Kayla Grennes‡ (Agriculture); Amanda Pawlecki‡ (Engineering); Faith Chapman‡ (Engineering)

Abstract:

Bacteriophages (phages) are viruses that infect and replicate within bacteria. Studying the interactions between phages and their bacterial hosts is required to understand gene conservation and phage-host coevolution. This study aims to explore the genomic relationships between two bacteriophages, DoctorPepper and RootBeer, and their isolation host, strain B-2979 of Arthrobacter globiformis, focusing on the conservation of genes and their morphology. This paper outlines the investigation on whether genes from the B-2979 strain of A. globiformis are conserved in the DoctorPepper and RootBeer genomes. As phages are capable of horizontal gene transfer, studying gene conservation provides insight into microbial evolution. To address this question, the research team proposed a bioinformatics analysis, comparing the genomes of DoctorPepper and RootBeer with A. globiformis. Utilizing tools such as DNA Master for genome comparison and PyMOL for protein morphology analysis, the research team aims to identify conserved genes and assess their structure and function. This investigation will include an examination of nucleotide and amino acid differences to understand their effects on protein structure and function, potentially revealing shared evolutionary pathways and mechanisms of interaction between the phages and their host. This study builds on existing knowledge by applying a focused comparative genomic approach and offering insights into phage evolution, gene conservation, and the molecular basis of phage-host interactions.

Keywords: Bacteriophages; Conservation; Coevolution; A. globiformis; Phage-Host Interactions

Mentor(s):

AJ Gin (Engineering); Harry Ashbaugh (Engineering); Daphne Fauber (Engineering); Adam Quinn (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1666**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Machine Learning for Mode Space Basis Generation

Physical Sciences


Author(s):

Andrew Liu† (Science); Ansh Gangapurkar* (Science); Ben Miller* (Engineering); Eric Kang* (Science); Rahul Menon* (Science); Sangjin Lee* (Science)



Abstract:

The redundancy of large sparse Hamiltonian matrices of nanodevice cross sections poses a bottleneck to the analysis of device operation, such as the I-V relationship of a transistor. Thus, we seek to expand the capability of semiconductor device transport calculations. For every electron present in a cross section, we must solve Schrödinger's equation to obtain the wave vectors that will make up a band structure. This is fundamentally an eigenvalue problem of a matrix H, the Hamiltonian of the cross section. As mentioned, the size of H is a primary cause of complexity. Though, many eigenstates (and hole states) are irrelevant for our purposes, so we can reduce the size of H through a change of basis. A reduced band structure is then created with the transformed basis through discrete sampling of k-values. We also modify energy ranges in our band structures to define a region in which we strive for accuracy. Currently, we have run several computer simulations with variations made in sampling and offsets, and obtained a collection of basis sets of a silicon cross section. The data collected now and in the future on other materials will be used to develop a machine learning model that can produce basis sets in a more optimal and automated manner. Through this work, we expect the analysis of larger scale devices to be more practical.



Keywords: Semiconductor; Nanodevice; Machine Learning; Band Structure


Mentor(s):

Tillmann Kubis (Engineering); Logan Melican (Engineering); Daniel Lemus (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1667**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Seismic Cracking of Embankments and Earth Dams**

Innovative Technology/Entrepreneurship/Design

Author(s):

Jingqing Liu† (Engineering)

Abstract:

When embankments and earth dams are subjected to seismic loadings, lateral and longitudinal deformations, crest settlement, transverse and longitudinal cracking, and liquefaction may occur. Earthquake-induced cracks are considered one of the most hazardous consequences of seismic damage because they can lead to increased seepage through the dam and internal erosion, which may result in failure of the dam and catastrophic release of the water in the reservoir. Ensuring the safety of earth dams relies on an adequate assessment of their seismically-induced deformations. This study aims to improve the seismic design of embankments and earth dams by expanding and modernizing the existing database. Data on earthquakes, dams, and seismically-induced damages was collected from the technical literature, which included conference publications, journal papers and technical reports. The modernized database containing information on the performance of 385 dams during 21 different seismic events from 2000 through 2023, has been carefully examined to select reliable and high-quality data. Correlations between the type of dam, PGA and/or earthquake intensity and damage to the dam in the form of longitudinal and transverse cracking have been proposed. Creation of such database, along with the correlations established, will be crucial to enhancing the seismic resilience of embankments and earth dams, as well as advancing the current knowledge on the seismic response of dams.

Keywords: Earthquake-Induced Cracking; Seismic Damages; Embankments and Earth Dams

Mentor(s):

Antonio Bobet (Engineering); Juan Jimenez (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1668**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Effect of AI Benevolence on Humans' Trust and Use of an AI Assistant in a Video Game

Social Sciences/Humanities/Education

Author(s):

Hecun Liu† (HHS, Liberal Arts)

Abstract:

Recent studies emphasize trust as crucial for artificial intelligence (AI) adoption. While existing research primarily examines AI reliability for trust calibration, other human-centric factors like integrity and benevolence remain understudied. This experiment investigates the role of AI benevolence in trust and willingness to use an AI assistant. Participants (N=88) interacted with either a benevolent or non-benevolent AI in a simulation game developed by our team. After the game, participants answered whether they would cooperate again with the AI assistant in another session and then responded to a series of questions about their perceived benevolence, trust in the AI assistant, and willingness to use it, using 1-7 Likert-type ratings. The results revealed significantly higher willingness to cooperate again with the benevolent AI (90%) compared to the non-benevolent AI (57%). Ratings for perceived benevolence, trust, and willingness to use the AI assistant were all higher for the benevolent condition than for the non-benevolent condition, with the largest difference observed for perceived benevolence. The higher ratings of perceived benevolence and trust for the benevolent AI assistant suggest it was perceived more positively than the non-benevolent AI assistant. The choice to continue cooperating with the benevolent AI assistant and the higher ratings of willingness to use indicate that the participants would continue to use the benevolent AI assistant. These findings underscore the importance of perceived AI benevolence in shaping trust and willingness to use.

Keywords: Human-AI Trust; Benevolent AI; Human-AI Cooperation; Usage Intention; Virtual Interactive Game

Mentor(s):

Thomas Redick (HHS); Robert Proctor (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1669**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Quantitative Analysis of 3D Nuclei Segmentation Data in Whole Mount Zebrafish Embryos**

Mathematical/Computation Sciences


Author(s):

Lionel Loo† (Science)



Abstract:

[Abstract Redacted]



Keywords: Machine Learning; Nuclei Segmentation; Data Processing; Quantitative Analysis; Computer Science



Mentor(s):

Linlin Li (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1670**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Design and Prototyping of Compliant Robotic Grippers

Innovative Technology/Entrepreneurship/Design

Author(s):

Riley Mann† (Engineering, JMHC)

Abstract:

This project deals with the design and prototyping of a compliant robotic gripper system capable of variable levels of force. The ideal device operates more similar to a human hand than a traditional robot grabber with two states, open and closed. The proposed robotic grippers will be able to close with variable force based on the application. The robotic grippers are controlled by a force sensing system using integrated raspberry pi cameras which watch the deflection in the external soft material of the hands and determine the level of force applied to the gripper. From this, the correct force will be able to be applied to the object being grasped. This robotic gripper is intended for human interactions and possible therapeutic applications due to its compliant nature.

Keywords: Robotics; Compliant; Grippers; Computer Vision; Human Robotic Interactions

Mentor(s):

Dongming Gan (Polytechnic); Muhammad Hammad Alvi (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1671**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Does intergroup contact impact children's relation to outgroups?

Social Sciences/Humanities/Education

Author(s):

Gianna Martire† (HHS, JMHC); Kris Sass† (HHS, Liberal Arts)

Abstract:

Current literature on Intergroup Contact Theory (Tropp et al., 2022) documents children's attitude development towards various outgroups, with outgroup attitudes becoming more positive with increased equal, cooperative, and supported intergroup interaction around shared goals. Research with this theory designating immigrants as the outgroup is limited. Additionally, as Social Identity Theory (Nesdale, 2017) states, individuals who hold ingroup identities as important are more likely to have more negative outgroup attitudes. Research into what factors affect the amount U.S. children relate to immigrant children could give insight into how to potentially mitigate the development of negative attitudes. A sample of 8- to 12-year-olds ($N = 358$) told us about their experiences with immigrants and how much they related to children from other countries. We measured how close U.S. children related to other U.S. children and children from three chosen countries, Mexico, China, and Egypt. We then measured direct contact (e.g., friendships), extended contact (e.g., books), and the valence of extended contact children had with immigrant peers (i.e., nice or mean). Direct, extended, and the valence of extended contact were all statistically significant factors predicting increased relation to the outgroup over the ingroup, $ps < .009$. When analyzed collectively, valence was the only significant factor, $p <.001$. This showcases the merits of positive contact above other factors when relating to immigrant outgroups, consistent with Intergroup Contact Theory. These results can be used to promote effective interventions that foster increased positive attitudes towards immigrant peers among children.

Keywords: Social Development; Intergroup Attitudes; Child Development; Prejudice; Immigration Attitudes

Mentor(s):

Laura Elenbaas (HHS); Megan Norris (HHS); Jane Singman (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1672**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## The Hardy Strong Foundation Mobile Application

Innovative Technology/Entrepreneurship/Design

Author(s):

Luke Matheny† (Polytechnic, JMHC)

Abstract:

The purpose of this design project is to collaborate with a nonprofit organization called the Hardy Strong Foundation to help them save software licensing costs and to aid in their pursuit of stomach cancer prevention. As a childhood friend of Justin Hardy, who the foundation was named after, I have seen firsthand the impact of his incredible story. Below is a link to a short documentary that ESPN made during the final year of his life. This past summer the foundation had their first event and raised over $150,000! The board of directors then came to me knowing that I had experience in software development. They wanted to see if I could create an app to replace the software they currently paid for. I loved the idea and I believe it gives me a lot of freedom to create an intuitive application that handles all their use cases in a very creative way. We have already sketched out a lot of the features and I hope to use the software engineering skills I learned at Purdue to help me with this project. The final deliverable will be an iOS application that followers of the foundation can download from the app store. The backend database will be supported by Firebase. Inside of the app, users will be able to sign up to volunteer at upcoming events, learn more about genetic testing for gastric cancer, and even apply for the foundation's memorial scholarship.

Documentary Link: https://www.youtube.com/watch?v=WuFRHjxffp8

Keywords: Software Engineering; Community Impact; Agile Development; Cloud Storage; Deployment Pipeline

Mentor(s):

Tianyi Li (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1673**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## The Effects of Lactobacillus Casei and Streptococcus Mitis on Sulfated Glycosaminoglycan Content and RNA Expression in Chondrocytes

Life Sciences

Author(s):

Allison Matovic† (Engineering); Sanjana Muniraj* (Graduate School)

Abstract:

Osteoarthritis is one of the most common musculoskeletal diseases, affecting millions of individuals. Osteoarthritis is known to affect synovial joints and the molecular mechanisms therein. There are many connections between the gut microbiome and human disease progression, and this type of connection may exist for osteoarthritis. To test one aspect of this potential relationship, the effect of microbe metabolites from two different bacterial strains on the sulfated glycosaminoglycan (sGAG) content released into media and within the cell layer of chondrocytes was examined. As osteoarthritis progresses, sGAG content decreases, and thus sGAG content may be used as an indicator for osteoarthritis severity. Lactobacillus casei is positively associated with osteoarthritis while Streptococcus mitis is negatively associated with osteoarthritis. To study differences in sGAG released into media, cells were cultured in monolayers with or without diluted (1/64) S. mitis or L. casei in standard culture media as determined from cytotoxicity-based measurements. The samples were cultured for a period of 72 hours with intermediate media change at 24-hour increments. Using a dimethyl-methylene blue (DMMB) assay, sGAG content was compared between the two culture conditions. Additionally, changes in RNA expression will be measured between the culture conditions. The results from these experiments may provide beneficial insights into the changes in extracellular matrix content and gene expression that have implications in understanding the mechanisms of knee joint degeneration.

Keywords: Osteoarthritis; Gut Microbiome; Lactobacillus Casei; Streptococcus mitis; Chondrocytes

Mentor(s):

Deva Chan (Engineering); Mikayla Roach (Engineering); Shrea Roy (Engineering); Clarisse Zigan (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1674**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## 3D Printed Flexible Tactile Sensor for Rehabilitation

Innovative Technology/Entrepreneurship/Design

Author(s):

Liam McCormack† (Polytechnic); Eveyln McCarthy‡ (Engineering)

Abstract:

Wearable devices that provide sensory feedback and function as sensors have applications in areas such as rehabilitation. The progress and development of these devices has been supported by advancements in technologies such as soft actuators, flexible sensors, and wireless acquisition devices. This study focuses on a glove prototype with 3D printed flexible sensors attached to the finger sections of the glove. The prototype takes advantage of resistance-based sensors made of a custom conductive, flexible 3D printed filament and the insulating effects of standard commercial thermoplastic polyurethane. Five of these sensors were printed and placed on the finger sections of the glove for reading finger movements as the fingers bend. The sensors were connected to a Wheatstone bridge circuit to monitor the changing resistance. To test the functionality of the prototype, the wearer of the glove grasped several different objects in varying sizes. As pressure was applied by the wearer's hands to the sensors on the glove, the voltage and resistance values responded and were measured using a digital multimeter. The rotation angle and radius of the actuator were measured using deformation tracking software. Five trials were performed for each object. The primary application of this technology is to help with rehabilitation efforts. These flexible sensors can be applied to multiple parts of the body and give real-time data on a patient's movement. Data from these sensors can be used by medical professionals to assess the progress the patient is making in their mobility and to adjust their treatments.

Keywords: Rehabilitation; Thermoplastic Polyurethane; Flexible Sensor; Soft Actuators; Biosensing Human Motion

Mentor(s):

Brittany Newell (Polytechnic); David Moreno (Polytechnic); Diana Narvaez (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1675**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**RoboGripper: EMG-Controlled, Wrist Brace-Mounted, Robotic Manipulator for Hand Paralysis Patients**

Innovative Technology/Entrepreneurship/Design

Author(s):

Shaiv Mehra† (Engineering, JMHC); Tyler Merrill† (Engineering)

Abstract:

Hand paralysis, commonly caused by stroke, cerebral palsy, or spinal cord injuries (SCI), is a life-altering disability. SCI often causes incomplete tetraplegia, the partial loss of functionality in the extremities, including the hands. In 2023, the National Spinal Cord Injury Statistical Center reported that in the US alone approximately 302,000 people suffer from traumatic SCI with 142,242 people having incomplete tetraplegia. They lose their independence, requiring assistance with daily tasks. Many patients also develop tenodesis grips or other unnatural wrist positions that provide them with limited, potentially harmful hand functionality. Restoring gripping functionality could greatly increase their independence and overall quality of life, but current therapeutic and assistive technology solutions are expensive and unintuitive.

An EMG-controlled, robotic gripper is being developed, capable of attaching to a wrist brace and allowing patients to manipulate everyday objects. It is 3D-printed to reduce cost and EMG-controlled to enable easy triggering by the flex of the bicep. This assistive device incorporates triangular, compliant grippers that conform to differently shaped objects to improve grip.

For the grippers, various infill geometries and densities of Thermoplastic Polyurethane (TPU), a flexible 3D-printing material, are being tested on diamond-shaped objects with differing dimensions and force sensitive resistors (FSR). The designs are being evaluated based on their force output, overall deformability, and ability to manipulate a wide range of objects including finger foods and office supplies. An optimal gripper geometry will be implemented into the EMG-controlled device to assist those with incomplete tetraplegia to interact with the world around them.

Keywords: EMG-Controlled; Assistive Technology; Robotic Gripper; Disability; Hand Paralysis

Mentor(s):

Bradley Duerstock (Engineering); Mitchell Sanchez (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1676**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Image Compression Using Singular Value Decomposition

Mathematical/Computation Sciences

Author(s):

Ronit Mehta† (Science)

Abstract:

Image compression is a process that minimizes storage size while maintaining image quality. This project aims to understand singular value decomposition and explore its applications to image compression. Beginning with a comparison and understanding of various decomposition methods, using these insights, we programmed an SVD implementation. To compress images, we conducted experiments by reducing the number of singular values. To optimize compression further, we explored the underlying principles behind RGB to grayscale conversions. Recognizing that human eyes are more sensitive to brightness in images, we explore novel ways to compress the image's luminance, blue chrominance, and red chrominance channels. SVD was implemented through the combination of Matlab and Python, allowing us to successfully reduce pictures into component matrices and return an image like the original while requiring smaller matrices. The primary objective of our research is to explore creative ways of storing the SVD of an image rather than the image matrix. Moving forward, we plan to build upon existing techniques such as Run-Length and Huffman Encoding to reduce redundancy in our image file data.

Keywords: Image Compression; Python/Matlab Programming; Singular Value Decomposition; Linear Algebra

Mentor(s):

Mahesh Sunkula (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1677**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## RISC-V Vector Processor for Embedded Applications

Mathematical/Computation Sciences

Author(s):

Maxwell Michalec† (Engineering, JMHC); Fahad Aloufi† (Engineering); Om Gupta† (Engineering)

Abstract:

RISC-V's vector extension, ratified in November 2021, adds vector instructions to the ISA that can exploit data-level parallelism in tasks like machine learning, graphics processing, and digital signal processing to improve a CPU's execution speed. This project aims to implement the Zve32x standard extension, which is an integer-only subset of the full vector extension with a maximum element size of 32 bits. This extension will be added to the Purdue SoCET VIP team's 32-bit RISC-V core to improve its performance on data-parallel tasks in embedded applications. Rather than an independent vector unit, we implement an architecture that tightly integrates the vector and scalar functionalities to minimize area and design complexity. Simultaneously, we utilize a decoupled frontend and backend architecture in which vector instructions are decoded into simpler micro-ops to allow them to execute on a less complex backend that still implements the entire Zve32x standard extension. Our design has a maximum throughput of 4 element computations per cycle. This number can be further increased to 16 through the use of SIMD functional units in a future revision. We use SystemVerilog as the hardware description language to create our digital design. We also simulate our design with test cases using Verilator with the eventual goal of fabricating the design using Skywater's 130nm process node. To demonstrate performance improvements on the target applications, we will use the Embench benchmark suite compiled with Clang, which supports auto-vectorization for the RISC-V ISA.

Keywords: Computer Architecture; Vector Processing; Embedded Systems; RISC-V; System on Chip

Mentor(s):

Mark Johnson (Engineering); Cole Nelson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1678**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Minecraft Gaming Elasticity Solver Modification for Learning Structure Mechanics

Innovative Technology/Entrepreneurship/Design

Author(s):

Chawin Mingsuwan† (Polytechnic)

Abstract:

This study explores the educational potential of Minecraft, a popular video game, to engage students in mechanical engineering. An elasticity solver mod built in Minecraft allows users to perform stress analyses on structures, bridging the gap between virtual and real-world engineering concepts. The research objective is to create user-friendly video tutorials for downloading and using the mod, accompanied by a downloadable Minecraft World featuring progressively challenging engineering tasks. This initiative aims to enhance teaching methods by providing an interactive platform for students to apply theoretical knowledge. The mod will be deployed in the Honors section of the Statics course in Fall 2024, offering students a dynamic learning experience. The long-term goal is to make the mod widely accessible, extending its impact beyond the classroom and promoting innovative approaches to teaching engineering and physics. By seamlessly integrating Minecraft as an educational tool, this research seeks to captivate student interest, foster exploration, and bridge the gap between theory and application in the field of mechanical engineering.

Keywords: Minecraft; Mechanical Engineering; Educational; Video Games; Statics

Mentor(s):

Adrian Tepole (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1679**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**3D-Printed Biomechanical Device to Prevent Finger Injuries in Soccer**

Innovative Technology/Entrepreneurship/Design

Author(s):

Uday Mittal† (Engineering, JMHC); Juliana Asencion† (Engineering); Luke Johnson† (Engineering); Matthew Schaller† (Engineering)

Abstract:

In soccer, goalkeepers have up to five times more upper extremity injuries compared to outfield players. These injuries can include finger sprains, jams, dislocations, and fractures. Current devices help prevent hyperextension of the fingers, but they make it more difficult to bend fingers forward, restrict side-to-side movement, and do not prevent jamming. The goal of this device is to prevent hyperextension and jamming while also being adjustable and not limiting movement. To accomplish this, multiple iterations of the device were designed on Autodesk Fusion 360. The device, 3D-printed in nylon, consists of individual links connected by a cam hinge system. The link closest to the fingertip curves over the finger to take initial impact from the incoming force. The goal is to distribute the force to the back of the hand without hindering the fingers or their actions. Data will be obtained from users with an electronic hand dynamometer with gloves and will be compared to parallel data collected while using traditional finger guards to assess potential quantitative impairments in grip strength. Additionally, a finite element analysis (FEA) stress simulation will be conducted to evaluate the product's overall strength, identifying both stress resistance and weak points. Planned testing will evaluate if this device is an innovative solution to finger injuries that is both cost effective and adjustable.

Keywords: Biomechanics; Sports Injury Prevention; 3D-Printed; Stress Mechanics

Mentor(s):

Aaron Lottes (Engineering); Neal Patel (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1680**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Comparing the reconstruction methods of the top quark in hadron collisions**

Physical Sciences

Author(s):

Wyatt Montgomery† (Science, JMHC)

Abstract:

In particle physics, the heaviest elementary particle is the top quark. Due to its sheer relative mass, it decays before it is able to be detected directly at the CMS in the Large Hadron Collider. In order to study its behavior, there are a number of methods used to reconstruct the top quark using the kinematics of the daughter particles. The two analytical algorithms for this task are the neutrino reweighting and the ellipse method. In addition, there are machine learning methods such as the nu2flows developed by Raine, J et. al as well as the TransBLSTM method which is being developed by the Jung group here at Purdue. These methods have been applied to a smaller simulated Monte Carlo dataset, and the goal of my research is to implement these methods on a different larger 'Full Sim' dataset. Comparing these methods and their efficiency would allow us to see if any particular method produced better uncertainties or resolutions for the reconstructed kinematics. These results could lead to a further implementation of said method(s) on CMS data.

Keywords: Top Quark; CMS; Ellipse Method

Mentor(s):

Andreas Jung (Science); Yao Yao (Science); Ethan Colbert (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1681**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**A Decadal In-depth Analytical Exploration (2012-2022): Holistic Examination of Management Discussion and Analysis (MD&A) Integrating Comprehensive Market Risk Assessment for American, Delta, and United Airlines**

Social Sciences/Humanities/Education

Author(s):

Kamanda Mosongo† (Polytechnic, JMHC)

Abstract:

This research aims to evaluate the statistical analysis of Delta, United, and American Airlines over a 10-year analysis. The data was from the quarterly reports from 2012 to the fourth quarter of 2022 and the Form 10-K reports from each airline under their respective SEC filings. The individual calculations the researcher performed using Microsoft Excel to find the airline's Stock Closing Price, Net Profit (Operating) Margin, Earnings Per Share (Diluted), and Revenue. Each of these components was found based on the 10-Q SEC Filing reports posted by the airlines. Data was also analyzed from prior literature based upon incidents from Delta and United Airlines, along with researching Chinese and Korean Airlines' MD&A. With these critical components to discuss the 10-year statistical analysis, the researcher also compiled the data of each airline's MD&A and Market Risk Factors over the 10-year range. To further divulge the importance of the 10-year analysis amongst Delta, United, and American Airlines, this research project had the following goals:

1. Determine the change of MD&A and market risks over ten years for Delta, United, and American Airlines

2. Analyze the 2012-2022 change of financial analysis for the three major airlines over ten years

After this research project, this paper should better understand the 10-year analysis of the three major airlines from 2012-2022. Implementing this study into other research projects discussing the analysis change of other global airlines will further provide insights into the forecast of other airlines and primary aviation industry impacting events in the foreseeable future.

Keywords: Statistical Analysis; 10-Year Analysis; United Airlines; Delta Airlines; American Airlines

Mentor(s):

Chien-Tsung Lu (Polytechnic); Haoruo Fu (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1682**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Leveraging Cancer-Associated Mutations to Identify Synthetic Lethal Therapeutic Strategies in Endometriosis

Life Sciences

Author(s):

Asmi Mukherjee† (Science)

Abstract:

Endometriosis is a disease caused by abnormal growth of the inner lining of the uterus, known as the endometrium, outside the uterus. Endometriosis and endometrial carcinoma exhibit similarities in ectopic growth, which could also imply other underlying correlations. There have been studies that reveal cancer-associated mutations in endometriosis (KRAS, ARID1A, PIK3CA, PPP2R1A). Of these, KRAS mutations (p.G12D, p.G12V) are of particular interest due to their strong influence on the pathogenesis of many aggressive cancers as well as their mutant recurrence in patients with endometriosis. In cancer, genetic mutations can lead to a cell's increased reliance and activation of additional genes for its survival. Targeting these genes that become essential due to evolved dependencies is therapeutically known as Synthetic Lethality. Work by our group and others has shown that comparing the relative essentiality of genes in mutant cancers compared to wild-type tissue can uncover novel therapeutic strategies for targeting mutated cells. However, this approach has not been applied outside of the context of cancer, to situations where cancer-associated mutations occur in non-cancer cells, as is the case with endometriosis. The KRAS mutation is significant in endometrial lesions and its relationship with other essential genes could reveal a new application for synthetic lethality concepts as strategies to pharmacologically regress lesions in endometriosis. In this study, we combine transcriptomic data from endometriosis patients with genetic screening data from endometrial cancer cell lines to identify genes with dysregulated expression in endometriosis that exhibit increased essentiality in the presence of a KRAS mutation.

Keywords: Endometriosis; Synthetic Lethality; Genetics; Mutation

Mentor(s):

Douglas Brubaker (Case Western Reserve University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1683**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Digital Therapeutics in Hearing Healthcare**

Innovative Technology/Entrepreneurship/Design

Author(s):

Keisuke Nakamura† (Science, JMHC)

Abstract:

Digital therapeutics (DTx) in hearing research have emerged as a new category of therapies that provide evidence-based intervention via digital means such as software, smartphone apps, or websites. However, as they are relatively new, yet not well-established. In this presentation, we review DTx technologies in hearing research fields, focusing on three categories: prevention and diagnosis, aid (assistance), and curing (digital medicine). We observed that the majority of DTx systems require interactions with users (or patients) without clinical professionals' direct support to obtain or collect medical evidence; this makes training (or education) features crucial to the success of the therapy. In this view, we will discuss the education or training functions of the current DTx and their contribution and purposes. The impact of emerging Artificial Intelligence (AI) on DTx in hearing research is being explored, along with discussions about the future of DTx concerning AI integration. We believe that this work will contribute to a better understanding of the current and future DTx technological advancements, shedding light on the field of hearing

research in particular.

Keywords: Digital Therapeutics (DTx); Hearing/Auditory; Artificial Intelligence

Mentor(s):

Noori Kim (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1684**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Cochlear Hair Cell Integrity Across Frequencies Following Exposure to Small Arms Fire-Like Noise**

Life Sciences


Author(s):

Andy Navarro† (Science); Emily Bell‡ (Science)



Abstract:

Noise-induced hearing loss (NIHL) poses a considerable concern for those in various occupational settings who frequently encounter high-intensity sounds, such as military personnel. Exposure to intense noise can induce significant morphological changes in the auditory system, such as the cochlea's inner and outer hair cells (IHCs, OHCs). Distortion product otoacoustic emissions (DPOAEs), which are faint signals generated by the cochlea triggered by exposure to tones similar in frequency, serve as a reliable indicator of OHC integrity and function. This study aims to investigate the impact of small arms fire (SAF) noise exposure on DPOAEs across different frequencies (2, 4, 8, 10 kHz) over a span of time (d7, d14, d28, d56). We hypothesize that exposure to SAF noise will result in frequency-dependent reductions in DPOAEs, reflecting compromised outer hair cell integrity. IM administration of ketamine was used to sedate F-344 rats (N = 8) before their exposure to a sequence of 13 biphasic pulses, simulating SAF noise at a frequency of 0.33 Hz, occurring over a 2.5-minute interval and reaching a peak intensity of 120 dB SPL. Under isoflurane anesthesia, DPOAE recordings were conducted using an earpiece containing a microphone and two sound delivery tubes placed in the animal's ear. Preliminary analysis of the DPOAEs suggests OHC damage as evidenced by a decreased signal-to-noise ratio (SNR) relative to the control. Understanding the specific damage patterns of OHCs along different frequency regions of the cochlea could provide valuable insights into the mechanisms of NIHL and treatments to reduce damage.



Keywords: Distortion Product Otoacoustic Emission; Outer Hair Cells; Noise-Induced Hearing Loss; Fischer 344 Rat; Cochlea


Mentor(s):

Edward Bartlett (Science); Meredith Ziliak (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1685**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Zebrafish actb1 knock-in

Life Sciences

Author(s):

Henrietta Ndubuokwu† (Science)

Abstract:

Patients with diabetes can often have foot ulcers that do not heal and are often characterized as wounds with wet surroundings. This project focuses on wound closure as it is a complicated process that requires precise spatiotemporal regulation. Abnormal wound healing processes can often be detrimental in patients with chronic wounds, such as diabetic foot ulcers. These wounds can ultimately result in a patient's foot being amputated because of a long progression of the disease. The goal of this research is to understand the process of wound closure to find ways to cure abnormal wound healing leading to chronic wounds. The actomyosin ring has been identified as the major driving force in the process of wound closure, so revealing the dynamics of actin in wound closure may provide a deeper understanding of its function in wound closure. To visualize the structure of actin in zebrafish epithelia, RFP/GFP is inserted into the C terminus of the actin DNA sequence with a CRISPR-Cas9 system through the non-homologous end-joining method. Microinjection is performed to insert the new DNA sequence into the zebrafish embryo (day 0), and then screened for fluorescent protein signals (day 3). Positive F0 are raised to adulthood and mated with wildtype zebrafish to identify founders. A knock-in functional test is performed on an identified founder to confirm the protein does not affect wound closure. It is expected that the founder DNA is the same as the altered DNA sequence injected into the embryos. In the future, we will be screening and visualizing actin/myosin present in wound closure.

Keywords: Genetic Engineering; CRISPR-Cas9; Knock-In; Non-Homologous End Joining; actb1

Mentor(s):

Qing Deng (Science); Chang Ding (Science); Scotty Secrist (VP Diversity and Inclusion)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1686**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## true time delay circuit for wideband IF beamforming based on switched capacitor array

Innovative Technology/Entrepreneurship/Design

Author(s):

Long Nguyen† (Education)

Abstract:

For baseband beamforming applications, the N-path filter stands out for its potentially good time delay and delay resolution with exceptionally high density per die area. However, the signal's delay depends on how slowly we undersample the signal until the Nyquist frequency, which limits most N-path literature to sub-10 nanoseconds max delay. Time-interleaved switch capacitor sampling arrays (SCAs) are a promising new technology for baseband beamforming as they offer a number of advantages over traditional N-path filters, including high power efficiency, large delay range, and fine resolution. This paper explores the implementation of an SCA-based true time delay unit with nested N-path filter undersampling the signal at low frequency to extend the possible delay and an outer layer N-path filter that samples the circuit at high frequency to maintain the signal waveform and resolves possible aliasing issue from the inner layer N-path filter. By the time of writing this abstract, a preliminary 8x8  implementation already achieved an outstanding delay of 30nano seconds, further delay can be realized with further optimization. Even though time-interleaved SCAs are a relatively new technology, they have the potential to revolutionize baseband beamforming such as those used in 5G and future wireless communication systems with the further implementation of digital beamforming techniques and such for handset applications

Keywords: RFIC; Analog/Mixed Signal; Switch-Capacitor; Phased Array; True Time Delay

Mentor(s):

Sutton Hathorn (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1687**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Cascade Control with Stanley-Tracking for High-Speed Autonomous Racecars

Mathematical/Computation Sciences

Author(s):

Alec Pannunzio† (Engineering)

Abstract:

Autonomous vehicles rely on a control algorithm to determine how to turn the steering wheel to follow the desired trajectory computed by the planner. In high-speed applications, engineers tend to favor pure pursuit or follow-the-carrot tracking, which picks a reference point at a lookahead on the path and controls heading to either intersect the path at or point towards that lookahead point, over Stanley tracking, which tracks both cross-track error and yaw difference with reference to the front axle.

However, I propose a variation of a Stanley-tracking controller that uses cascading controllers to control the two errors, injecting heading and path curvature, which allows the tracking to be effective even in high-speed applications.

Using TUM Simulink vehicle dynamics simulation for the Dallara AV-21 racecar, the controller was able to comfortably maintain < 0.6 meters cross-track error and < 0.1 radians yaw difference at speeds in excess of 170 miles per hour.

Keywords: Controls; Autonomous Vehicles; Self-Driving Cars; Racing; AI

Mentor(s):

Samuel Labi (Engineering); Shreyas Sundaram (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1688**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Reducing Financial Burden: Early Identification of Cardiac Arrest using Machine Learning

Innovative Technology/Entrepreneurship/Design

Author(s):

Elainna Papandrea† (HHS); Subbi Sathya† (HHS); Ethan Lin† (HHS); Elena Warble† (HHS); Duc Le† (HHS, JMHC); Devin Reynolds† (HHS); Vicky Zheng† (HHS); Linda Zou† (Science); Aneesh Poddutur† (Engineering); Yen Lai* (HHS)

Abstract:

Introduction:  Cardiac arrest is a medical emergency, resulting from the heart's abrupt cessation of normal rhythm, impairing vital organ function. Over 300,000 in-hospital cardiac arrests (IHCA) occur annually in the U.S., with a 28.7% survival rate. Post-cardiac arrest care costs in the U.S. reach 33 billion USD yearly, with 6 billion USD attributed to index hospitalization. Research shows patients display vital sign shifts, indicating cardiac arrest up to 12 hours in advance. The subtlety of changes challenges timely detection by medical personnel. Machine learning (ML) offers an opportunity to develop accurate, predictive models for improved IHCA predictions.

Purpose: This research aims to develop a machine learning model (MLM) capable of recognizing clinical decline leading up to cardiac arrest and, in doing so, improving the cost-effectiveness of patient care.

Methods: This retrospective secondary analysis of the Medical Information Mart for Intensive Care (MIMIC) IV-ED dataset, representing ED patient encounters at Beth Israel Deaconess Medical Center (2011-2019). The primary focus is predicting IHCA. Feature variables, including age, sex, and changes in vital signs, will be incorporated into a multilayer perceptron (MLP) framework. Performance will be assessed using the area under the receiver operating characteristics curve (AUROC) and the area under the precision-recall curve (AUPRC). Comparisons will be made against logistic regression.

Impact: Implementing a MLM that predicts cardiac arrest will help to reduce costs for in-hospital cardiac arrests by timely identifying at-risk patients, alleviating financial burden effectively.

Keywords: Cardiac Arrest; Machine Learning; Vital Signs; Finance; Early Identification

Mentor(s):

Laura Moffat (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1689**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Comparison between Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) and benchtop X-Ray Fluorescence (XRF) performance for trace elemental exposure in rat tissues

Life Sciences


Author(s):

Stefano Parducci† (HHS)



Abstract:

Heavy metal toxicants are detrimental in almost every organ system in the human body and account for a large amount of environmental pollution. The standard methodology for elemental contents in biological tissues uses ICP-MS. However, this technique is complicated, costly, and time-consuming. XRF have improved capabilities to offer an alternative for trace metal analysis offering similar capabilities. The purpose of this study is to evaluate the performance of both instruments for the quantification of elemental exposure in rat tissues. The comparison of both techniques was performed for measuring elemental concentrations in rat tissue samples and achieved using laboratory preparation and instrumentation. The XRF systems are expected to offer comparable detection to ICP-MS.  The analysis showed that each elemental concentration in rat tissues exhibited strong linear correlations, specifically copper (R2 = 0.88), zinc (R2 = 0.77), cadmium (R2 = 0.81), arsenic (R2 = 0.86), and manganese (R2 = 0.88) between XRF and ICPMS. Pearson correlation value was r = 0.95 ($\alpha \leq 0.05$) between the mean concentrations obtained with ICPMS and XRF techniques and median minimum detection limits for 5 elements were found to be 0.12 µg g-1 with minimum detection limits from Cd (0.0042 µg g-1), Cu (0.040 µg g-1), Zn (0.12 µg g-1), As (0.25 µg g-1) to Mn (0.35 µg g-1) within 7.5 minutes repeated measurements. This study highlights the potential of XRF as an alternative method to ICP-MS for quantifying elemental contents in organ tissues that combats the issues from ICP-MS application.



Keywords: Elemental Contents; ICP-MS; Benchtop X-Ray Fluorescence; Metals; Rat Tissues


Mentor(s):

Aaron Specht (HHS); Kolawole Adesina (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1690**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

### Exploring the Efficacy of Acoustic Monitoring in Insect Biodiversity Assessment: Insights from BirdNet and Seasonal Activity Patterns

Life Sciences


Author(s):

Saloni Parkar† (Science, JMHC); Isabella Duzman* (Science, JMHC); Zhixin Cai* (Science, JMHC)



Abstract:

Insects play a crucial role in ecosystem dynamics, and their monitoring is vital for understanding ecosystem health and function. Acoustic monitoring has emerged as a promising tool for insect biodiversity assessment due to its non-invasive nature and scalability. Nevertheless, its efficacy for use with insects remains largely untested. This study explores the potential of acoustically monitoring insect biodiversity using BirdNet, a popular machine-learning-based bird sound classifier, in large-scale agricultural fields. This study includes three fields with in situ management practices ranging from sustainable to highly conventional. We focus on ground and tree crickets due to their ecological importance and distinct acoustic signatures. Our research aims to determine the accuracy of species prediction for insect taxa and identify the most active time for insect monitoring in terms of seasonality and diel patterns. We employ a multi-step approach, including testing an existing insect classifier, analyzing labeled samples in BirdNet, generating spectrograms of audio samples to identify insect calls, and utilizing BirdNet for taxa identification. The research is divided into two phases: phenology analysis and species identification. In the phenology analysis, we compared standard acoustic indices across six trials, with different settings (FFT size of 512 or 1024, minimum frequency of 500 Hz or 1000 Hz, maximum frequency of 11000 Hz or 22000 Hz), across three types of agricultural sites (sustainable, moderately conventional, conventional). We examined spectrograms of audio files (~10,4000) to determine insect presence. Additionally, we trained an AI tool with labeled data of specific insect species, such as ground crickets and field crickets, to assess its performance in identifying target species in unlabeled data. We evaluated species identification precision using a confusion matrix, revealing varying precision levels ranging from 0.39 for specific species to 0.70 for family-level identifications. However, when applying the AI tool to unlabeled data, precision dropped to 0.00. Overall, our findings underscore the potential of acoustic monitoring in insect biodiversity assessment while offering insight into current challenges associated with existing data analysis methods. Our research highlights the efficacy of Trial 6 in achieving consistently robust results even in the presence of external noise, like road noise while capturing a broad range of insect



Keywords: Acoustic Monitoring; Insect Biodiversity; BirdNet; Agricultural Fields; Species Identification


Mentor(s):

Christine Elliott (Agriculture); Kristen Bellisario (JMHC)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1691**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Genomic Insights into the Breed Composition of Purdue Beef Cattle

Life Sciences

Author(s):

Marcos Daniel Pastrana† (Agriculture)

Abstract:

Accurate breed identification is crucial for preserving and managing genetic diversity within livestock populations. This study analyzed the breed composition of beef cattle based on their genomic information. Genotypes were collected from two beef cattle farms at Purdue University: Feldun Purdue Agricultural Center (1,040 animals genotyped using 41,750 SNP markers), and Southern Indiana Purdue Agricultural Center (SIPAC; 356 animals genotyped using 51,380 markers). After the genotypic quality control based on minor allele frequency, call-rate (for both animals and genotypes), Hardy-Weinberg equilibrium, and pruning for linkage disequilibrium, we remained with 998 animals and 34,962 SNP markers from Feldun, and 350 animals and 37,389 SNP markers from SIPAC. Genotypic quality control and principal component analysis (PCA) were performed using the PLINK software, and admixture analyses were performed using the ADMIXTURE software. All analyses were performed within farm. For the Feldun farm, the first and second principal components (PC1 and PC2) explained 12.36% and 9.2% of the variance, respectively. Predominantly, the use of Simmental breed was identified at the Feldun farm, with notable representation of Angus animals and their crosses. Admixture analysis provided insights into the ancestral populations that generated the current Feldun population. At the SIPAC farm, PCA identified three distinct groups of animals, with PC1 explaining 17.56% of the variance and PC2 explaining 9.64%. Admixture analysis for SIPAC identified a broader mix of ancestral populations. Overall, this preliminary genomic analyses sheds light on the genetic composition and population structure of beef cattle populations raised at Purdue University. Further investigations are warranted.

Keywords: Admixture; Genetic Diversity; Principal Components; Genotypes; Population Structure

Mentor(s):

Hinayah Rojas de Oliveira (Agriculture); Henrique Mulim (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1692**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Separating Standard Model and SUSY Dataframes Using Neural Networks**

Physical Sciences


Author(s):

Rohan Patel† (Engineering); Cara Suh† (Science); Xiaoyu Liu† (Science); Yicheng Wu† (Science); Amelia Binau* (Science)



Abstract:

Using kinematic variables from the Compact Muon Solenoid (CMS) experiment at the LHC, statistical algorithms are used to identify particles from their mass-energy. However, supersymmetric theories often predict small deviations from the predictions of the Standard Model. To be able to better detect a supersymmetric particle with a spontaneously broken symmetry, we train and test a classifier AI model on data from the CMS detector. Traditionally, experimental data (signal) is compared to a curve fitted to a theoretical model (background) in order to find statistically significant differences. Using an ML-based approach, we create an algorithm that directly separates signal (SUSY) from background (SM) datapoints, potentially leading to more accurate results as well as more consistency than what can be done with curve fitting/peak finding algorithms and what can be done with the human eye. We expect the classifier to be able to separate signal and background to a statistically significant level. Our approach brings insight into how machine learning can be employed for data analysis that requires accurate separation of similar signals with enough available data. Further research needs to be done in how the ML-parameters we used affects the results and how an ML algorithm compares to other methods like shape ratio, difference thresholding, and CWT.



Keywords: Supersymmetry; Standard Model; Neural Network; Signal Separation



Mentor(s):

Andreas Jung (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1693**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Development of a lab-scale welding fume test system for occupational health and toxicological research

Physical Sciences

Author(s):

Nicholas Pecoraro† (HHS); Shane Limas† (HHS, JMHC)

Abstract:

Arc welding uses a consumable electrode in the electric arc to join metals. The byproduct of this process is welding fumes containing metallic aerosols. Inhalation of these metallic aerosols can cause adverse health effects, for example, cancer and neurological damage. Specifically, chronic exposures to manganese found within the welding fumes can result in manganism, characterized as tremors, stiffness, slowed motor movement, and muscle spasms. Furthermore, the onset of these symptoms is typically preceded by aggressiveness, depression, and hallucinations. In order to protect welders who use their skills to earn their living, it is important to understand the effects of manganese and how to prevent exposure in welding occupations. However, toxicology testing measuring welding fume exposure in the field can prove challenging. To overcome this problem, a lab-welding fume test system is developed. Specifically, the system consisted of a welding station to generate welding fumes, an exposure chamber to place sampling/monitoring systems or animal subjects, and a centrifugal fan to pull the welding fumes to the exposure chamber. To characterize the metallic aerosols in the welding fume, respirable samplers utilizing mixed ester cellulose filters were installed in the exposure chamber. After collecting the welding fumes for 20 min, the samples collected on the MCE filters were analyzed gravimetrically. Metal contents in the samples were also analyzed using using X-ray fluorescence (XRF). From the results of gravimetric analysis, the mass concentration of respirable particles in the welding fumes was 5.69±0.779 mg. The results of the XRF analysis show that Mn concentration in the respirable particles was 118.345±14.832 µg. The results show that the developed system can be further used for various occupational health and toxicological research. In the future study, we will simulate the various welding conditions including different welding types, materials, and generation rates.

Keywords: Welding; Fumes; Aerosol; Manganese; XRF

Mentor(s):

Jae Hong Park (HHS); Chang Geun Lee (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1694**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Characterization of proteins from the bacteriophage RiverMonster**

Life Sciences


Author(s):

Ashley Phoenix† (Science, JMHC); Austin Lu* (Science)



Abstract:

Bacteriophages are viruses that infect bacteria. They inject their genetic material into bacterial cells, which is then replicated to produce new bacteriophages using the host machinery. This process leads to lysis of the bacteria, where the newly synthesized phages are released into the environment to infect and kill additional cells. Given that they are a natural predator of bacteria that have co-evolved, bacteriophages serve as promising therapeutics, as their specificity allows them to target and kill select strains of pathogenic bacteria. One obstacle to using bacteriophages for therapeutics, however, is that not much is known about the vast number of bacteriophages in existence. To fill this knowledge gap, the objective of this project is to better understand how phages hijack and kill bacteria by characterizing the structure and function of proteins from the bacteriophage RiverMonster, which was discovered at Purdue University. The genes from RiverMonster are cloned and amplified using PCR and inserted into a plasmid for expression in bacteria. After expression, the proteins are purified, and structural characterization performed using size-exclusion chromatography, circular dichroism spectroscopy, computational modeling, and X-ray crystallography. The structures of these proteins will offer clues about their function, which will be investigated in future studies.



Keywords: Bacteriophage; Proteomics; Structural Biology



Mentor(s):

Nicholas Noinaj (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1695**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## LLMs in Digital Hardware Design: A Literature Review

Innovative Technology/Entrepreneurship/Design

Author(s):

Michael Piper† (Engineering)

Abstract:

Despite the recent massive growth in popularity of large language models (LLMs) such as ChatGPT and Copilot for writing software, their usage for digital hardware design remains minimal. However, a substantial amount of hardware is designed with hardware description languages (HDLs), such as Verilog, that have many similarities to programming languages. Because of this, the success of the LLM in creating functional software could be replicated for hardware, saving many hours of work writing and checking designs. To evaluate the current capabilities of LLMs for generating useful Verilog, recent research on training and verifying LLM Verilog outputs will be considered from the viewpoint of functional accuracy and output quality. This assessment will provide an evaluation of the readiness of LLMs for usage in the hardware design role.

Keywords: Verilog; Large Language Model; LLM; Hardware Description Language

Mentor(s):

Mark Johnson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1696**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Applying the Critical Incident Technique to Analyze the Ethical/Unethical Experiences of Biomedical Engineering Faculty

Social Sciences/Humanities/Education

Author(s):

Tyler Ramsey† (Engineering)

Abstract:

Within the field of Biomedical Engineering (BME), numerous concerns have risen over the last decade regarding ethics. Majority of the interviewed faculty felt ethics are poorly considered within the field of BME. To better understand and gain perspective, our team interviewed 25 biomedical engineering researchers about their experiences with ethical engineering research. From the different backgrounds and experiences of the BME faculty, the research team utilized the Critical Incident Technique (CIT) to discover key incidents and experiences where ethical/unethical actions and choices were made by or experienced by BME faculty during their careers. From the interviews, we have extracted 144 incidents from the 25 interviews. Going forward, the research team is placing the extracted incidents into categories based on its type of incident. After extracting, analyzing, and categorizing the incidents, the research team plans to introduce educational methods for promoting cultures of ethical engineering in BME.

Keywords: Biomedical Engineering; Research Ethics; Qualitative; CIT

Mentor(s):

Justin Hess (Engineering); Andrew Brightman (Engineering); Nicholas Fila (Iowa State University); Alison Kerr (Colorado School of Mines)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1697**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Examining the Identity Development and Community Experiences of Multiracial, Gender-Diverse Emerging Adults

Social Sciences/Humanities/Education

Author(s):

Sarah Ramsey† (HHS, JMHC)

Abstract:

The Multiracial Population is one of the fastest-growing racial groups within the U.S. (U.S. Census, 2022). However, more research needs to be done to examine healthy identity development practices for this demographic. Additionally, while some preliminary research within recent years has been done to examine community experiences of Queer People of Color (Dawes et al., 2023), little research has been done on specifically Queer Multiracial individuals (de Vries & Sojka, 2022), and no research has been done on Multiracial people that fall outside of the gender binary. Our research hopes to fill this gap within the literature, by interviewing 20 Multiracial Gender Diverse emerging adults (ages 18-29) on their experience with race, identity development, community, and gender identity. Preliminary findings suggest themes of Self Protection, Negotiation, Liminality, and Fluidity. Self-protection refers to how participants have said that with multiple minoritized identities it is often important to protect themselves from disclosing sensitive information. Negotiation relates to the experience of often navigating which identities to project within different spaces. Liminality refers to how even though these individuals fall into multiple categories, they often feel not quite like a member of either group. Fluidility refers to the longstanding experience with navigating the fluidity of race, which then translated later on in life when exploring non-traditional forms of gender expression. These preliminary findings suggest that Multiracial Gender diverse adults require more open conversation and support to aid in healthy identity development. This research could create interventions and workshops on allyship for this group.

Keywords: Multiracial; Identity Development; Gender Identity; Intersectionality; Community and Allyship

Mentor(s):

Annabelle Atkin (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1698**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Modeling Avian Color Vision: Spectral Discrimination in Ultraviolet Sensitive and Violet Sensitive Birds

Life Sciences


Author(s):

Jordan Reynolds† (Science, JMHC)



Abstract:

Spectral discrimination is the ability to discriminate between colors across the light spectrum. The receptor noise-limited model (RNL) included in the R package PAVO is a framework for predicting color vision of various species based on a set of visual parameters. In this study, we investigate the spectral discrimination abilities of two subsets of the avian species: ultraviolet sensitive (UVS) and violet sensitive (VS), utilizing a specific visualization called a spectral discrimination curve derived from the output of the RNL. Our study aimed to validate the accuracy of our generated spectral discrimination curves by comparing our predicted values to the behaviorally confirmed spectral discrimination curves for the Carassius auratus. Following the validation of our methods, we concluded that VS species generally exhibit superior spectral discrimination compared to UVS species, which is a contradiction to previous literature. We attribute this disparity to two factors. Firstly, past literature employed alternative methods to measure discrimination, primarily based on the species' ability to discriminate between natural reflectances (objects) rather than spectral stimuli (lights). Secondly, a previously proposed contributor to increased spectral discrimination relates to the regions of overlap between photoreceptor peak absorbances, particularly where the slopes of the sensitivity spectra are steep. Future research is needed to explore the effects of these regions of overlap on the avian visual system. Understanding these mechanisms both enhances our comprehension of avian vision and has broader implications for the fields of evolutionary biology and sensory ecology.



Keywords: Spectral Discrimination; Sensitivity Spectra; Ultraviolet/Violet Sensitive; Peak Absorbance; Natural Reflectance



Mentor(s):

Esteban Fernandez-Juricic (Science); Carlay Latour Teed (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1699**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Sexual Dimorphism in Subcortical Auditory Pathways: Investigating Sex-Specific, Long-Term Consequences of Damaging Noise Exposure

Life Sciences

Author(s):

Paula Rivera Carrasquillo† (Science); Audrey Harrison* (Science, JMHC); Emily Bell* (Science); Andy Navarro* (Science); Morgan DesEnfants* (Science); Sahil Desai* (Engineering); Anushka Shome* (Science); Valentina Micolisin* (Science)

Abstract:

Sexual dimorphism in human hearing is often recognized by researchers. For example, post-menopausal women exhibit a sharper decline in hearing compared to age-matched men. Thus, identifying auditory pathway structures leading to disparities may enable sex-specific interventions for noise-induced damage. This study evaluates the effects of small arms fire (SAF) exposure on the subcortical regions of rats, specifically the long-term, sex-specific differences in post-noise exposure auditory evoked potentials (AEPs). Anesthetized six-month-old rats were exposed to SAF for 2.5 minutes. To study the effects of SAF, we presented brief, sequential auditory stimuli that elicit AEPs, known as clicks, before exposure, and on days 7, 14, 28, and 56 after exposure. As our experiments are still ongoing, results will be discussed in the final presentation. For analysis, we will compare the average time progression of click-evoked middle latency responses (MLRs) of AEPs in females vs. males. We will study P0 and N0, components of MLR associated with transmission from subcortical to thalamocortical processing. By measuring changes in component amplitude, magnitude, and latency, we might identify differing effects of exposure such as sex-specific variations in neural response strength and neural transmission speed. Females and males are predicted to show similar initial subcortical damage, with both exhibiting decreases in amplitude, affected waveform morphology, and/or prolonged latency. Understanding such differences in subcortical AEPs is essential for identifying unique sex vulnerabilities. If differences are observed, there is basis for exploration of the mechanisms/structures affected in each, with future investigations focusing on development of sex-specific interventions for NIHL.

Keywords: Sexual Dimorphism; Small Arms Fire Exposure; Subcortical Regions; Auditory Evoked Potentials; Middle Latency Response

Mentor(s):

Edward Bartlett (Science); Meredith Ziliak (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1700**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Forecasting the 2024 U.S. Elections using Mathematical Modeling

Mathematical/Computation Sciences

Author(s):

Alexia Rodrigues† (Science); Joseph Cromp† (Science); Thanmaya Pattanashetty† (Science)

Abstract:

Election forecasting is an exciting, yet complex and uncertain process that is often under scrutiny from the public eye. Our presentation is focused on forecasting the upcoming 2024 Presidential, Senate, and Gubernatorial elections in the United States. We use mathematical models based on the Susceptible–Infected–Susceptible (SIS) model in epidemiology to mimic interactions between voters. In combination with this, we use polling data and data-science approaches to forecast and visualize results for upcoming elections. Our forecasts are publicly shared on our website (https://c-r-u-d.gitlab.io/2024/) with interactive features to display the uncertainty in election forecasting. Looking forward, we hope to increase the accuracy of our forecasts and to expand upon our methods for visualizing uncertainty.

Keywords: Math; Computational Modeling; Data Science

Mentor(s):

Alexandria Volkening (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1701**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Exploring The Impact Of Ferumoxytol On Reactive Oxygen Species In Various Cell Types**

Life Sciences


Author(s):

Valeria Rodríguez† (Science); Camryn Clapper* (HHS, JMHC)



Abstract:

Immune cells, like macrophages, produce large amounts of reactive oxygen species (ROS), in order to, to kill cancer cells. The purpose of this study is to compare the amount of  ROS produced by GL-261, a murine glioblastoma cell line and RAW 264.7, a murine macrophage cell line, on their own and in coculture when exposed to various concentration of ferumoxytol. Ferumoxytol is an iron nanoparticle; thus, the iron can enhance the ROS production through the Fenton reaction. We hypothesize that the macrophages will have higher basal production of ROS. Furthermore, when cocultured, GL261 and Raw 264.7 will produce more ROS. Therefore, we hypothesize that when we add ferumoxytol, ROS production will be further increased in order to kill more cancer cells. GL-261, RAW 264.7, and our co-culture were incubated with ferumoxytol. After 24 hours, the cells were strictly washed and the APF agent was added. APF reagent reacts with ROS species to become fluorescent and the fluorescence is directly proportional to the ROS. After 30 minutes, fluorescence was measured. The RAW 264.7 and co-culture cells had a higher production of ROS when compared to GL-261. Additionally, the higher concentrations of ferumoxytol were associated with higher production of ROS. Ferumoxytol leads to more ROS production, which results in increased cancer cell death. Ferumoxytol may be a promising treatment strategy to slow the tumor progression of cancer patients.



Keywords: Ferumoxytol; Reactive Oxygen Species; Macrophages; Cancer Cells; Immune Cells



Mentor(s):

Matthew Scarpelli (HHS); Jessica Veenstra (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1702**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Who Shot the Mastodon?**

Social Sciences/Humanities/Education


Author(s):

Zachary Ryan† (Polytechnic); William Shumway* (Liberal Arts)



Abstract:

For over a century, evidence has linked the Clovis people, known for their stone spear-points, with mammoths and mastodons during the last Ice Age (approximately 13,500 years ago; Howard, 1933, 1935). Such evidence has led to suggestions that human hunting significantly contributed to the extinction of these "megafauna." Although evidence of human interaction with these large North American animals exists, such as butchery marks on their sub-fossilized remains, direct evidence of humans hunting them remains elusive. The butchery marks attributed to the Clovis people could also indicate scavenging the remains from animals that were already dead, and not necessarily killed by hunting. This ambiguity complicates attempts to infer the causes of the Megafauna extinction. To address this problem, our project conducted randomized controlled experiments to replicate marks on animal bones created by hunting projectile weapons used by the Clovis people. Should the replicated marks match those found on megafauna remains from Clovis times, it would suggest that Clovis people indeed hunted megafauna using such weapons. This study involves creating controlled Bone Surface Modifications (BSM) that could have been produced during a hunt, by mechanically launching replicated Clovis projectile points into commercially available animal carcass parts. These BSM are then cast and measured with a microscopic 3D scanner, creating a digital surface model for analysis. This allows for a comparison against other non-hunting BSM using advanced computational and statistical tools. Through these modern analytical techniques, we aim to understand prehistoric human behaviors and their potential impact on the environment.



Keywords: Bone Surface Modifications; Megafauna; Hunting; Clovis People



Mentor(s):

Erik Otarola-Castillo (Liberal Arts)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1703**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## How do perceived learning gains compare across three NSF REU (Research Experience for Undergraduates) sessions?

Social Sciences/Humanities/Education

Author(s):

Aishani Sakalabhaktula† (Engineering)

Abstract:

Purpose: The hope of this study was to understand how significant an impact the pandemic had on the learning community and to also help current institutions gain a better understanding of what sort of learning helped their students more.

Methods: This study used a Retrospective Post-then-Pre-Survey to gather data and analyzed the results with a paired sample T-test through SPSS.

Results: The results of this study displayed the potential for virtual learning. But, as only 3 samples were used, the results were mixed and there was no clear discernment between whether virtual or in-person was determined to be better.

Implications: With the pandemic forcing the world to become virtual, understanding the new paths of the world of teaching is imperative for bringing participation in engineering research. In the future, the authors advise the NSF (National Science Foundation) to conduct more testing on various approaches to REU delivery, like the length of the program and its format. With more observation and attention being placed on these various methods, figuring out what specific audiences prefer can help bring more interest into engineering and its possible research experiences.

Keywords: Undergraduate; Renewable Energy; Entrepreneurship; REU; Engineering

Mentor(s):

Lisa Bosman (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1704**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Does the C-terminus of Bordetella's Fic protein influence GMPylation-mediated signal transduction?

Life Sciences


Author(s):

Rahul Saproo† (Agriculture); Rohan Aryan† (Science)



Abstract:

Fic (Filamentation induced by cAMP) proteins are an emerging family of enzymes that regulate cell signaling in bacteria and eukaryotes via post-translational modifications (PTMs). AMPylation/adenylylation is a predominant PTM in Fic proteins where the Fic protein catalyzes ATP to add an AMP moiety to its target. We discovered a highly conserved Fic protein in the Gram-negative Bordetella sp., members of which cause respiratory diseases including Whooping Cough in humans. Our studies with the Bordetella bronchiseptica Fic protein (BbFic), revealed that this clade of Fic proteins carries out a previously unseen PTM. Specifically, BbFic functions as a guanlylyltransferase, catalyzing GTP to add a GMP on itself and its putative target(s). We term this novel PTM GMPylation.

We solved the crystal structure of apo BbFic at 3.1 Å, which validated our biochemical characterization of BbFic as a GMPylating enzyme. Further, using AlphaFold (albeit with a weak confidence prediction score), we identified the C-terminus of BbFic as a putative helix-turn-helix (HTH) domain, typically involved in DNA binding. Accordingly, using DNA supercoiling assays, transfection of mammalian cells, and Galleria mellonella models, we observed that BbFic binds DNA and translocates to the nucleus, respectively and plays a role in pathogenesis. Here, we describe the cloning and purification of the C-terminal domain of BbFic (BbFic-Cterm) to 1) determine the X-ray crystallographic structure of BbFic-Cterm's putative HTH domain, and 2) use BbFic-Cterm as a bait to capture BbFic's interacting partners. Our preliminary data are presented, which give us important insights into BbFic's physiological function.



Keywords: Bordetella; Fic Protein; GMPylation; Helix-Turn-Helix



Mentor(s):

Seema Mattoo (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1705**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## The Process of Scientific Inquiry: Undergraduate Conceptions and Formulations of Scientific Hypotheses and Predictions

Life Sciences

Author(s):

Nandhitaa Satya† (Science, JMHC); Perion Sharp† (Science)

Abstract:

The process of scientific inquiry is known across disciplines within science, and is regarded as the foundation of scientific discovery. One integral step of it is the generation of hypotheses and predictions, crucial to producing accurate experimental results. While this process is standardized, our previous research in interview settings and a national survey indicates a disparity between instructors' and students' understandings of the concepts of hypotheses and predictions in biological sciences. Older preliminary analyses of responses show instructors, overall, have similar conceptions of hypotheses and predictions. Faculty responses showed full agreement on the relationship between the two while undergraduate responses varied and were less descriptive. Variations in how students and instructors define and formulate hypotheses and predictions may explain this discrepancy in understanding. In our recent data collection, biology undergraduates at an R1 university were interviewed. They defined and composed a hypothesis and prediction(s) based on a given scenario, and we analyzed responses using a deductive codebook built on Karl Popper's work on scientific inquiry's nature, with alterations by us due to new ideas emerging. Based on previous data, a disparity between the undergraduates' defined/self-constructed hypothesis and prediction(s) is expected. We expect to continue accumulating data and interpreting its meaning and how it can shape universities' curriculum. Many institutions incorporate scientific hypotheses and predictions in curriculum due to their importance in future pursuits. These concepts are especially important for biology undergraduates because understanding them allows undergraduates to explain/prove data validity and increase their scientific literacy.

Keywords: Hypothesis; Prediction; Process of Scientific Inquiry; Deductive Coding; Undergraduate Biology Students

Mentor(s):

Stephanie Gardner (Science); Anupriya Karippadath (Emory University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1706**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Identifying metabolic signatures associated with PFAS exposure and their role in neurotoxicity in the African clawed frog (Xenopus laevis)

Life Sciences


Author(s):

Jenna Schoonmaker† (Agriculture)



Abstract:

Per- and polyfluoroalkyl substances (PFAS) are a class of chemicals widely used in household and industrial products that exhibit environmental persistence and cause a multitude of negative health effects in humans and ecosystems. Additionally, literature has revealed that PFAS are potential neurotoxicants that induce neurobehavioral effects. PFAS and their toxicity are well-studied, but there is a significant knowledge gap surrounding their neurotoxic effects and the mechanism by which they cause pathophysiological changes in neural systems. Addressing this knowledge gap, recent research indicates that certain PFAS can alter bile acid synthesis from cholesterol, due to their utilization of the same transporters used by bile acids in the gut to re-enter enterohepatic circulation. Bile acid synthesis and cholesterol metabolism differ in people with neurodegenerative diseases like mild cognitive impairment (MCI) and Alzheimer’s Disease (AD), suggesting that the brain-liver-gut microbiome axis influences cognitive change. The objective of this study is to explore potential mechanisms of neurotoxicity for PFOS, a ubiquitous and highly bioaccumulative PFAS. Specifically, the metabolic and transcriptome changes in the liver-brain axis in African Clawed Frogs (Xenopus laevis), a common model for aquatic exposures, will be screened for. This will be accomplished by exposing larvae to PFOS and examining transcriptomic and metabolomic responses in liver, plasma, and brain tissues. The experiment will occur in late March 2024, and the research team hypothesizes that Xenopus laevis exposed to PFOS will have decreased bile acid synthesis and increased re-uptake, which will interfere with the bile-liver-brain axis and cause neurotoxic effects in the brain.



Keywords: PFAS/PFOS; Neurotoxic Effects; Bile-Liver-Brain Axis; Omics; Xenopus laevis


Mentor(s):

Maria Sepúlveda (Agriculture); Priyanka Baloni (HHS); Tyler Hoskins (Agriculture); Nathan Mak (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1707**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Identification of Biomarkers of Aging by Targeted Proteomics**

Life Sciences

Author(s):

Faith Scott† (Science)

Abstract:

The risk of many chronic diseases increases with age. With the rapidly growing elderly population, better understanding the biology of aging is critical. Advances in proteomics have allowed for the assessment of thousands of proteins in biological matrices, which can be translated into clinical biomarkers. This project aimed to investigate the biology of aging and identify potential biomarkers of aging utilizing proteomics techniques. We performed both untargeted and targeted proteomic analyses of liver tissues collected from young and old mice to identify specific proteins that are differentially regulated with age. First, we generated a protein library using comparative proteomics to identify differentially regulated liver proteins. Then used this library to develop Multiple-Reaction-Monitoring-Mass Spectrometry (MRM-MS) assays which facilitate the accurate quantification of proteins within different samples. For MRM assays, we selected several previously reported senescence-related proteins as well as several newly identified proteins from our study to quantify and assess differences in the specific peptides corresponding to the proteins of interest. MRM-quantification of target peptides allowed for the precise determination of which proteins are up- or down-regulated in old mice relative to young counterparts. These proteins include an apoptosis-inducing factor and eukaryotic translation initiation factor. Using these proteins that were differentially regulated during biological aging let us develop a method that identifies age-related biomarkers in a tissue-specific manner by studying the pathways they are involved in using a core protein database of known protein-protein interactions. This information is necessary for the future development of therapies to prevent age-associated diseases and promote proper tissue repair in older individuals.

Keywords: Aging; Proteomics; Biomarker Discovery; Multiple-Reaction-Monitoring; Mass Spectrometry

Mentor(s):

Uma Aryal (Veterinary Medicine); Rodrigo Mohallem (Veterinary Medicine); Allison Schaser (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1708**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Widening Reinforced Concrete Elements Using Chemical Anchoring Systems**

Physical Sciences

Author(s):

Sharma Kashish† (Engineering); Vanessa Grace Uy* (Engineering)

Abstract:

Within the United States, there exists a persisting issue in combating challenges due to increased traffic volumes in bridges from traffic bottlenecks and generalized congestion. A potential solution to this issue is to increase the width of bridges and adding more lanes in order to ease the congestion. Post-installed rebar technology is gaining attention for its versatile applications in retrofitting and rehabilitation, as well as its use in widening existing concrete elements. The installation process of the post-installed rebar involves of hole drilling, hole cleaning, filling the hole with epoxy, and finally rebar installation. This paper explores the development of necessary design provisions for the application of post-installed chemical anchoring systems for bridge extensions. Specimen level tests are conducted on beam end type specimen which represented realistically a part of reinforced concrete bridge. This study examines the effect of parameters such as embedment depth of post installed rebar, usage of transverse and longitudinal reinforcement, rebar clear cover, and rebar sizing on required development length for post-installed rebar. Preliminary results show a significant increase in load carrying capacity of post-installed rebar with increasing embedment depth. Presence of transverse reinforcement in the specimen also led to an increase in peak load.

Keywords: Post-Installed Rebar; Chemical Anchorages; Embedment Depth; Bridge Widening; Concrete Specimens

Mentor(s):

Akanshu Sharma (Engineering); Dheeraj Waghmare (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1709**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Generative AI in Education

Mathematical/Computation Sciences

Author(s):

Anvit Sinha† (Science); Shruti Goyal† (Science, JMHC); Zachary Will Sy† (Liberal Arts, Science)

Abstract:

This research investigates the potential of Generative AI (GenAI) to enhance educational practices, focusing on improving the efficiency of instructional staff on discussion platforms and enriching the learning experience for Computer Science undergraduates at Purdue University. The study explores the integration of AI tools for automating responses to student inquiries, uniquely positioning a person at the center of the process to re-prompt, filter, and refine the outputs with minimal effort, thereby enhancing the use of GenAI tools for the educational benefit of first and second-year students. We show a framework for this that improves instructional staff response times, positively impacts learning outcomes by providing increased quality and breadth of responses, and reduces instructional staff workload. These findings suggest GenAI's capacity to improve educational communication and methodologies, offering scalable solutions to enhance learning experiences and underscoring GenAI's transformative potential in education, advocating for its responsible integration to bolster educational outcomes.

Keywords: Generative AI; Automated Response Systems; Instructional Efficiency; Learning Experience Improvement

Mentor(s):

Andres Bejarano (Science); Ethan Dickey (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1710**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Breaking Barriers to Mental Health Support: Exploring CAPS' Specialized Care Programs

Social Sciences/Humanities/Education

Author(s):

Hyerin Sohn† (DSB)

Abstract:

This research paper delves into the dynamics of mental health programs tailored for specialized care groups within Purdue CAPS. Focusing on diverse cohorts such as international students, the LGBTQA+ community, and individuals with ADHD, the study scrutinizes the unique processes involved in catering to their mental health needs. The primary research strategies used in this study are interviews and questionnaires. The interview approach will involve a structured format with a CAPS clinician and Dr. Crystal Cordes. In the questionnaire approach, about 10 questions will be asked to first-year students and fourth-year students at Purdue University. It investigates the requisite qualifications and training for mental health program counselors, emphasizing the distinct educational approaches necessary for effective support across various specialized care groups. Furthermore, the paper conducts a comprehensive data analysis of common mental disorders prevalent among students at Purdue University. Through this analysis, it delineates the frequencies of each disorder, shedding light on the prevailing common mental health issues within the university populace. Moreover, the study explores students' awareness of mental health programs available at Purdue and examines the prevalence of mental health illnesses among Purdue students, providing insights into the magnitude of mental health challenges faced by the student community. By presenting empirical evidence and statistical analyses, the paper offers a nuanced understanding of the evolving mental health needs within university environments, thereby advocating for tailored interventions and support mechanisms to foster student well-being.

Keywords: CAPS; Program Process; Qualification of Counselors; Mental Disorders; Awareness

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1711**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## IT Personnel's Perception on the Cyber Resilience Act

Innovative Technology/Entrepreneurship/Design

Author(s):

Braeden Strahm† (Polytechnic, JMHC)

Abstract:

The Cyber Resilience Act (CRA) is anticipated to significantly influence product security worldwide, extending far beyond its origins in Europe. There is considerable debate regarding the legislation's potential breadth and implications. Yet, the perspectives of security professionals on the CRA's impact remain largely unexplored. In our study, we conducted a thematic analysis to delve into the views held by Information Technology professionals concerning the proposed CRA within the European Union framework.

Utilizing posts and comments from cybersecurity-related subreddits over the past year as our data set, we sought to understand the professional discourse surrounding the CRA. The findings highlight key concerns among the community, notably the potential adverse effects on open-source software, heightened restrictions on software development, and the security challenges arising from the mandated disclosure of vulnerabilities.

This research offers valuable insights for security experts and policymakers, aiming to shed light on the cybersecurity field's response to the CRA and inform future legislative processes.

Keywords: Cyber Resilience Act; Law; Cybersecurity; Open Source

Mentor(s):

Tatiana Ringenberg (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1712**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Beyond5G**

Mathematical/Computation Sciences

Author(s):

Daanish Suhail† (Science); Kshitij Shah† (Engineering); Jack Willard† (Engineering, JMHC); Troy Madden† (Engineering); Pryce Tharpe† (Engineering, JMHC)

Abstract:

The Beyond5G team developed an understanding of 5G and 6G technologies. This was accomplished by dividing the team members into a series of subteams who each specialized in a different area. The primary areas being the usage of USRP, symbol recovery and the study of error-correcting codes in simulation.

The USRP subteam worked together to learn the basics of digital and analog signals and the standards of signal-based communication. The team researched the isolation of HD radio from FM signals using a USRP board paired with the GNU radio API. Using this tool, we plan on receiving an FM signal and demodulating the HD bands to find the presence of HD radio. Furthermore, the team will focus on researching and applying symbol recovery to reconstruct a bitstream to an image using a preamble. The team expects to contribute tangible results including isolated HD radio and successful reconstruction of an image using symbol recovery with MATLAB.

For error-correcting codes, the subteam built on work relating to the convolution code from the previous semester. This semester, we showcase decoding techniques such as the Viterbi algorithm which utilizes a series of circuits and trellises in order to successfully decode a corrupted codeword and we began the creation of a simulation for the BCJR decoder which sees real implementation in some standards today. With this our team was able to construct a successful decoding simulation for the Viterbi algorithm and in the future, we believe we can do the same with BCJR.

Keywords: Signal; Detection; Electrical Engineering; Simulation; Implementation

Mentor(s):

Chih-Chun Wang (Engineering); David Love (Engineering); James Krogmeier (Engineering); Manish Kumar Krishne Gowda (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1713**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# Computer Simulations of Air Quality

Physical Sciences

Author(s):

Trisha Suresh† (Engineering, JMHC); Paul Michael Vasquez* (Engineering); Joshua Fan* (Science)

Abstract:

Global $CO_2$ emissions from fossil fuels reached 36.6 billion tons in 2022, causing a further increase in poor air quality worldwide. However, the sources of emissions in different regions are still relatively uncertain because of the way pollutant concentrations are currently measured. Previous research has covered the development of several chemical mechanisms (predictions of complex chemical reactions) for reactions occurring in the atmosphere. This research project aims to understand how accurate these different mechanisms are to actual atmospheric emissions, and how this information can be applied to explain atmospheric occurrences in forest ecosystems. In order to do this, data for select chemical mechanisms and forest VOC/$NO_x$ observations were extracted from previous literature. The atmospheric modeling tool AtChem2 was used to reproduce these mechanisms and measure the concentration of various molecules over time. Several Python scripts were written to generate and run a thousand simulations with varying initial VOC/$NO_x$ concentrations. The simulations were then rerun, accounting for isotopes of nitrogen. The results of all the simulations will be compared to real atmospheric emission data in forested areas to determine how accurate each mechanism is to measured atmospheric chemical compositions. This comparison will provide insight into what model(s) produce the best representation of the atmosphere and differentiate the effects of isotope quantities on ozone concentrations. This information can be used to explain not only the source breakdown of emissions, but also the disparity in seasonal observations of ozone.

Keywords: Atmospheric Chemistry; Box Model; VOC Concentrations; Emissions

Mentor(s):

Greg Michalski (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1714**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Machine Learning-based assessment of surgeons' non-technical skills

Innovative Technology/Entrepreneurship/Design

Author(s):

Maheen Syed† (Engineering)

Abstract:

Primary contributing factors to adverse events in surgical procedures are often behavioral, linked to the non-technical skills (NTS) of a surgeon. One of the methods used for the assessment of NTS is Non-Technical Skills for Surgeons (NOTSS) system, which allows experts to assess certain behavioral markers for a rating of a surgeon's NTS. However, the limitations of these ratings are primarily the subjectivity of the results, which varies between the raters. Thus, this project proposes using objective machine learning models to minimize the subjectivity of NTS assessments. Twenty-five robotic-assisted surgeries were video-recorded, each of which was rated by 3 to 6 raters using NOTSS. These ratings were annotated and classified to create a large dataset of transcripts of NTS events which were used to develop different machine learning models. These models will be trained to predict scores for NTS events, differentiate good and bad NTS behaviors, and summarize why a particular behavior is non-exemplar. The trained model will then be applied to new NTS events that are not included in the training dataset. This study will eliminate biases from subjective assessments, leading to more objective ratings and consequently targeted interventions to improve NTS.

Keywords: Non-Technical Skills; Machine Learning; Robotic-Assisted Surgeries

Mentor(s):

Denny Yu (Engineering); Marian Obuseh (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1715**

*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## A global analysis of transcription factor gene expression dynamics during cotton fiber development

Life Sciences


Author(s):

Ethan Szajko† (Science)



Abstract:

Cotton is the foundation of a multi-billion-dollar renewable textile industry. Amazingly, this commodity is based on the size, shape, and mechanical properties of single cells. Fibers develop in a highly regulated process that begins as the trichoblast emerges from the seed coat epidermis, followed by prolonged elongation, and cell wall thickening phases before reaching maturity. There are many opportunities in the biological economy to engineer cotton fibers with novel properties, such as longer, thicker, or more elastic fibers, which leads to a more durable and higher quality product. Understanding the molecular, cellular, and developmental program of fibers is of utmost importance, with the long-term goal of controlling processes that determine key fiber traits. The temporal dynamics of the cotton fiber gene expression is not currently known. As an approach to analyze fiber development at a systems-level, global analysis of mRNA and protein levels were quantitatively analyzed at daily intervals across a wide swath of fiber development from 6 to 24 days post initiation. This level of temporal resolution has never been attempted with purified cotton fibers. This poster focuses on defining the temporal patterns of transcription factor expression. Transcription factors are a special class of proteins that act as master regulators of dynamics and phenotypic expression. They contain DNA binding domains that enable them to bind promoters of target genes and an activation/repression domains that can increase or decrease mRNA transcription, respectively. The transcriptomics and proteomics data for TFs will be presented. TF gene expression data were subjected to several data filtering steps to identify expressed genes and reduce noise. The resulting gene expression patterns analyzed using a self-organizing map machine learning method to group genes with similar expression patterns. Ten temporally unique expression groups were identified. Results will be presented to describe how these expression patterns and a model for transcriptional control might be linked to important fiber traits.



Keywords: Cotton; Transcriptomics; Proteomics; Transcription Factors



Mentor(s):

Daniel Szymanski (Agriculture)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1716**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

# READI Semiconductor Program

Innovative Technology/Entrepreneurship/Design

Author(s):

Pranav Tallapaka† (Science)

Abstract:

With the rise of jobs in areas like electronics and other technology spaces, introducing youth to engineering and other technical areas at an early stage can prove beneficial in opening pathways to possible career opportunities. Under funding for workforce development, the READI Summer Semiconductor Program held last summer was designed in partnership with a large midwestern university and local community college to introduce high school participants to semiconductors, advanced manufacturing, and microelectronic technology. READI Summer Semiconductor Program works to give high school students in the Greater Lafayette area an opportunity to pursue their interests in the semiconductor field. These participants were selected from surrounding counties with the intention of exposing them to emerging career opportunities. The research team used focus group data to see how responses about the program works to enhance the program. Using the data, the research team, using content analysis, analyzed what worked and did not work, to better identify how to make the program more effective in future iterations. The team analyzed focus group responses from eight or so specific questions about the program, with the participants specifying how the program affected them, using this to find the ups and downs of the program. Financial incentives and program curiosity were found to be the main factors in joining the program, while sacrifices were a factor for not joining. Based on the findings, the participants left more informed about semiconductors, manufacturing, and microelectronics, however, the program content needs to be revised to include further groups of people.

Keywords: Semiconductors; Focus; Data; Participants; Findings

Mentor(s):

Shauna Adams (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1717**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Discrete, Tunable Wavefront Engineering using Binary Quadratic Optimization

Mathematical/Computation Sciences


Author(s):

Sarthak Tandon† (Engineering); Advay Welling† (Engineering)



Abstract:

Y-branch waveguides serve as integral components in photonic integrated circuits(PICs), providing efficient routing of optical signals. Through optimization, we would see a key increase in machine performance, which helps reduce material losses and improve efficiency. We are working towards optimizing Y-branch waveguides through S-Matrix analysis and eigenmode calculations. By optimizing the scattering matrices, we achieve a more accurate model for waveguide behavior, facilitating the design of efficient optical devices and reducing potential energy losses that occur during transmission.

We are working with arbitrary distributions of waveguides utilizing sine and cosine Fourier transformations to streamline the process. Since our problem involves predicting the input and control modes for the desired number of output modes, we formulated an objective function in terms of the SMatrix, output modes, input modes and control modes. We minimized this objective function through Boltzmann Sampling over low temperatures, helping us determine the minimum value of our energy function, in this case, the objective function to be minimized.

We are currently running all our simulations in Python, using the nanomcmc library, which is a highly optimized package for Boltzmann Sampling.



Keywords: Y Branch Waveguides; Scattering Matrix; Boltzmann Sampling; Simulations in Python; Input and Output Modes



Mentor(s):

Blake Wilson (Engineering); Vahagn Mkhitaryan (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1718**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Lean six sigma applications in semiconductor industry

Innovative Technology/Entrepreneurship/Design

Author(s):

Shou-Fu Tseng† (Science); Brandon Farber† (Engineering, JMHC)

Abstract:

Applying lean six sigma to the semiconductor industry would be a significant improvement to the current supply chain system within the semiconductor industry because it can reduce wastes, saves time, and efficiently produce results. Since most of the applications of lean six sigma are only in the manufacturing phase, we can hopefully generate new insights that can apply it to other phases of the industry: design, materials, packaging, etc. The project contains a PRISMA systematic review to analyze and filter scholarly papers, which will provide insights for the literature review paper.

Keywords: Lean Six Sigma; Semiconductor Industry; E-Waste Management; Electronic Waste Recycling; Semiconductor Process Improvement

Mentor(s):

Tho Le (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1719**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Associations Between Diet Quality and Behavioral Outcomes in Children with Angelman Syndrome

Life Sciences

Author(s):

Lauren Urban† (HHS)

Abstract:

Background: Angelman syndrome (AS) is a rare neurogenetic disorder that affects cognitive and motor development. People with AS suffer from gastrointestinal (GI) symptoms and challenging behaviors similar to individuals with autism. However, little is known about diet quality in AS and how it may affect these symptoms.

Aims: To examine differences between diet quality of children with AS compared to sibling controls. Among children with AS, to determine associations between diet quality and autism-related challenging behaviors.

Methods: The Healthy Eating Index (HEI) was used to measure diet quality. Challenging behaviors were measured using the Aberrant Behavior Checklist (ABC-2) and Brief Autism Mealtime Behavior Inventory (BAMBI). Paired Wilcoxon Rank Sum tests and Spearman's Correlations were conducted for associations between HEI and binary/categorical variables and continuous variables, respectively.

Results: While there was no difference in overall HEI scores between children with AS and their siblings, children with AS had greater HEI subscores for Added Sugars (p=0.03) and Seafood/Plant Protein (p=0.02) and lower score for Dairy (p=0.04) compared to their siblings. The Total BAMBI score was negatively correlated with Total Fruit (p=0.02), and the BAMBI Food Refusal subscale was negatively correlated with Total Fruit (p<0.001), Whole Fruit (p=0.01), Saturated Fats (p=0.03), and Whole Grains (p=0.04). The ABC-2 hyperactivity subscale was negatively correlated with Added Sugars (p=0.03) and positively correlated with Saturated Fats (p=0.04).

Conclusion: Diet quality subscores varied between siblings and were associated with several challenging behaviors among children with AS. These results may help families and clinicians provide better care for children with AS.

Keywords: Angelman Syndrome; Diet; Gastrointestinal Symptoms; Behavior; Nutrition

Mentor(s):

Anita Panjwani (HHS); Bridgette Kelleher (HHS); Regan Bailey (HHS); Steve Lindemann (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1720**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Custom children's powered wheelchair from the off-the-shelf components

Innovative Technology/Entrepreneurship/Design

Author(s):

Alex Valdes† (Engineering)

Abstract:

Movement and interaction with their environment are critical for the cognitive, emotional, and physical development of children. Children with disabilities can experience compounded delays due to an inability to autonomously interact with the world around them. GoBabyGo is an initiative to build powered wheelchairs from children’s toys. The designs are easily replicable modifications created with accessibility of use and creation in mind. This work was focused on creating an Arduino Mega based car designed with a focus on safety and ease of use. The car will include 360-degree control, embedded distance sensors and sensing based automatic stopping. The Arduino will be used with a custom daughter board to breakout connections for sensors, joysticks, and motor controller outputs. The coding aspect of this work was focused on creating a program to interpret sensor readings and joystick values. These values are checked to ensure the car is far enough away from obstacles and mapped the to the motor outputs to make the control of the vehicle as simple as possible. The code ensured a safe acceleration and deceleration of the vehicle to avoid possible jerking. The physical design of the vehicle is using an off the shelf base car with modifications made to accommodate the sensors and additional safety along with ergonomic considerations. To assess the functionality of the electronic components, distance testing was done to ensure the sensors read distances properly and fast enough to stop the car, and the responsiveness of the joystick was measured in both acceleration and deceleration.

Keywords: Sensors; Controls; Arduino; Accessibility

Mentor(s):

Brittany Newell (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1721**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Pathway-based PRS PheWAS Analysis of Bipolar Disorder and Major Depressive Disorder.

Life Sciences

Author(s):

Theoni Vlachos† (Temporary); Sophia Vlachos† (Temporary)

Abstract:

Bipolar disorder (BPD) and major depressive disorder (MDD) are complex mental disorders that negatively impact people worldwide. BPD and MDD are genetically correlated and overlap in characteristics. Both are polygenic, and multiple significant risk loci have been revealed, while further studies highlighted specific pathways involved in the development of the diseases. This study aimed to calculate the polygenic risk scores (PRS) of each of the involved pathways and then explore additional phenotypes associated with each. For MDD, the top 6 pathways found in a reference study were analyzed, while for BPD, a gene-based analysis was performed, and we found five significant gene-sets. Then, for each of the gene sets, we used PRSice to calculate the PRS on UK Biobank European individuals, using the larger available summary statistics of MDD and BPD as a base and selecting SNPs with p< 10-5. Then we performed a phenome-wide association scan (PheWAS) to explore the association of each gene-set PRS with other phenotypes available in UK Biobank. The results of this experiment provide an overview of the phenotypes associated with each gene-set PRS, which could be useful to address heterogeneity and stratify individuals by genetic risk, providing insights for earlier diagnoses, and therefore treatment early on.

Keywords: Bipolar Disorder; Major Depressive Disorder; Polygenetic Risk Scores; GWAS; PheWAS

Mentor(s):

Peristera Paschou (Science); Apostolia Topaloudi (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1722**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Mind over white matter: Subjective health perceptions and white matter tract integrity in a national sample

Social Sciences/Humanities/Education

Author(s):

Lauren Voss† (HHS); Quinn Clemenz* (Science); Olivia Richter* (HHS, JMHC); Samantha Maari* (Science)

Abstract:

Subjective perceptions of health strongly predict longevity. This association remains after chronic medical conditions are accounted for, suggesting people have access to relevant information about their health beyond knowledge of their illnesses. Interoception is a collection of senses responsible for consciously and subconsciously understanding what is going on inside the body. Prior studies found a specific brain region, the insula, and a large white matter tract that connects the insula with multiple brain regions, the uncinate fasciculus, were implicated in interoception. In the present study, we examined links between the integrity of the uncinate fasciculus and self-rated health hypothesizing that impaired integrity would correlate with poorer subjective health. Data (N=197) were from the Midlife in the US study (MIDUS) study, specifically the neuroscience sub-studies from third wave (2013-2014; n=116) and the Refresher cohort (2013; n=81). Data from diffusion-weighted images were used to estimate four metrics of white matter tract integrity (WMTI): Fractional Anisotropy (FA), a general measure of WMTI, Mean Diffusivity (MD), a rotational magnitude of water diffusion, Radial Diffusivity (RD), water diffusion perpendicular to, and Axial Diffusivity (AD), parallel to axonal fibers. Results from linear regression models demonstrated AD was significantly inversely associated with SRH, as predicted (p<;.05). FA and MD were also non-significantly associated with SRH in predicted directions (p<;.10). These results suggest that differences in white matter tract integrity may be reflected in subjective perceptions of health, but that these associations were relatively weak in this large, age-heterogeneous sample.

Keywords: Subjective Health; Insula; Interoception; White Matter Tract Integrity; Uncinate Fasciculus

Mentor(s):

Elliot Friedman (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1723**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Investigation of Chladni Patterns of Fiber Reinforced Polymer Composite Laminate with Different Fiber Orientation

Innovative Technology/Entrepreneurship/Design

Author(s):

Samantha Wadas† (Liberal Arts, Polytechnic); Caden Cowles† (Polytechnic); Sinhong Park† (Polytechnic)

Abstract:

This study investigated the acoustic emission (AE) behavior of carbon fiber composites with varying fiber orientations. A Chladni plate was employed to analyze the relationship between the composite resonant frequencies and the resulting pattern. Since every material has its own inherent resonant frequencies, the Chladni plate experiment was used to determine the node locations through patterns formed on the surface of the material. This evaluation provided significant insight into carbon fiber composites' structural integrity and mechanical properties. Since composites require fibers for its heightened material characteristics, the direction of the fibers within the material caused varying resonant frequencies. The motivation for this study was to understand how different fiber orientations affected the AE characteristics and resonant frequencies of the composite material. For testing, composite samples were fabricated with a total of eight unidirectional prepreg plies. By using unidirectional prepreg, three different symmetrically balanced fiber orientations were constructed including [0]8, [0/90]s2, and [0/45/-45/90]s. AE signals were recorded and analyzed to determine the relationship between the resonant frequencies and their associated patterns. Based on the patterns observed from the Chladni plate experiment, the results showed varying resonant frequencies for each sample. Each resonant frequency was then compared to the remaining samples, and a relationship between the fiber orientation and the resulting resonant frequency emerged. Overall, this study provided valuable insights into the AE characteristics of carbon fiber composites and highlighted the importance of fiber orientation in determining their mechanical behavior and resonant frequencies.

Keywords: Acoustic Emission (AE); Carbon Fiber Composite; Fiber Direction; Chladni Plate

Mentor(s):

Garam Kim (Polytechnic); Jacob Montrose (Polytechnic); Noori Kim (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1724**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Digital Phase Locked Loop for SoCET Applications

Innovative Technology/Entrepreneurship/Design

Author(s):

Nicole Wang† (Engineering); Asav Gandhi† (Engineering); Stephen Fetterman† (Engineering)

Abstract:

A phase locked loop (PLL) is a control system with the ability to adjust frequency to match the input signal. If the phase difference between the reference and the output is zero, the system is considered locked. Digital PLLs indicate that both inputs are digital. Therefore, the subcircuits include: a time-to-digital converter (TDC), digital loop filter, a digitally controlled oscillator (DCO), and a divider. The team will accomplish this using Cadence Virtuoso for design, testing, and layout. This is a two-semester senior design project where all team members will progress through the engineering design process. The overall goal is to design a digital PLL for the AFTx08 chip within the SoCET team.

Keywords: Digital Design; Analog Design; Phase Locked Loop; Semiconductor; SoCET

Mentor(s):

Mark Johnson (Engineering); Sutton Hathorn (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1725**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Mining Pre-Trained Models in Open-Source Software

Innovative Technology/Entrepreneurship/Design


Author(s):

Dulani Wijayarathne† (Engineering); Siddharth Prabakar* (Science); Shah Mahir* (Engineering)



Abstract:

In Open-Source Software (OSS), the adoption of Pre-Trained Models (PTMs) is on the rise to enhance efficiency. However, there's limited research on their full integration and related challenges.
Our research project dives deep into the PeaTMOSS dataset, featuring 281,638 PTMs across 27,270 GitHub projects. We focus our analysis on Pull Request conversations and Commit messages within these repositories, employing a data pipeline that leverages ChatGPT's API for summarization and analysis. This approach allows us to trace the lifecycle of PTMs within these projects, from their initial adoption and ongoing maintenance to eventual updates or removal.
Our work aims to contribute to a better comprehension of PTM reuse practices in software projects, laying the groundwork for future efforts to create automated tools tailored to this domain.



Keywords: Open Source Software; Pre-Trained Models; Mining; Dataset



Mentor(s):

James Davis (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1726**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Profiles In Lafayette's Underground Railroad: Martin L. Pierce

Social Sciences/Humanities/Education


Author(s):

Nah'Shon Williams† (Liberal Arts)



Abstract:

This project, conducted as part of the 'Documenting Black Heritage Sites' project in the Urban Matters Lab in the John Martinson Honors College, is part of a series of profiles on sites in the Greater Lafayette area that relate to the history of the Underground Railroad in Indiana. This profile highlights Lafayette banker and merchant, Martin L. Pierce. Pierce was a known abolitionist and is known to have stowed freedom seekers from the South in his home. Additionally, Pierce served on the Board of Trustees for Purdue University for several years and was influential in the campus' development in its early years. This profile will briefly discuss Pierce's life, his role as an abolitionist, and his contributions to Purdue's campus. This project's objective is to show the story of Pierce's allyship with the Abolition movement and benevolence to his community.



Keywords: Underground Railroad; Historical; Profile; Legacy; Abolition



Mentor(s):

Ashima Krishna (JMHC)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1727**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Ambient Particles and how they affect Cloud Formation**

Physical Sciences


Author(s):

Austin Willis† (Science)



Abstract:

Clouds are formed when a saturated air has a particle that water vapor can condense on. The ability of particles to act as nuclei for cloud droplets (i.e. cloud condensation nuclei, CCN) depends on their size and chemical composition. This study aims to investigate the CCN activity of particulate emissions in an agricultural area – West Lafayette, IN. It is based on observations of ambient particles using a CCN counter at the Agricultural Center for Research and Education (ACRE), Purdue University. The instrument simulates conditions for cloud formation in the atmosphere and measures the hygroscopicity of ambient particles. We observe a diurnal pattern in the total CCN number concentrations, with higher concentrations in late morning-afternoon.  A preliminary examination of size distributions at various relative humidities indicates a likely size dependency of chemical composition of the ambient particles, suggesting multiple sources for the observed CCN.



Keywords: Cloud Condensation Nuclei; Cloud Formation



Mentor(s):

Gouri Prabhakar (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1728**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Investigation of Food Quality, Accessibility, and Insecurity at Purdue University, West Lafayette**

Social Sciences/Humanities/Education


Author(s):

Clayton Wimmersberger† (Pharmacy, JMHC)



Abstract:

Looking at the food environment anywhere can tell you a lot about the health, happiness, and culture of a place. With these implications, food is always an important topic of discussion, especially on a college campus. Most students are always in a time crunch, don’t have kitchens, or do not have the proper instruments or knowledge to cook. Purdue University has a decent amount of options to eat out on campus, however there is only one mini-grocery store on campus. There is a general distaste in the dining court food, and a lack of resources when it comes to cooking for yourself. The main objective of this experiment is to collect data from interviews and questionnaires, to analyze and gain insight on Purdue’s food environment. I sent questionnaires to around 50-100 Purdue students, and interviewed 3 big proponents of the food industry at Purdue. A senior in HTM, a manager at the Wiley Dining Hall, and a professor in food sciences. I am finding that students are satisfied with the options to eat out on campus, but not satisfied with the price/health implications. I also am finding that students have trouble getting groceries/cooking their own food in general. This research is important because having reliable and healthy access to food is a basic need that no one should struggle with, especially with the workload Purdue students have already. I am helping shed some light on food insecurity at Purdue and offer a few solutions with this research project.



Keywords: Food Insecurity; Cooking; Healthy-Lifestyle; Food Accessibility; Exploratory Research



Mentor(s):

Michael Johnson (Liberal Arts)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1729**

*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Improving the Engineering Behind Purdue Pete Mascot Helmet

Innovative Technology/Entrepreneurship/Design

Author(s):

Sucheol Woo† (Polytechnic); Min Yong Chun‡ (Polytechnic); Seongyun Kim‡ (Polytechnic)

Abstract:

Since 1940, Purdue Pete has undergone several design transformations. In 1989, the current design of Purdue Pete was created and manufactured by Aeronautical Engineering Technology students using fiber-reinforced composite materials. Inside the head, a sports helmet is needed to secure Pete to the head, but it is often permanently fixed with expanding polyurethane foam, which increases weight and leads to poor ventilation, resulting in unsanitary conditions. In this study, Next-Generation Purdue Pete manufacturing incorporated further engineering improvements aimed at making Purdue Pete easier to manufacture, achieving a better surface quality, reducing weight, and enhancing comfort and sanitation for the Purdue Pete. Instead of using the traditional silicone mold for Purdue Pete head fabrication, a new metal mold was manufactured using reverse engineering via 3D laser scanning and a computer numerical control (CNC) milling machine. The metal mold provided a better surface finish quality for Purdue Pete and facilitated the manufacturing process. The interior of Purdue Pete was redesigned to allow for the sports helmet to be adjustable or replaced, enabling it to fit each Pete who has a different head size and eye location, and providing better ventilation and sanitation. Instead of using the foam, engineered carbon fiber-reinforced composite brackets were designed and implemented to secure the helmet to the Purdue Pete head. This was achieved through advanced ergonomic design and composite manufacturing technologies. The effectiveness of the new design will be assessed through user-experience evaluations.

Keywords: Purdue Pete; Reverse Engineering; Composite Material; Ergonomic Design

Mentor(s):

Garam Kim (Polytechnic); Ronald Sterkenburg (Polytechnic); Yuwei He (Polytechnic); Kangseok Lee (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1730**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

**Design of CO2 blow out cooling system for silicon particle detectors**

Physical Sciences


Author(s):

Lexing Xu† (Engineering); Anish Tilak‡ (Chhatrapati Sambhajinagar); Alexandre Chevalier* (Engineering); Nicholas Erikson* (Science)



Abstract:

This project focuses on the design and development of a $CO_2$ blow out system for evaluating the cooling performance of silicon detector structures for future particle detector like Electron Proton Ion Collider, utilizing carbon dioxide ($CO_2$) as a coolant. $CO_2$ is chosen for its low radiation length and stable cooling performance in the two phase region at -30 degree Celsius. The experimental setup involves an expansion valve and a heat exchanger followed by environment chamber for performance testing of mock silicon detectors with a heat input range of 130 W to 650 W. The system is designed to inject $CO_2$ as a saturated liquid at -30 degrees Celsius and use the cooling performance till vapor quality reaches 0.33. The study aims to elucidate the heat transfer properties of silicon detectors and their support structures and examine the variation in the heat transfer coefficient of $CO_2$ as it transitions from a saturated liquid to a saturated liquid-vapor mix. The goal of this research is development of a small lab scale $CO_2$ cooling system for thermal performance analysis and monitoring which is crucial for ensuring the efficient cooling of silicon detectors to prevent thermal runaway.



Keywords: Cooling; Thermodynamics; Physics


Mentor(s):

Andreas Jung (Science); Sushrut Karmarkar (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Poster Presentation Abstract Number: 1731**
*Presentation Time: April 9 in Session 4: 1:30pm-2:30pm*

## Downstream Solutions: Tackling Nutrient Pollution in the White River Basin

Physical Sciences

Author(s):

Yahan You† (Agriculture)

Abstract:

The project aims to devise a series of design interventions targeting the reduction of nutrient pollution, primarily Nitrogen and Phosphorus, in the White River, focusing on identified locations. As a prominent waterway flowing through Indiana, the White River has encountered challenges such as pollution and habitat degradation over the years. Currently, people engage in activities such as swimming, boating, and fishing in the White River under limitations. However, there is an opportunity to enhance these experiences and identify additional programming to foster human-nature interaction and improve water quality.

Various potential nutrient pollution sources contributing to the White River are under scrutiny, including CSO outlets, brownfields, wastewater treatment plants, industrial parks, and agricultural lands, examined using GIS data. By layering the data, discernible patterns emerge between potential site locations and pollution sources, informing the identification of distinct design interventions necessitated by different areas' land uses along the river.

The river traverses Hamilton County, where concentrations of single-family homes, parks, and golf courses are prominent, before entering Marion County, characterized by urban neighborhoods and likely significant pollution from CSO outlets. Finally, it runs across Morgan County, where nutrients are lost through agricultural lands and enter the river.

The analysis results provide an overview of existing landscape typologies along the river and imply potential locations to implement the design interventions.

Keywords: Water Quality; Nutrient Pollution; Constructed Wetland

Mentor(s):

Erin Percevault (Agriculture); Yiwei Huang (Agriculture); Aaron Thompson (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

# RESEARCH TALKS

*Research talk presentations are delivered in Stewart Center, Room 214 on April 11, 2024.*

## RESEARCH TALK SESSION 1 | 9:00-10:00

### ROOM: STEW 214A

9:20
**7000**
Impact of Structured Revision Intervention During the Peer Review Process on Scientific Writing Self-Efficacy in Undergraduate Biology Students
*Allison Peterson†; Gwyneth Wong*; Emelia Koester**
Mentor(s): Stephanie Gardner; Jill Cornell

9:40
**7001**
Teaching Applied Ethics in the context of Artificial Intelligence to Facilitate Peer Discourse
*Parth Joshi†*
Mentor(s): Alejandra Magana; Lucas Wiese

### ROOM: STEW 214B

9:00
**7002**
Various Repetitive Behavior Types Lead to Changes in Facial Affect
*Riley Rozniarek†; Anna Hodge*; Mallory Schrof**
Mentor(s): Brandon Keehn

9:20
**7003**
Evaluating the Perception of Vocal Fry
*Emily Clark†*
Mentor(s): Alexander Francis

9:40
**7004**
Navigating Health Information: Factors Influencing Decision Making in Emerging Adults
*Nicole Stepp†; Samantha Ky†; Evan Coblentz*; Caroline Packee**
Mentor(s): Monica Kasting; Andrea DeMaria; Trexie Rudd

### ROOM: STEW 214C

9:00
**7005**
Ω
Livestock Predation Patterns by Lions, Leopards, and Spotted Hyenas in the Ngorongoro Conservation Area, Tanzania
*Shayden Jones†; Max Zeltsar‡*
Mentor(s): Ingela Jansson; Bernard Kissui; Emmanuel Charles

9:20
**7006**
Ω
Orange Corn-based diet improves total antioxidant capacity in layer pullets compared to traditional yellow corn diets.
*Serena Wesley†*
Mentor(s): Greg Fraley; Sara Cloft; Darrin Karcher; Torbert Rocheford; Evan Rocheford

9:40
**7007**
ΨΩ
Exploring Black Heritage in Greater Lafayette through Cultural Places, Spaces, and Landscapes
*Johnny Dong†*
Mentor(s): Ashima Krishna

# RESEARCH TALK SESSION 2 | 10:00-11:00

## ROOM: STEW 214A

10:00 Exploring Gut Microbiome Interventions in Age-Related Osteoarthritis Progression: Insights from
**7008** Mouse Model Studies
*Noah Jasinkiewicz†; Sarah Staller‡*
Mentor(s): Deva Chan; Cameron Villarreal; Zachary Davis

10:20 Factors Affecting the Microbiome of Hydroponics Systems
**7009** *Aanya Doshi†*
Mentor(s): Caitlin Proctor; Emily Spicuzza

10:40 Real-Time Volatile Chemical Screening of Environmental Media to Support Disaster Response
**7010** *Grayson Wittbrod†*
Mentor(s): Brandon Boor; Nusrat Jung; Jianglin Jiang; Xiaosu Ding

## ROOM: STEW 214B

10:00 Dosimetry Testing for a New In-Vivo X-Ray Fluorescence Measurement System
**7011** *Daniel Read†*
Mentor(s): Aaron Specht; Chandler Burgos

10:20 Spatial Modifications In Pulmonary Lipids Following Nanoparticle Exposure
**7012** *Nicolas Medel†*
Mentor(s): Jonathan Shannahan; Christina Ferreira

10:40 Role Differentiated Bimanual Manipulation in Home Environment For Infants Two Years Old and
**7013** Younger
*Stephanie Koopman†; Riya Karpe†*
Mentor(s): Laura Claxton; Paige Thompson

## ROOM: STEW 214C

10:00 Intersectional Inequalities in Hiring: The Effects of Gender and a Criminal Record
**7014** *John Targett†*
Mentor(s): Trent Mize

10:20 Racial inequality on Mturk: Racial Differences in Gig Worker's Satisfaction with Schedules
**7015** *Julieta Aguilar†*
Mentor(s): Jeremy Reynolds; Reilly Kincaid

10:40 Artificial Infrastructures: Framing Young Professional Experience
**7016** *Teah Good†; Jefferey Chen†; Ean Hunt†; Eva Voelker†; Carissa Bauerband‡*
Mentor(s): Michael Salvo

## ROOM: STEW 214D

10:00 The Role of Conductive Cooling and Moringa oleifera Supplementation of Heat Stressed Sows on
**7017** the Cheek Lipidome of Neonatal Piglets
*Evy Tobolski†*
Mentor(s): Theresa Casey; Leriana Garcia Reis; Linda Beckett; Allan Schinckel; Christina Ferreira

10:20 Rapid Inference and Theoretically Driven Forecasting of Supernovae using Amortized Posterior
**7018** Inference
*Braden Garretson†*
Mentor(s): Danny Milisavljevic

10:40 Tool for Runtime Analysis and Complexity Evaluator (TRACE)
**7019** *Shubhaang Agarwal†; Benson Tsai*; Tzung-Ying Hsieh*; Aanya Jha*; Jiarui Xie*; Nilisha Bhandari**
Mentor(s): Andres Bejarano

# RESEARCH TALK SESSION 3 | 11:00-12:00

## ROOM: STEW 214A

11:00 **7020** Investigating the Implication of Delta-Like 1 Intracellular Domain Over-expression on Muscle Stem Cell Differentiation
*Kashyap Akkinapally†*
Mentor(s): Shihuan Kuang; Sara Scinto

11:20 **7021** Withdrawn

11:40 **7022** Differences in Gut Microbial Patterns between Individuals with Angelman Syndrome and their First-Degree Relatives.
*Carina Crisan†*
Mentor(s): Steve Lindemann; Anita Panjwani; Bridgette Kelleher; Regan Bailey

## ROOM: STEW 214B

11:00 **7023** Racial and Ethnic Disparities in Service Referral and Use Among High-Risk Children Diagnosed with Autism Spectrum Disorder
*Aaliyah Saunders†; Sarah Langdon‡*
Mentor(s): Brandon Keehn; Rebecca McNally Keehn; Angela Paxton

11:20 **7024** Evaluation of the Collection Efficiency of the Size-Selective Inlet Used for the Lab-Made Bioaerosol Sampler
*Anthony Bovenschen†*
Mentor(s): Jae Hong Park; Subin Han

11:40 **7025** School Environmental Factors and Substance Use Disparities in Indiana Adolescent
*Tanya Pinthapataya†*
Mentor(s): Shandey Malcolm; Rita Chukwu

## ROOM: STEW 214C

11:00 **7026** The Well-being of Habitat for Humanity's Partner Families
*Casey Kaufman†*
Mentor(s): Jason Ware

11:20 **7027** Engineering Faculty Perceptions of Participating in a SoTL Professional Development Intervention
*Rhea Dutta†*
Mentor(s): Lisa Bosman

11:40 **7028** Exploring Innovative Methods for Teaching Semiconductors to young children
*Salam Zaid Alkilani†; Sebastian Arthur‡*
Mentor(s): Rosa Diaz

# RESEARCH TALK SESSION 4 | 12:00-1:00

## ROOM: STEW 214A

12:00 Autonomous in-air charging for UAVs
**7029** *Craig Cheung†; Abhishek Kini†; Aayush Iyengar†; Nikita Dubrovskyi†*
Mentor(s): Ran Dai; Yooseung Choi

12:20 In-air Charging of Unmanned Aerial Vehicles
**7030** *Aayush Iyengar†; Craig Cheung‡; Yooseung Choi‡; Abhishek Kini‡; Nikita Dubrovskyi‡; Megan Collins‡; Ethan Walker‡; Clifford Gamble‡*
Mentor(s): Ran Dai

12:40 Convolutional Neural Networks for Enhanced Subvisible Particle Analysis
**7031** *Anika Mathur†; Sohum Thadani†*
Mentor(s): Brett Meyers; Pavlos Vlachos

## ROOM: STEW 214B

12:00 Overview of the Child Automated Speech to Text (CAST) Project
**7032** *Akshitha Kartigueyan†; Aadya Pawar†; Bruna Jasinowodolinski†*
Ω Mentor(s): David Purpura; Avery Closser

12:20 Implementing Campus-Wide Vaccine Clinics Through Interdisciplinary and Community Partnerships
**7033** *Samantha Ky†; Nicole Stepp†; Evan Coblentz†; Sathveka Sembian‡; Caroline Packee**
Ω Mentor(s): Monica Kasting; Andrea DeMaria; Trexie Rudd; Kaitlyn Koch

12:40 Upcycling Biomass to Sustainable Aviation Fuel via Far-Equilibrium Electrification
**7034** *Simone Moulton†*
Ω Mentor(s): Tony Dong; Tian Li; Abhirup Sen

## ROOM: STEW 214C

12:00 Digitalized Manufacturing of Fiber-reinforced Composite Patching for Steel Bridge Girder Repair
**7035** *Clayton Cobb†; Jeremy Rashkin†; Chloe Graham†*
Mentor(s): Garam Kim; Sung Jun Choi; Timothy Ropp; Kyubyung Kang

12:20 Investigation on the Impact of Target Surfaces in Relation to Rotorcraft Fuel Tank Drop Test
**7036** Certification Processes.
*Matthew Elliott†; Ryan Seller†; Simon Lin†*
Mentor(s): Garam Kim; Jacob Montrose; Waterloo Tsutsui

12:40 Acoustic-based sensing for detection of potato tuber
**7037** *Stephane Duval†; Parikshit Sah†*
Mentor(s): Suranjan Panigrahi

## ROOM: STEW 214D

12:00 The Making of the BGA: Black Games Archive
**7038** *Joanna Senff†*
Δ Mentor(s): Samantha Blackmon

12:20 The Effectiveness of Protest Strategies: An ACT UP Analysis
**7039** *Kris Sass†*
Ψ Mentor(s): Kathryn Brownell

12:40 Accurate Iron Quantification in Cells
**7040** *Sidney Schwartz†*
Mentor(s): Matthew Scarpelli

# RESEARCH TALK SESSION 5 | 1:00-2:00

## ROOM: STEW 214A

1:00 Placing Electric Vehicle Charging Stations: An Optimization Problem and Unsupervised Machine
**7041** Learning Solution
*Bharath Anand†*
Mentor(s): Ananth Grama

1:20 Spatial and Temporal Diffusion of Secondary Injury Markers following Localized Brain Injury In Vitro
**7042** *David Kim†*
Mentor(s): Riyi Shi; Timothy Beauclair

1:40 Material Stiffness Sensing using DEAs
**7043** *Pranav Parigi†*
Mentor(s): Alex Chortos

## ROOM: STEW 214B

1:00 Disrupting the Binary in Laboratory Paradigms: Validation of a New Measure of Emotional Variation
**7044** in Cognitive Control
*Mads Owen†*
Mentor(s): Sarah Karalunas; McKenzie Figuracion

1:20 The effects of COVID-19 vaccine on hormone levels in adolescence and disparity between sexes
**7045** *Prudence Regacho†*
Mentor(s): Kristine Marceau

1:40 Latent Learning Trends Using AI and VR
**7046** *Leland Huey†*
Δ Mentor(s): Jerod White; Tara Behrend

## ROOM: STEW 214C

1:00 Noncanonical regulation of genes by KMT5C-H4K20me3 in EGFR inhibitor resistance in non-small
**7047** cell lung cancer
*Alexandra Glaws†*
Mentor(s): Andrea Kasinski; Jihye Son

1:20 Diagnostic gas-phase ion-molecule reactions for the identification of hydroxy-substituted N-
**7048** nitrosamines in tandem mass spectrometry
*Daria Tsoneva†*
Mentor(s): Hilkka Kenttamaa; Annika Little

1:40 Withdrawn
**7049**

## ROOM: STEW 214D

1:00 Exploring the Quantitative Impact Medical Marijuana Dispensaries Have on Residential Sale Prices
**7050** in Oklahoma
*Joshua Clark†*
Mentor(s): Michael Delgado

1:20 What factors influence the willingness to pay and consumption frequency of different meats in
**7051** Chinese consumers?
*Jemima Baributsa†*
Mentor(s): Holly Wang; Yizhou Hua

1:40 Estimation of Genetic Parameters for Twinning Rate in Holstein Cattle
**7052** *Hsin-Yu (Sinyu) Hou†*
Mentor(s): Hinayah Rojas de Oliveira; Henrique Mulim; Jacquelyn Boerman; Luiz Brito

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement
Ω Interdisciplinary Project; Ψ Archival Project; Δ Digital Humanities Project

## RESEARCH TALK SESSION 6 | 2:00-3:00

### ROOM: STEW 214A

2:00 Mechanosynthesis of Urea-Gypsum Cocrystals
**7053** *Tovia Owens†*
Ω Mentor(s): Kingsly Ambrose; Vidya Nagaraju

2:20 Decoding fNIRS Neural Responses: A Machine Learning Approach
**7054** *Dalton Aaker†*
Ω Mentor(s): Maureen Shader

2:40 Predicting EV Charging Station Demand: A Novel Approach Utilizing Traffic Flows
**7055** *Hsin-Wei (Ryan) Hsieh†; Hyunsang (Ethan) Cho†; Jaewon Cho†; Zachary Witeck†; Byung Wook Kim‡; Hyunjun Park‡; Spencer Gries‡; Kisal Wijesooriya‡; Thilak Babu**
Mentor(s): Sivaranjani Seetharaman

### ROOM: STEW 214B

2:00 Development and evaluation of a ferritin-Izumo1 protein vaccine for immunocontraception of wildlife.
**7056** *Gangmin Kim†; Delilah Flora‡*
Mentor(s): Harm HogenEsch; Ahmed AbdelKhalek; Raluca Ostafe

2:20 Examining Neuron Density in human-derived Cortical Organoids Carrying Epilepsy-Related SCN2A
**7057** Mutation L1342P
*Hope Harlow†*
Mentor(s): Yang Yang; Maria Olivero-Acosta

### ROOM: STEW 214C

2:00 Benchmarking Quantum Error Correction Codes Against Realistic Error Models for Superconducting
**7058** Qubits
*Santiago Lopez†; Jonathan Andrade Plascencia**
Mentor(s): Alex Ruichao Ma; Gabriel Perdue

2:20 Cold Spot Crater Characterization on the Moon Using an Unsupervised Neural Network
**7059** *Sara Cuevas-Quiñones†*
Mentor(s): Ali Bramson; Lior Rubanenko

2:40 How skin color modulates behavioral fever in Northern leopard frogs
**7060** *Ethan Guardado†*
Mentor(s): Cat Searle; Jonathan Lopez

### ROOM: STEW 214D

2:00 Impact of Freedom School At Purdue For Students K-5
**7061** *Teagan Drumm†; Lauren Spedale**
Mentor(s): Breanya Hogue; Youli Mantzicopoulos

2:20 A Metanalysis over Autism Spectrum Disorder and Math Word Problem Intervention
**7062** *Nicholas Cline†*
Mentor(s): Yan Ping Xin

# RESEARCH TALK SESSION 7 | 3:00-4:00

## ROOM: STEW 214A

3:00 High-throughput platform for macromolecular transport screening
**7063** *Crystal Jiang†*
Mentor(s): Julie Liu; Paulina Babiak

3:20 An in vivo assessment of cardiac remodeling during chronic hypertension in pregnancy
**7064** *Sarah Grev†*
Mentor(s): Craig Goergen; Elnaz Ghajar-Rahimi; Adalyn Meeks; Kyoko Yoshida; Molly Kaissar

3:40 Enhancing Solid Propellant Burning Rate Predictions through Machine Learning Modeling
**7065** *Camille Jorenby†*
Mentor(s): Steven Son; Shane Oatman

## ROOM: STEW 214B

3:00 The International Congress of Women and Transnational Advocacy Networks
**7066** *Annelise May†*
Ψ Mentor(s): Melissa Will

3:20 Constructing Carol: Racial Science, Eugenics, Biological Essentialism, and Carcerality
**7067** *August Trepanier†*
Ψ Mentor(s): Yvonne Pitts

3:40 Examining how Mitochondrial Content Differences in Twin Plant Sperm Cells Impact Double
**7068** Fertilization
*Keila Jellings†*
Mentor(s): Leonor C. Boavida

## ROOM: STEW 214C

3:00 Scaling limit of asymptotically-free self-interacting random walks to Brownian Motion perturbed at
**7069** Extrema
*Xiaoyu Liu†*
Mentor(s): Jonathon Peterson; Thomas Mountford

3:20 A Genomic Analysis of the Global House Dust Mite Allergen Diversity
**7070** *Sarah Bennett†*
Mentor(s): Qixin He; Pavel Klimov

3:40 Quantifying the impact of cone opponency on predictions of color discrimination.
**7071** *Lilianne Brush†*
Mentor(s): Esteban Fernandez-Juricic; Carlay Latour Teed

## ROOM: STEW 214D

3:00 Does Consuming Mushrooms with a Healthy Mediterranean-style Dietary Pattern Affect Indexes of
**7072** Brain Health in Adults?
Ω *Nok In Chan†*
Mentor(s): Wayne Campbell; Dan Foti

3:20 Developmental Exposure of Human Induced Pluripotent Stem Cell-derived Cortical Cultures to
**7073** Methylmercury Induces Persistent Functional Effects
Ω *Madeleine Strom†*
Mentor(s): Aaron Bowman; Anke Tukker

3:40 Designing, Implementing, and Evaluating a Sex Trafficking & Domestic Violence Training Program
**7074** for Licensed Salon Professionals in Indiana
Ω *Juliana St. Denis†; Abhinaya Nagalla†; Ashton Allen†; Jordan Cooley†; Alexandria Bedard†; Sophie Shank‡; Evan Coblentz‡*
Mentor(s): Kathryn Seigfried-Spellar; Andrea DeMaria; Alexandra Hughes-Wegner

# RESEARCH TALK SESSION 8 | 4:00-5:00

## ROOM: STEW 214A

4:00 Water Quality Assessment of Air Conditioning Condensate for Onsite Use
**7075** *Jackie De Leon†*
Mentor(s): David Warsinger; Andrew Fix; Andrew Freeman

4:20 Demonstrating Space Planning Possibilities using Trend and Outlier Analysis of International Space
**7076** Station Data
*Davi Carvalho†; Chirag Pimpale†*
Mentor(s): Xiaoyu Liu

4:40 Engineered Collagen Polymeric Materials Maintain Tissue Volume and Support Regenerative
**7077** Remodeling after Volumetric Muscle Loss
*Joshua Sexton†*
Mentor(s): Sherry Harbin; Stacey Halum; Lujuan Zhang; Rachel Morrison

## ROOM: STEW 214B

4:00 Nitrous Oxide and its Agents of Influence
**7078** *Lila McMahill†*
Mentor(s): Rich Grant

4:20 Systematic Development and Optimization of Helix Stabilized Stapled Peptides for Inhibitory Use
**7079** Against the Viral Oncoprotein, HPV-E6
*Elizabeth Andersen†; Karthik Arcot‡; Sophie Zhou‡*
Mentor(s): Jo Davisson; Vallabh Suresh; Dino Petrov

## ROOM: STEW 214C

4:00 ARTEMIS: AI-driven Robotic Triage Labeling and Emergency Medical Information System
**7080** *Revanth Krishna Senthilkumaran†; Mridu Prashanth†*
Ω Mentor(s): Aniket Bera; Kshitij Tiwari; Hrishikesh Viswanath

4:20 Exploring Protein-bound Chlorophyll a's Vibrational Spectrum at Room Temperature  Through
**7081** Microsampling and Isotope Substitution
Ω *Sarah Alvarez†; Sajal Salim**
Mentor(s): Mike Reppert; Jacob Wat

4:40 Cellular Activation is Sensitive to Abundance and Distribution of Rare Lipids
**7082** *Alex Alonzo†*
Ω Mentor(s): Shalini Low-Nam; Joy Wu; Vinay Menon


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement
Ω Interdisciplinary Project; Ψ Archival Project; Δ Digital Humanities Project

**Talk Presentation Abstract Number: 7000**
*Presentation Time: April 11 in STEW 214A at 9:20am-9:40am*

## Impact of Structured Revision Intervention During the Peer Review Process on Scientific Writing Self-Efficacy in Undergraduate Biology Students

Social Sciences/Humanities/Education

Author(s):

Allison Peterson† (Science); Gwyneth Wong* (Science); Emelia Koester* (Pharmacy, JMHC)

Abstract:

Undergraduate students in biological sciences, from lab courses to research, are tasked with carrying out experiments and writing reports on their experimental design, findings, and interpretations. A quasi-experimental study was adopted to explore how a structured revision intervention during the peer review process impacts science writing self-efficacy in students enrolled in a first-year introductory biology laboratory course. Students were tasked with carrying out an experiment to identify different bacterial species based on their unique biochemical, metabolic, and physiological properties, writing a lab report, and providing feedback on their classmates' reports. Between two semesters, one-half of the class (n=185) was given a structured revision scaffold after receiving peer feedback, and the other half (n=139) a general revision scaffold. In the structured revision treatment, students were asked to assess each piece of feedback received and separately determine if they would use it to revise their work. In the general revision treatment, students were asked to simply list any revisions they've made from their first to final draft. All students were then surveyed on their confidence in their ability to be a peer reviewer and how useful they thought the peer review process was to their own writing. We analyzed 176 student survey responses (n=101 structured and n=75 general) to develop a codebook we have used since our fall presentation to provide data for statistical models to explore the relationships between students' scientific writing-self efficacy and perceived utility of the peer review process between these two revision scaffold types.

Keywords: Structured Revision Scaffold; Student Survey Responses; Data for Statistical Models; Codebook; First-Year Introductory Biology Laboratory

Mentor(s):

Stephanie Gardner (Science); Jill Cornell (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7001**
*Presentation Time: April 11 in STEW 214A at 9:40am-10:00am*

## Teaching Applied Ethics in the context of Artificial Intelligence to Facilitate Peer Discourse

Innovative Technology/Entrepreneurship/Design

Author(s):

Parth Joshi† (Polytechnic)

Abstract:

With artificial intelligence (AI) becoming more embedded in society, the focus of education for students—of all disciplines—needs to focus on ethical and societal implications of AI. Many current students will have to make decisions in the near future when it comes to the ethical usage of AI and AI-powered tools. However, traditional ethics teaching strategies, which are often grounded in reasoning and theoretical philosophies, may not lead to the ultimately desired societal goal—ethical behavior. Recent literature on the inefficacy of these traditional methods informs this study's purpose to explore how novel ethics pedagogy can improve ethics curriculum. This study first details a learning intervention that presents an ethical dilemma to technology students and leverages moral intuitions and peer discourse to solve the dilemma. Then, by leveraging students' learning artifacts and reflections about the dilemma, we seek to gather information about how students' intuitions and emotions inform sociotechnical facts and engage in peer discourse. From preliminary qualitative analysis, we find that Jonathan Haidt's social intuitionist model helps explain why some students can engage in productive ethical discourse and some cannot. Furthermore, we find that active discussions during the learning intervention impacted students' ethical beliefs more than mere ethical reasoning. Quantitative analysis will also explore more differences in students' ethical beliefs and behaviors from a pre-post survey instrument. While preliminary, this study supports the need for updated ethics education goals that focus on moral foundations and deliberative discussion for positive ethical outcomes when teaching AI ethics.

Keywords: Artificial Intelligence; Ethics; Education

Mentor(s):

Alejandra Magana (Polytechnic); Lucas Wiese (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7002**
*Presentation Time: April 11 in STEW 214B at 9:00am-9:20am*

## Various Repetitive Behavior Types Lead to Changes in Facial Affect

Social Sciences/Humanities/Education

Author(s):

Riley Rozniarek† (HHS); Anna Hodge* (HHS, JMHC); Mallory Schrof* (HHS)

Abstract:

Repetitive behaviors are a common symptom shown in those with autism, genetic disorders, and intellectual disabilities, but research surrounding their function is limited. To investigate whether repetitive behaviors improve responses in low- and high-social demand contexts, we examined changes in facial affect (positive, neutral, and negative) pre- to post- repetitive behavior in toddlers and young children with autism. To date, data from 87 participants have been analyzed. Repetitive behavior type (motor, object use, or speech), the level of social demand (high, low), and the facial affect of the child (positive, neutral, or negative) before and after the repetitive behavior were recorded using ELAN software. Motor repetitive behaviors resulted in a positive facial affect change 50% of the time in a high-demand context, but only 37.5% of the time in a low-demand context. Object repetitive behaviors led to no change in facial affect 79% of the time in high-demand context and 71% of the time in low-demand context. Repetitive speech behaviors led to no change in facial affect 58% of the time in high-demand contexts but led to negative facial affect change 80% of the time in low-demand contexts. Our findings support the hypothesis that repetitive behaviors subtypes may have unique functions, which may differ depending on the level of social demand level. In sum, these findings help provide more knowledge on the function of repetitive behaviors and the effect these behaviors have on the affective state of children.

Keywords: Autism; Repetitive Behaviors; Social Demand; Facial Affect; Toddlers

Mentor(s):

Brandon Keehn (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7003**
*Presentation Time: April 11 in STEW 214B at 9:20am-9:40am*

**Evaluating the Perception of Vocal Fry**

Social Sciences/Humanities/Education

Author(s):

Emily Clark† (HHS, JMHC)

Abstract:

Glottal fry or vocal fry is a speech register in which the vocal folds oscillate irregularly. It is often characterized as sounding raspy or harsh. Some listeners characterize glottal fry negatively, but it occurs in most speakers to varying degrees. Previous research has focused mostly on the use of glottal fry by women, and I wish to extend that work to include male speakers as well. My overarching objective is to quantify individual variability in the use and perception of glottal fry by male and female young adults. I will also be examining whether the age of the listener influences perception of vocal fry. Finally, I will see if it is possible to alter the listener's perspective if there is a bias.

For this study, voice samples of 40 participants (20 self-identified as male and 20 as female) were collected and analyzed. I categorized the samples using acoustic analyses and took the four samples with the most and the four samples with the least vocal fry. I am now conducting an online experiment in which 160 listeners will rate the perceived characteristics of these speakers before and after an intervention involving watching a video of a high-status person with or without significant vocal fry in their speech. We hypothesize that speakers perceived to be female with vocal fry will be judged more negatively compared to males. We also hypothesize that the older the listener is, the more likely they are to rate a speaker with vocal fry negatively.

Keywords: Vocal Fry; Social Perception

Mentor(s):

Alexander Francis (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7004**
*Presentation Time: April 11 in STEW 214B at 9:40am-10:00am*

## Navigating Health Information: Factors Influencing Decision Making in Emerging Adults

Social Sciences/Humanities/Education

Author(s):

Nicole Stepp† (HHS); Samantha Ky† (HHS); Evan Coblentz* (Agriculture, JMHC); Caroline Packee* (Science)

Abstract:

Background: Entering university signifies medical independence for emerging adults, yet accessing healthcare can be challenging as they transition to adult-centered care, especially without a primary care provider while living away from home. Understanding these challenges is crucial for improving healthcare outcomes for this population.

Purpose: This study aims to assess healthcare decision-making and influences among emerging adults receiving vaccinations and explore health information access, knowledge, and communication at an on-campus vaccination clinic.

Methods: Data was collected at two no-cost vaccine clinics at Purdue in September and October 2023. A voluntary online survey with 24 questions on demographics, clinic materials, communication preferences, HPV knowledge, attendance factors, and health information access was offered to attendees. 687 responses from emerging adults aged 18-25 were included in the analysis, conducted using IBM SPSS Statistics (Version 27).

Results: The final analytic sample (n=687) included a majority women (n=420, 61.1%), non-Hispanic White (n=407, 59.2%), and students (n=678, 98.7%). The majority of participants (n=592, 86.2%) had access to their vaccine records. However, a higher percentage of men (30.7%) than women (23.4%) reported they would have a moderate to hard time accessing the record. Most participants (n=447, 65.1%) informed their parents about their vaccination. Additionally, more women (81.8%) than men (66.9%) informed a friend about their vaccine clinic visit (p<0.001), while more men (23.0%) than women (15.1%) did not inform anyone (p=0.046).

Conclusion: Findings highlight healthcare challenges during emerging adulthood. External and internal influences, like family, friends, and prior HPV vaccine views, notably affect decisions. Understanding these factors can improve interventions and support systems to enhance healthcare access and outcomes for emerging adults.

Keywords: Emerging Adults; Decision-Making; Vaccination; Health-Care Access; Medical Autonomy

Mentor(s):

Monica Kasting (HHS); Andrea DeMaria (HHS); Trexie Rudd (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7005**
*Presentation Time: April 11 in STEW 214C at 9:00am-9:20am*

## Livestock Predation Patterns by Lions, Leopards, and Spotted Hyenas in the Ngorongoro Conservation Area, Tanzania

Life Sciences

Author(s):

Shayden Jones† (Agriculture); Max Zeltsar‡ (Middlebury College)

Abstract:

In the Ngorongoro Conservation Area (NCA), livestock predation by African lions (Panthera leo), African leopards (Panthera pardus), and spotted hyenas (Crocuta crocuta) is a detrimental conflict. This study evaluated how predation behavior differs by carnivore species

depending on environmental factors and livestock management strategies within the NCA. The study hypothesized that there are significant differences between predators under the context of

spatial distribution, environmental conditions, herd management, and livestock prey preferences. Spatial analysis identified specific locations within the NCA where predation events occurred in

higher density indicating potential need for selective mitigation. Analysis of environmental factors (season, time of day, location of livestock) and pastoralist herd management strategies

(herd size, number of herders, age, and sex of herders present) found that there are differences between predator species and what influences patterns of livestock predation. It was found that

predation by lions is most likely to occur on cattle and was overall more prominent during the evening/night, in the dry season, and when animals were herded at pasture with fewer herders

present. Leopards most commonly attacked shoats, which was more likely at night, in the wet season, in close proximity to bomas, and when fewer herders were present. Hyenas most frequently attacked cattle but had the fewest influenced patterns. They attacked significantly more at night and when animals were lost at pasture. This study was completed with the goal of providing resources for creating informed management initiatives to be used in mitigation efforts by KopeLion and communities within the NCA.

Keywords: Human-Wildlife Conflict; Livestock Predation Patterns; Spatial Analysis; AIC Analysis; Predator Behavior

Mentor(s):

Ingela Jansson (KopeLion); Bernard Kissui (SFS); Emmanuel Charles (KopeLion)

**Talk Presentation Abstract Number: 7006**
*Presentation Time: April 11 in STEW 214C at 9:20am-9:40am*

## Orange Corn-based diet improves total antioxidant capacity in layer pullets compared to traditional yellow corn diets.

Life Sciences

Author(s):

Serena Wesley† (Agriculture, JMHC)

Abstract:

Orange Corn (OC) used in our project, developed by Dr. Torbert Rocheford, contains significantly higher carotenoid levels compared to Yellow Corn (YC). Carotenoids have multiple biological functions. Carotenoids are known to increase antioxidant capacity in vertebrates, although the exact mechanism by which this occurs is still not known. We hypothesized that an OC diet will improve laying hen health and performance due to increased antioxidant capacity. For the initial study stages 1400 Bovan Brown chicks across 2 rooms, evenly split into 2 groups were put on diets that were formulated to be equicaloric, varying only in corn source. At 7 weeks of age, each room was split into a total of 4 rooms (350 chicks each) retaining their respective dietary treatments. At 20 weeks of age, 10 birds per group were euthanized by cervical dislocation, and tissues collected and immediately frozen on dry ice. Supernatant from homogenized spleen and liver, or undiluted blood serum samples were assayed for total antioxidant capacity (TAC) using a commercially available kit, and TAC determined calorimetrically using a spectrometer at 405nm. 150-mg tissue samples were homogenized in 1.0ml buffer solution (5 mM $K_3PO_4$, pH 7.4, 0.9% NaCl, 0.1% glucose). Data were analyzed by Student's t-Test. Our results showed that OC-fed birds had significantly higher TAC in spleen tissue ($p = 0.0281$) and blood serum samples ($p = 0.0017$) when compared to YC-fed birds. Our data suggest an OC diet could effectively increase antioxidant capacity within birds, and therefore could improve laying hen performance and welfare.

Keywords: Zeaxanthin; Lutein; Glutathione Peroxidase; Superoxide Dismutase; System Xc

Mentor(s):

Greg Fraley (Agriculture); Sara Cloft (Agriculture); Darrin Karcher (Agriculture); Torbert Rocheford (Agriculture); Evan Rocheford (NutraMaize)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7007**
*Presentation Time: April 11 in STEW 214C at 9:40am-10:00am*

## Exploring Black Heritage in Greater Lafayette through Cultural Places, Spaces, and Landscapes

Social Sciences/Humanities/Education


Author(s):

Johnny Dong† (HHS, JMHC)



Abstract:

This research project explores and documents the historical and cultural significance of three sites in the Greater Lafayette area to establish their significance in Black heritage and history. These diverse sites include the location for a murder on 7th and Main St (cultural place), Quillar T Smith Businesses on 625 and 662 Main St (cultural space), and the Greenbush Cemetery (cultural landscape)--each of which play a role in shaping the Black heritage of the region. The goal is to uncover the rich stories embedded in these sites, contributing to a more inclusive understanding of the local cultural landscape. To achieve this, the research combines archival investigation, oral history interviews, and architectural analysis. The methodology for this project involved a deep dive into historical documents, photos, and relevant literature related to each site to grasp the structural importance of the chosen building/site. The outcomes of the research will provide a nuanced perspective on the historical, social, and cultural aspects of the selected sites. By blending information from archival research, oral histories, and architectural analysis, the project aims to bring to light narratives that may have been overlooked, contributing to a more complete representation of the region's cultural heritage and shedding light on the role these sites played in shaping the local Black community. The findings of this research project carry significance for heritage preservation, community engagement, and historical interpretation. Additionally, it will provide insight for educational initiatives, fostering a broader understanding of the diverse cultural contributions within Greater Lafayette.



Keywords: Lafayette; Black History; Heritage Preservation; Research; Cultural Landscape



Mentor(s):

Ashima Krishna (JMHC)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7008**
*Presentation Time: April 11 in STEW 214A at 10:00am-10:20am*

## Exploring Gut Microbiome Interventions in Age-Related Osteoarthritis Progression: Insights from Mouse Model Studies

Life Sciences

Author(s):

Noah Jasinkiewicz† (Engineering); Sarah Staller‡ (Engineering, JMHC)

Abstract:

The gut microbiome's role in Osteoarthritis (OA) onset and progression is recognized, but the timing and duration of its impact remain unclear. This study explores the link between gut microbiome alterations and spontaneous OA in aged mice through antibiotic dosing, fecal microbiota transplant, and age control, assessing bone morphology and function via micro-CT imaging and morphometry analysis. The study examines four treatment groups of mice: untreated (n=7/7 M/F), continuous dosing of antibiotics (1 g/L ampicillin + 0.5 g/L neomycin) provided ad libitum in drinking water (n=8/8 M/F), delayed dosing of antibiotics (18 months-22 months, n = 7/7 M/F), and initial dosing followed by fecal microbiome transplant (n=6/5 M/F). Left hindlimbs were collected, imaged with micro-CT, and morphometrically analyzed to determine trabecular bone metrics. A significant difference ($p=0.0007$) in mean trabecular thickness existed between the untreated group ($\mu = 7.329 \pm 4.300$pixels) and the fecal microbiota transplant group ($\mu=8.443\pm4.434$ pixels). Continuous dosing did not alter trabecular thickness, but continuous dosing with fecal microbiome transplant did, indicating that in aging, rapid disruption to the gut microbiome may more directly affect bone turnover. Although trabecular thickness appears to increase in this dataset, it cannot be confirmed as osteoarthritic or osteoarthritic protective without histology. Future work will confirm the effects of delayed dosing and the effects of all groups on subchondral plate metrics to potentially highlight the effects of antibiotic dosing on the progression of OA in mice.

Keywords: Osteoarthritis; Gut Microbiome; Trabecular Thickness; micro-CT; Morphometry Analysis

Mentor(s):

Deva Chan (Engineering); Cameron Villarreal (Engineering); Zachary Davis (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7009**
*Presentation Time: April 11 in STEW 214A at 10:20am-10:40am*

**Factors Affecting the Microbiome of Hydroponics Systems**

Life Sciences

Author(s):

Aanya Doshi† (Engineering)

Abstract:

Hydroponics is a system of growing crops within a liquid nutrient solution as opposed to traditional, soil-based agricultural practices. However, crops grown in hydroponics systems are susceptible to disease if the microbiome is not carefully monitored. This experiment aims to determine the primary sources of microbes and how they are sustained, to pinpoint possible human pathogens that may impact the system. Supported by literature, we hypothesize that the number and diversity of microbes are influenced by the type of plant, the type of growing system, and a variety of environmental conditions. In this experiment, we are quantifying and characterizing the microbiome in planktonic and biofilm phases of several hydroponics systems. The systems tested in this study include (1) a basil nutrient-film hydroponics system with (a) no plants, (b) poor growing conditions, and (c) improved conditions, as well as (2) deep water hydroponics systems with a variety of exotic plants. Initial microbial conditions in influence and environmental controls, as well as over time within each system will be quantified with flow cytometry. Both biofilm and planktonic samples are also being collected for DNA extraction and subsequent microbiome characterization. Plant health is also monitored in all systems. Our results will give insight into the methods required to control a healthy microbiome. Ultimately, we aim to develop strategies for microbiome control that will both promote plant growth and prevent the spread of harmful pathogens throughout the system.

Keywords: Microbiome; Human Pathogens; Hydroponics; Microbes

Mentor(s):

Caitlin Proctor (Agriculture); Emily Spicuzza (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7010**
*Presentation Time: April 11 in STEW 214A at 10:40-11:00*

## Real-Time Volatile Chemical Screening of Environmental Media to Support Disaster Response

Physical Sciences

Author(s):

Grayson Wittbrod† (Engineering)

Abstract:

The growing complexity and economic relevance of commercial manufacturing necessitates increasingly precise and accurate analysis of contaminants to facilitate effective regulation. Human and environmental health is jeopardized by insufficient understanding of the consequences of such activity. A recent disaster in East Palestine, Ohio, has underscored the importance of proper contamination assessment; on February 3rd, 2023, a Norfolk Southern train derailment led to the controlled burning of over 100,000 gallons of a known carcinogen, vinyl chloride, as well as leaking of various other hazardous compounds into creeks, soil, air, and homes. To gauge the extent of contamination and potential for health-related concerns, state-of-the-art proton transfer time-of-flight mass spectrometry (PTR-TOF-MS) has been utilized to analyze water samples in real time with a sensitivity to volatile organic compound (VOC) concentrations under 10 parts per trillion. Ionizing VOCs allowed for high resolution measurement of mass (over a thousandth of an AMU) and identification of compounds based on a mass to charge ratio spectrum. Quantifying the released compounds will allow for well-informed health advising, more effective cleanup methods, and a more steadfast metric to assess accountability from Norfolk Southern. The results should serve to aid in disaster relief efforts in East Palestine as well as improving standard practices pertaining to sustainable, safe practices in industrial manufacturing, human and environmental health monitoring, transportation, and disaster remediation.

Keywords: PTR-TOF-MS; VOC; Air Quality; Disaster; Environmental Health

Mentor(s):

Brandon Boor (Engineering); Nusrat Jung (Engineering); Jianglin Jiang (Engineering); Xiaosu Ding (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7011**
*Presentation Time: April 11 in STEW 214B at 10:00am-10:20am*

## Dosimetry Testing for a New In-Vivo X-Ray Fluorescence Measurement System

Physical Sciences

Author(s):

Daniel Read† (HHS, JMHC)

Abstract:

Lead exposure poses severe health risks to individuals, impacting cognitive function, growth, learning, and behavior. Current lead detection methods, primarily blood testing and X-ray fluorescence (XRF) of bone, both have limitations. This study introduces a novel in vivo XRF measurement system using K-shell energies of lead, addressing limitations of previous methods. The study aimed to characterize beam directionality, subject radiation dose, and operator occupational exposure.

Using a high-energy x-ray tube and room-temperature detectors, various parameters were assessed with bone and tissue phantoms. Dose measurements were taken by altering voltage, current, and shielding. Scatter and spatial measurements highlighted increased scatter with bone and tissue presence, emphasizing the safest positions for bystanders and operators.

Results exhibited expected dose rate changes with varying parameters, showcasing the impact of bone and tissue on scatter radiation. The system's total body effective dose for an adult was 1.94 μSv and a child aged 10 was 3.28 μSv with an 8 mm molybdenum shielding indicating minimal risk compared to established public dose limits.

This system demonstrates promising capabilities for lead exposure monitoring, offering negligible occupational exposure and minimal risk to individuals being scanned. Its safety and efficacy position it as a valuable tool in assessing lead exposure, potentially improving preventive measures.

Keywords: Dose Assessment; Exposure; Radiation; X-Rays; Trace Metals

Mentor(s):

Aaron Specht (HHS); Chandler Burgos (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7012**
*Presentation Time: April 11 in STEW 214B at 10:20am-10:40am*

## Spatial Modifications In Pulmonary Lipids Following Nanoparticle Exposure

Life Sciences


Author(s):

Nicolas Medel† (HHS, JMHC)



Abstract:

Silver nanoparticles (AgNPs) are commonly used in manufacturing processes and consumer/biomedical products. Inhalation is a primary route of nanoparticle exposure and AgNPs have demonstrated lung toxicity including oxidative stress, inflammation, and pulmonary injury. Pulmonary inflammation is associated with the development of diseases including fibrosis, asthma, and cancer. Bioactive lipids govern the initiation and resolution of inflammation. Currently, there is little understanding regarding pulmonary lipid-mediated mechanisms of inflammation following nanoparticle inhalation. This knowledge gap impedes our ability to treat exposures and diseases where inflammation is a primary component. Within this study, we hypothesize AgNP exposure will induce a pulmonary inflammatory response via the dysregulation of lipid mediators. To test this hypothesis, mice were exposed to 50μg of AgNPs or vehicle (control) via oropharyngeal aspiration. Three days following exposure, bronchioalveolar lavage fluid (BALF) and the right lung lobes were collected while the left lung lobe was fixed in carboxymethyl cellulose. BALF analysis demonstrated increased total protein levels and neutrophils following AgNP exposure compared to controls demonstrating pulmonary inflammation and injury. AgNP exposure increased gene expression of inflammatory genes including interleukin-1b (IL-1b), macrophage chemoattractant protein-1 (MCP-1), interleukin-6 (IL-6), tumor necrosis factor-a (TNF-a), and C-X-X motif chemokine ligand 1 (CXCL1) while no alterations were observed for genes associated with resolution of inflammation interleukin-4 (IL-4) or interleukin-10 (IL-10). Assessment of BALF cytokines demonstrated elevations of the pro-inflammatory mediators macrophage inflammatory protein-2 (MIP-2) and macrophage chemoattractant protein-1 (MCP-1) and no alterations in IL-10 in mice exposed to AgNPs. Fixed lung lobes were sectioned and evaluated via a variety of imaging techniques. Hyperspectral darkfield imaging was utilized to determine AgNP localization while staining with hematoxylin and eosin histologically evaluated inflammation within the lung. Desorption electrospray ionization mass spectrometry (DESI-MS) was employed to assess spatial alterations in lipid mediators and demonstrated AgNP-induced alterations in lipid mediators. Hematoxylin and eosin staining and hyperspectral darkfield microscopy allowed for cross referencing of areas of inflammation and AgNP deposition with MassLynx d



Keywords: Nanoparticle; Desi; Lipids; Macrophage; Inflammation


Mentor(s):

Jonathan Shannahan (HHS); Christina Ferreira (Centers & Institutes)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7013**
*Presentation Time: April 11 in STEW 214B at 10:40-11:00*

## Role Differentiated Bimanual Manipulation in Home Environment For Infants Two Years Old and Younger

Life Sciences

Author(s):

Stephanie Koopman† (HHS); Riya Karpe† (HHS, JMHC)

Abstract:

As infants navigate their developmental journey, acquiring different skills along the way, they discover various approaches to engage with objects.  One of those ways is through role-differentiated bimanual manipulation, also known as RDBM. This technique involves the coordination of both hands for object manipulation, with one hand serving as the stabilizer while the other one actively manipulates the object. For our project we examined hour-long videos of infants aged 9-, 12-, 15-, 18-, and 24- months in a naturalistic home setting as they engaged in their daily activities, coding every instance of RDBM. Observing infant behavior in a naturalistic environment allows researchers to observe day-to-day behavior, in comparison to gathering observations in a controlled laboratory setting. For the data collection, a researcher recorded an hour of everyday activity between a primary caregiver and their child at their home. Then through the use of the coding software Datavyu we conducted two passes for each video. In the first pass, we examined the frequency of object interactions in each age group. In the second pass, we coded instances of RDBM and variables such as object size (small, medium, or large), and whether the infant stabilized or manipulated the object upon beginning the interaction. Our findings contribute to a deeper understanding of how RDBM is displayed in a naturalistic setting. Additionally, they shed light on how infants learn to coordinate their movements to better explore their environment.

Keywords: Motor Development; Object Manipulation; Infants

Mentor(s):

Laura Claxton (HHS); Paige Thompson (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7014**
*Presentation Time: April 11 in STEW 214C at 10:00am-10:20am*

## Intersectional Inequalities in Hiring: The Effects of Gender and a Criminal Record

Social Sciences/Humanities/Education

Author(s):

John Targett† (Liberal Arts, JMHC)

Abstract:

Those who have a criminal record struggle to get a job. But past research shows that these disparities in hiring are not equally distributed. Most past research has focused on how criminal record disparities differ across racial groups. In this study, I examine an overlooked factor in past work: the applicant's gender. I argue that perceptions of warmth and competence for men and women will have differing degrees of impact on their perceived hireability for middle class jobs. Specifically, I hypothesize that the warmth of men will be more impacted by the presence of a criminal record due to stereotypes of violence, abrasiveness, and lack of warmth. In this study, measures of warmth, competence, and abrasiveness are used as important perceptions of job candidates and then disparities in hiring recommendations are assessed. To test this, I collected data on 270 participants in an online survey experiment where they were asked to rate one of four job candidates on measures of warmth, competence, abrasiveness, and likelihood of being hired. The results show that the perceptions of warmth and hostility of both men and women criminals are impacted by the presence of a criminal record, but that competence and hiring prospects are not significantly different between criminals and non-criminals. However, I do find some evidence that hiring prospects are harmed for men who have criminal records, but not for women—suggesting potential differential effects depending on an applicant's gender.

Keywords: Gender; Criminal Record; Hiring; Stereotype; Survey Experiment

Mentor(s):

Trent Mize (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7015**
*Presentation Time: April 11 in STEW 214C at 10:20am-10:40am*

## Racial inequality on Mturk: Racial Differences in Gig Worker's Satisfaction with Schedules

Social Sciences/Humanities/Education


Author(s):

Julieta Aguilar† (HHS, Liberal Arts)



Abstract:

Racial inequality is common in the conventional economy, and much research suggests that racial inequality is also prevalent in the gig economy, especially in the case of Airbnb and Uber. This paper examines whether racial differences are also present among microtask workers on the Amazon Mechanical Turk platform (Mturk). The MTurk platform might minimize racial differences because all aspects of worker's identity including race are kept confidential. However, by operating in a race-neutral fashion, MTurk might also allow racial variations in worker's situations outside of the platform to generate inequalities on the platform. Using survey data from a large sample of Mturk Workers in 2020, we examine whether different racial groups are equally satisfied with their Mturk schedules. The ability to set one's own schedule is one of the main perks that gig platforms promise. We find that although the platform operates in a race-blind fashion, respondents of color are less satisfied than white respondents with the timing of their microtask hours. For respondents who identify as Black or other, lower satisfaction stems from their overall financial situations and the perception that paid work interferes with their personal/family lives. For Hispanic respondents, lower satisfaction reflects a perception that they have less influence over the timing of their hours. Together, these findings suggest that even race-neutral gig platforms do not erase racial inequalities.



Keywords: Gig Work; Amazon Mechanical Turk; Race/Ethnicity; Schedule Satisfaction; Racial Inequality



Mentor(s):

Jeremy Reynolds (Liberal Arts); Reilly Kincaid (Liberal Arts)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7016**
*Presentation Time: April 11 in STEW 214C at 10:40-11:00*

## Artificial Infrastructures: Framing Young Professional Experience

Social Sciences/Humanities/Education

Author(s):

Teah Good† (Liberal Arts); Jefferey Chen† (Liberal Arts); Ean Hunt† (Liberal Arts); Eva Voelker† (Liberal Arts); Carissa Bauerband‡ (Polytechnic)

Abstract:

Artificial Infrastructures articulates the emergent roles of artificial intelligence (AI) in high technology environments, focusing on the concerns of technical and professional writing experts providing an accessible resource to young writers from a wide range of familiarity with AI technology. The purpose that drives the research team is improving the readability of subject matter experts' (SME) content through an AI-generated transcript. The work involved reviewing SME testimonies and interpreting their content for a new audience. Starting with the initial framework of an AI-generated transcript, our team focused on further developing the text for a novel format. This process involved weekly collaborative meetings, in which we would provide updated progress reports, and also set goals for the next steps of transforming the transcript and additional prose into a manuscript ready for publication. We found as researchers we were able to concentrate on writing our analyses and organizing the book contents; AI-generated transcripts reduced frustration and repetition in our work while maximizing our engagement with the ongoing research. AI tools such as Otter.AI streamlined the research process, giving us the ability to focus on the core aspects of the research over the more tedious parts of research that arise. By working closely with high-end technologies, young writers will gain the experience needed to edit future transcripts effectively and prepare the content for publication. The Wilke Undergraduate Research Internship will prepare young professionals with the writing and communication skills needed to collaborate with industry experts.

Keywords: User-Oriented; Interpretive; Collaborative; Editorial; Artificial Intelligence

Mentor(s):

Michael Salvo (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7017**
*Presentation Time: April 11 in STEW 214D at 10:00am-10:20am*

# The Role of Conductive Cooling and Moringa oleifera Supplementation of Heat Stressed Sows on the Cheek Lipidome of Neonatal Piglets

Life Sciences

Author(s):

Evy Tobolski† (Agriculture)

Abstract:

Exposure to heat stress during gestation and lactation increases risk for poor litter growth. Studies of growing weaned pigs found heat stress alters lipid metabolism. Whether exposure to maternal heat stress during gestation and lactation impacts lipid metabolism in neonates is currently unknown. Buccal cheek cells serve as a non-invasive, readily available source of cells that may be used to evaluate the metabolic response to treatments. A 2x2 factorial study was conducted to investigate the impact of maternal heat stress and Moringa (a high antioxidant feedstuff) supplementation on lipid composition of neonate buccal cells. We hypothesized that cooling and Moringa supplementation would alter lipid composition of buccal cells. Sows were assigned to 1 of 4 treatments: electronic cooling pad (ECP; n=12), heat stressed (HS; n=12), HS + Moringa (M; n=12), ECP + M (n=12). Cheek cells collected using a cytology brush were obtained from 4 piglets (2 males/2 females) from litters of 16 sows randomly selected across 2 trial reps (total:128) at day 19 postnatal. Lipids were extracted and analyzed using multiple reaction monitoring (MRM) profiling. Relative abundance of lipids was calculated and MetaboAnalyst 6.0 was used for statistical analysis of the overall effect of cooling, diet, sex, and study rep on the lipidome of the neonates. Of the 887 lipids measured, cooling affected abundance of 253, diet 82, rep 266, and sex 75 lipids (P<0.05). Preliminary results reflect the critical role of sex in lipid metabolism and support that cooling, and diet alter lipid profiles of buccal cells.

Keywords: Lipidomics; Maternal Nutrition; Lipid Damage

Mentor(s):

Theresa Casey (Agriculture); Leriana Garcia Reis (Agriculture); Linda Beckett (Agriculture); Allan Schinckel (Agriculture); Christina Ferreira (Centers & Institutes)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7018**

*Presentation Time: April 11 in STEW 214D at 10:20am-10:40am*

## Rapid Inference and Theoretically Driven Forecasting of Supernovae using Amortized Posterior Inference

Physical Sciences

Author(s):

Braden Garretson† (Science)

Abstract:

Current physical models of supernovae use high dimensional semi-analytical or hydrodynamical simulations combined with time consuming Approximate Bayesian Computation (ABC) methods, such as Markov chain Monte Carlo (MCMC), to infer their physical properties. While very accurate, this method of inference requires multiple CPU hours on average, and must be repeated whenever new observations become available, thereby making it practically impossible to infer the explosion properties of the thousand’s events that modern all sky surveys such as the Vera Rubin Observatory will discover each night. In this work, we present an alternative approach using Amortized Neural Posterior Estimation (ANPE), which is a simulation-based inference method that uses neural networks to estimate posterior probability distributions over the full range of observations. Once trained, it can rapidly infer model parameters of any event orders of magnitudes faster than traditional methods (< 1 second), thereby enabling real time inference of survey alert streams and theoretically driven follow-up. This not only facilitates the swift identification of significant events but also optimizes the strategic allocation of follow-up resources to maximize the scientific gain of the survey.

Keywords: Astronomy; Supernovae; Machine Learning; Physics

Mentor(s):

Danny Milisavljevic (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7019**
*Presentation Time: April 11 in STEW 214D at 10:40-11:00*

## Tool for Runtime Analysis and Complexity Evaluator (TRACE)

Mathematical/Computation Sciences


Author(s):

Shubhaang Agarwal† (Science, JMHC); Benson Tsai* (Science); Tzung-Ying Hsieh* (Science); Aanya Jha* (Science); Jiarui Xie* (Science, JMHC); Nilisha Bhandari* (Science)



Abstract:

This research focuses on developing a web platform for analyzing an algorithm’s runtime complexities, a crucial metric of algorithmic efficiency and scalability. Our method requires input source code and test cases in conjunction with code coverage tools from the respective programming language. We test the efficacy of the proposed approach using a repository of actual student project submissions. For each submission, we report a runtime analysis by performing regression using residual plots to observe the deviation from the expected runtime complexity of a student’s code. Our results show that the platform can correctly classify standard runtimes such as O(1), O(n), and O(n^2), and produces a relevant report for the user. The current analysis data suggests our platform helps provide time complexity results to students, thus helping them develop and improve their analytical and coding skills.



Keywords: Runtime Complexity; Algorithm Analysis; Software Engineering; Computer Science Education



Mentor(s):

Andres Bejarano (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7020**
*Presentation Time: April 11 in STEW 214A at 11:00am-11:20am*

## Investigating the Implication of Delta-Like 1 Intracellular Domain Over-expression on Muscle Stem Cell Differentiation

Life Sciences

Author(s):

Kashyap Akkinapally† (Engineering)

Abstract:

The purpose of this study is to investigate the relationship between over-expression of Delta-Like 1 ligand (DLL1), a Notch1 ligand associated with muscle stem cell maintenance and development. The study focuses on the functional significance of Dll1 Intracellular Domain (Dll1ICD), which is predicted to interact with the notch intracellular domain in the nucleus causing downstream effects on muscle cell differentiation through cell to cell signaling cascade. The experimental framework consists of the over-expression of Myc tagged Delta-like 1 Intracellular Domain (Dll1ICD) in the mouse myoblast cell line, C2C12. The experiment was then conducted in triplicate using three biological replicates of transfected cells. Immunofluorescent labeling techniques were used to visualize the over-expression of Myc tagged Dll1ICD. Additionally, western blot was performed to ensure that the over-expression of the Myc tagged protein DLL1ICD was being expressed. The findings show evidence that Dll1ICD over-expression impedes differentiation. This study is significant in defining the relationship between DLL1 and Notch Signaling pathway, which is critical for understanding muscle stem cell differentiation mechanisms. This discovery is consistent with current studies on Duchenne Muscular Dystrophy (DMD) which can impact prospective treatment strategies to improve muscle regeneration.

Keywords: Muscle Stem Cell; DLL1 ICD; Stem Cell Differentiation; Notch Signaling; Delta-Like 1

Mentor(s):

Shihuan Kuang (Agriculture); Sara Scinto (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7022**
*Presentation Time: April 11 in STEW 214A at 11:40am-12:00pm*

## Differences in Gut Microbial Patterns between Individuals with Angelman Syndrome and their First-Degree Relatives.

Life Sciences

Author(s):

Carina Crisan† (Liberal Arts, Science, JMHC)

Abstract:

Angelman Syndrome (AS) is a rare genetic disorder on chromosome 15 in the UBE3A gene. AS individuals face gastrointestinal (GI) difficulties such as constipation, diarrhea, and gastroesophageal reflux. Our research explores whether persons with AS have gut microbiome environments contrasting immediate family members, considering external variables such as diet. Previous research has shown correlation between the gut microbiome and nervous system, including with Prader-Willi Syndrome and Autism Spectrum Disorder. Given the rarity of this syndrome, there is a research gap in GI treatment and therapeutic options for AS persons, and this study is notable given the lack of research on their gut microbiome.

Stool samples were collected from seventeen children with AS and a non-AS relative at three different time points. FastDNA Spin Kit was used to extract DNA from stool. The v4-v5 16S genetic region was amplified via PCR and bead clean up removed primers. Short-read sequencing data was processed through Mothur MiSeq SOP and diversity, abundance, and taxonomic metrics were calculated. Metadata from study subjects included HEI dietary scores. Data analysis was completed using Python and Excel.

Alpha diversity comparisons between AS persons and their sibling significantly differed for many pairs, though directionality was not consistent across all subjects. There is a statistically significant difference between AS and non-AS gut microbiomes. Specifically, various OTUs annotated as families Erysipelotrichaceae, Lachnospiraceae, and Ruminococcaceae were found to be significantly correlated with AS. This data suggests there may exist unique gut microbiome characteristics in AS persons that could contribute to certain symptoms.

Keywords: 16S rRNA; Amplicon Sequencing; Angelman Syndrome; Diet and Nutrition; Gut Microbiome

Mentor(s):

Steve Lindemann (Agriculture); Anita Panjwani (HHS); Bridgette Kelleher (HHS); Regan Bailey (Texas A&M University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7023**
*Presentation Time: April 11 in STEW 214B at 11:00am-11:20am*

## Racial and Ethnic Disparities in Service Referral and Use Among High-Risk Children Diagnosed with Autism Spectrum Disorder

Social Sciences/Humanities/Education


Author(s):

Aaliyah Saunders† (HHS, Liberal Arts); Sarah Langdon‡ (Indiana University)



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 differences in early intensive behavioral intervention (EIBI) enrollment, wait times, dosage, and perceived progress for children diagnosed with ASD.

Methods: Participants included 47 young children with ASD (Non-Hispanic White [NHW]= 25, Any other race [OR] =22). Caregivers completed demographic and intervention surveys. The intervention survey focused on service recommendations and utilization, as well as barriers to service use. Families completed intervention survey within 8 weeks of diagnosis and 6 months later to measure changes in service utilization.

Results: Preliminary results show that at 6 months there were no differences in the proportion of NHW families (40.63%) compared to OR families (60%) receiving EIBI. Furthermore, for provider recommendations, the proportion of children recommended for Applied Behavior Analysis did not differ between NLW and OR families.

Additionally, wait times (NHW = 169.8 days; OR = 199.3days) and dosage (NHW = 28.19 hrs; OR = 31.88 hrs) did not differ between groups. However, perceived child progress was marginally lower in OR compared to NHW families.

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. The current study is in progress; longitudinal data at 12- and 24-months will provide a further description of EIBI access and use in children with ASD.



Keywords: Autism; Disparities; Race; Ethnicity; Socioeconomic Status


Mentor(s):

Brandon Keehn (HHS); Rebecca McNally Keehn (Indiana University); Angela Paxton (Indiana University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7024**
*Presentation Time: April 11 in STEW 214B at 11:20am-11:40am*

## Evaluation of the Collection Efficiency of the Size-Selective Inlet Used for the Lab-Made Bioaerosol Sampler

Life Sciences


Author(s):

Anthony Bovenschen† (HHS, JMHC)



Abstract:

Bioaerosols are aerosols of biological origin (e.g. viruses, bacteria, fungi, etc.) and the inhalation of pathogenic bioaerosols can cause serious diseases. To protect people against exposure to pathogenic bioaerosols, knowing its presence in the air is the first step. The current and conventional methods of detecting the pathogenic bioaerosols 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, a new bioaerosol sampler was developed. The sampler consisted of two serial impactors. The first impactor was used as a size-selective inlet to remove the particles larger than the target size and the second impactor was a wet inertial impactor to collect the particles of interest. Specifically, the size-selective inlet was designed to remove particulate matter greater than 2.5 µm. In this study, the collection efficiency of the size-selective inlet was evaluated and then cut-off diameter was determined from the collection efficiency results. For the collection efficiency test, the suspension of polystyrene latex was aerosolized using a vibrating mesh nebulizer, and concentrations of the test particle with and without the size-selective inlet were measured using an optical particle counter. The results show that the size-selective inlet could effectively remove the particles larger than 2.25 µm which is slightly smaller than the designed value but acceptable. In the future study, further experiments will be conducted with the wet impactor.



Keywords: Bioaerosol Sampler; Collection Efficiency; Wet Impactor



Mentor(s):

Jae Hong Park (HHS); Subin Han (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7025**
*Presentation Time: April 11 in STEW 214B at 11:40am-12:00pm*

## School Environmental Factors and Substance Use Disparities in Indiana Adolescent

Innovative Technology/Entrepreneurship/Design

Author(s):

Tanya Pinthapataya† (HHS)

Abstract:

Background: Health disparities among adolescents extend to substance use, its complications, and its rate of decline. Schools, where adolescents spend a substantial amount of time, are responsible for school-based policies and programming. They can, therefore, create environments that either prevent or contribute to substance use disparities.  Our study sought to determine if socio-demographic factors predict negative school environmental factors and if these factors predict substance use (smoking cigarettes, e-cigarettes, marijuana use, and alcohol consumption) among Indiana adolescents aged 15-17.

Methods: We utilized the 2021 Indiana Youth Risk Behavior Survey (N=989, Mage=16.4 years, 51.6% male, 70.1% white, 23% sexual minority) and multivariate logistic regression analysis to answer both study questions.

Results:  Sexual minorities were more likely to report being threatened, which, in turn, was associated with marijuana use (OR=2.55, 95%CI=1.22-5.35) and e-cigarette use (OR=2.54, 95%CI=1.32-4.89). Additionally, sexual minorities, racial minorities, and males were less likely to feel close to someone at school, which, in turn, was associated with marijuana use (OR=0.57, 95%CI=0.34-0.95) and cigarette use (OR=0.39, 95%CI=0.21-0.76). We also found that sexual minorities, racial minorities, and males were more likely to be bullied, which was not linked to substance use. Finally, none of the school environmental factors were related to alcohol use.

Conclusions: To address substance-use disparities among Indiana youth, our study supports tailored prevention strategies and public health initiatives that create a welcoming and inclusive school environment.

Keywords: Adolescents; Health Disparities; Prevention; School Environment; Substance Use

Mentor(s):

Shandey Malcolm (HHS); Rita Chukwu (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7026**
*Presentation Time: April 11 in STEW 214C at 11:00am-11:20am*

## The Well-being of Habitat for Humanity's Partner Families

Social Sciences/Humanities/Education

Author(s):

Casey Kaufman† (HHS, JMHC)

Abstract:

This is a qualitative research project in collaboration with Habitat for Humanity, my community partner. My research question seeks to understand how Habitat for Humanity's homeownership program affects the livability (ability to live, considering conditions of the environment / neighborhood nearby) and life-ability (ability to cope with the problems of life) of the families who participate and move into new homes. My terms are defined by Ruut Veenhoven's, The Four Qualities of Life. I have partnered with Habitat for Humanity to help them incorporate the results of my research findings into how they story the effectiveness of their affordable housing program as it pertains to wellbeing. I have conducted semi-structured interviews with 5 partner families as my data collection method. I have conducted content analysis examining the transcribed interviews using Veenhoven's theoretical framework of livability, life-ability and appreciation of life. My initial findings suggest that through the Habitat homebuilding process, the wellbeing of the partner families has benefited from the impact of Habitat's educational resources, heightened sense of community, and greater sense of freedom of owning their own home. Moreover, families have learned how to budget their money and take care of their own property from financial and home maintenance classes. They feel integrated into a small community of hard-working families. Lastly, they feel free in their abilities to customize their homes and live however they wish now that the property is theirs.

Keywords: Well-Being; Habitat for Humanity; Homebuilding; Quality of Life; Families

Mentor(s):

Jason Ware (JMHC)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7027**
*Presentation Time: April 11 in STEW 214C at 11:20am-11:40am*

## Engineering Faculty Perceptions of Participating in a SoTL Professional Development Intervention

Social Sciences/Humanities/Education

Author(s):

Rhea Dutta† (Engineering, JMHC)

Abstract:

Purpose: This study looked at the perceptions that drive engineering educator motivations, following a professional development intervention, in integrating the scholarship of teaching and learning (SoTL) within the engineering classroom.

Methods: First, 30 participants participated in a professional development intervention and, upon completion, commented on their experiences in a self-report qualitative survey. After undergoing the program, participants answered two separate qualitative surveys which provided detailed feedback regarding participants' sentiments. The survey data was inputted into a qualitative analysis software and overarching themes were created. Corresponding sub-themes were developed from pattern analysis.

Results: From the literature, the four encompassing themes that were identified are: (1) Seeing Value, (2) Supportive Environment, (3), Self-Efficacy, and (4) IDEA. After an analysis of the qualitative feedback provided by participants, the emerged subthemes for each of the aforementioned categories, respectively, are: (1A) Student Engagement, (1B) Gaining Student Feedback, and (1C) Access to New Resources; (2A) Peer Feedback and (2B) New Perspectives; (3A) Participant Confidence, (3B) Skills Development Through Dissemination, and (3C) Student Confidence; and (4A) Integration of New Methods and (4B) Diversity of Perspectives.

Implications: Higher education engineering educators' successful implementation of the scholarship of teaching and learning can be aided by changes made by various groups within higher education. These groups include Ph.D. programs, Provost's offices, University Centers for Teaching and Learning, professors, and engineering students.

Keywords: Engineering; Faculty; Professional Development; Scholarship of Teaching and Learning; Undergraduate

Mentor(s):

Lisa Bosman (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7028**
*Presentation Time: April 11 in STEW 214C at 11:40am-12:00pm*

## Exploring Innovative Methods for Teaching Semiconductors to young children

Innovative Technology/Entrepreneurship/Design

Author(s):

Salam Zaid Alkilani† (Engineering, JMHC); Sebastian Arthur‡ (Engineering, JMHC)

Abstract:

The aim of this research was to understand how learning complex phenomena could be facilitated by focusing on unique and unconventional methods of educating groups of primary school children from Lafayette and West Lafayette, including those attending traditional schools and homeschooling.

This study specifically targeted the teaching of semiconductors and different kinds of microscopes, employing 90-minute sessions to establish connections between these concepts and familiar ideas such as photosynthesis. It also emphasized learning through hands-on exploration and discovery via engaging experiments, alongside visual representations and comparisons.

Additionally, the effectiveness of these techniques was gauged through researcher observations during sessions and pre- and post-session surveys. These surveys probed students' knowledge on relevant topics, career interests, and excitement for learning.

Teaching about semiconductors and microscopes to young learners can be challenging using traditional methods. By identifying impactful instructional approaches, this research aims to offer schools a diverse range of strategies to enhance overall educational experiences, promoting academic success and fostering a passion for learning.

Keywords: Semiconductors; Education Techniques; Uncommon Relations; Innovative Teaching Methods; Student Engagement

Mentor(s):

Rosa Diaz (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7029**
*Presentation Time: April 11 in STEW 214A at 12:00pm-12:20pm*

## Autonomous in-air charging for UAVs

Innovative Technology/Entrepreneurship/Design

Author(s):

Craig Cheung† (Engineering); Abhishek Kini† (Engineering); Aayush Iyengar† (Engineering); Nikita Dubrovskyi† (Engineering)

Abstract:

Unmanned aerial vehicles(UAVs) are extremely useful in a multitude of applications, such as search and rescue, military surveillance,  agriculture monitoring, etc. However, one key drawback stands in place of widespread adaptation of UAVs: mission duration. A typical high end consumer UAV such as DJI Mavic 3 pro can fly for around 40 minutes, after which the drone needs to be charged for several hours. To improve mission duration, the team proposes a system to perform autonomous in-air recharging of the UAVs. By having a large UAV carrying a charging pad, small UAVs can land on the charging pad until they are fully recharged. By having all the operations occur autonomously, this reduces the need for human monitoring and increases the scalability of the system. To demonstrate the effectiveness of the proposed system, the team will simulate the proposed system in Gazebo, as well as develop a physical prototype system that will conduct a 30-minute flight demonstration of the system. The proposed system should greatly increase the mission duration of the small UAVs, as each large charger UAV should be able to support 3-4 cycles of charging, thus tripling or quadrupling the mission duration of the small drones.

Keywords: Unmanned Aerial Vehicles (UAVs); Autonomation; Recharging; Mission Duration

Mentor(s):

Ran Dai (Engineering); Yooseung Choi (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7030**
*Presentation Time: April 11 in STEW 214A at 12:20pm-12:40pm*

## In-air Charging of Unmanned Aerial Vehicles

Innovative Technology/Entrepreneurship/Design


Author(s):

Aayush Iyengar† (Engineering, JMHC); Craig Cheung‡ (Engineering); Yooseung Choi‡ (Engineering); Abhishek Kini‡ (Engineering); Nikita Dubrovskyi‡ (Engineering); Megan Collins‡ (Engineering); Ethan Walker‡ (Engineering); Clifford Gamble‡ (Engineering)



Abstract:

Battery charge times have been a long-time burden in the EV industry. In recent years, extensive battery research has made them applicable across diverse industries. More specifically, the application of EVTOL/UAVs has rapidly developed, making breakthroughs in every industry. Although UAVs are common, flight time has always been an issue requiring constant charge breaks. This semester's study aims to streamline the UAV charge process by developing an autonomous in-air charging rig so that the UAV can remain in the air and charge without returning home to land. A large obstacle with autonomous docking is developing an accurate vision-tracking system. We based our initial system on OpenCV, an open-source computer vision learning system. Obtaining the data is straightforward, but refining it and removing external noise is the main obstacle. We approached this problem by utilizing and integrating a Butterworth filter with an image processing algorithm to utilize only the frequencies that give us the cleanest vision data. We also designed and manufactured the charging and landing platforms for autonomous docking in which a recently built small drone will serve as the docker on the larger in-air charging platform. Finally, an image processing algorithm was developed to accurately track the center of the small drone during the docking process. The integration of these processes sets the stage for the autonomous charging of in-air vehicles, a topic that will continue to be explored in the future.



Keywords: UAV; Funnel; In-Air Charging; Butterworth Filter; Autonomy


Mentor(s):

Ran Dai (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7031**
*Presentation Time: April 11 in STEW 214A at 12:40pm-1:00pm*

## Convolutional Neural Networks for Enhanced Subvisible Particle Analysis

Mathematical/Computation Sciences

Author(s):

Anika Mathur† (Science); Sohum Thadani† (Science)

Abstract:

The pharmaceutical industry must conform to many industry standards for the safe production and packaging of drugs to treat illness. One standard in particular deals with the amount of subvisible particles (SVP) — material such as glass, plastic, or other substances smaller than 10 μm — as their presence in high quantities can impact drug stability and trigger unintended immunogenic responses upon administration. The conventional approaches to quantify the presence of SVPs includes identification by eye of samples under a microscope. While there are several existing works exploring the automated identification of SVPs using machine learning and artificial intelligence, they are limited by their reliance on datasets consisting solely of oil and protein particles, resulting in poor performance when applied to particles with similar shapes and features. This study explores the application of improved convolutional neural networks (CNNs) to classify various SVP types potentially found in the packaging of high molecular weight protein drug therapies delivered by autoinjectors. To achieve this, we assembled a diverse dataset consisting of production-grade oils, glass microsphere particulates, and protein aggregates. Analysis revealed similarities between oil and glass SVPs in their circular shapes, while protein aggregates exhibited varied shapes and sizes. Leveraging these insights, we designed a CNN architecture featuring multi-branch networks to process specific features and enhance differentiation between particle types. By employing CNNs, our study aims to mitigate human error and offer a tool to automatically perform robust identification of SVPs for protein-rich drug solutions.

Keywords: Subvisible Particles (SVPs); Convolutional Neural Networks (CNN); Machine Learning

Mentor(s):

Brett Meyers (Engineering); Pavlos Vlachos (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7032**
*Presentation Time: April 11 in STEW 214B at 12:00pm-12:20pm*

## Overview of the Child Automated Speech to Text (CAST) Project

Innovative Technology/Entrepreneurship/Design


Author(s):

Akshitha Kartigueyan† (Science); Aadya Pawar† (Science); Bruna Jasinowodolinski† (Science)



Abstract:

[Abstract Redacted]



Keywords: Machine Learning; NLP; ASR; Linguistics; Language Development



Mentor(s):

David Purpura (HHS); Avery Closser (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7033**
*Presentation Time: April 11 in STEW 214B at 12:20pm-12:40pm*

## Implementing Campus-Wide Vaccine Clinics Through Interdisciplinary and Community Partnerships

Social Sciences/Humanities/Education

Author(s):

Samantha Ky† (HHS); Nicole Stepp† (HHS); Evan Coblentz† (Agriculture, JMHC); Sathveka Sembian‡ (Engineering); Caroline Packee* (Science)

Abstract:

Background: The human papillomavirus (HPV) vaccine, introduced in 2006, has been instrumental in reducing HPV-infections. Campus-wide vaccination clinics have proven effective in bolstering vaccination rates, acting as hubs for community engagement and dispelling misconceptions.

Objective: This study aimed to investigate vaccine communication strategies and decision-making processes among participants attending a community-wide, no-cost vaccine clinic.

Methods: Leveraging support from the College of Pharmacy and the Indiana Immunization Coalition, two vaccine clinics were held, offering age-approved vaccines at no out-of-pocket cost. Participants completed a one-time online survey assessing decision making factors and clinic marketing strategies. Analysis from electronic surveys conducted using IBM SPSS Statistics (Version 27) revealed insights from the two September and October 2023 clinics.

Results: Flu (n=1332), Meningococcal B (n=311), and HPV (n=115) were the most distributed amongst all vaccines (n=2330) given at the clinic. Those who completed the survey (n=813) were predominantly women (n=475; 58.40%), residing in West Lafayette (n=656; 89.7%), and students (n=735; 90.4%). Respondents receiving the HPV vaccine (n=47) at each clinic indicated cost-free availability (n=36; 76.6%) and understanding vaccine benefits (n=17; 36.2%) as key facilitators. Respondents that have not received or did not know if they received the HPV vaccine (n=415) indicated barriers including a perceived lack of need for the HPV vaccine (n=91; 21.9%). Clinic awareness spread mainly through social networks and social media (n=645; 67.2%).

Conclusions: Our analysis showcases the pivotal role of cost-free accessibility and educational outreach in promoting HPV vaccine acceptance. This study contributes valuable insights to inform future initiatives, emphasizing targeted awareness campaigns to address misconceptions and enhance HPV vaccine knowledge within diverse community settings.

Keywords: Campus-Wide Clinic; HPV; Vaccinations

Mentor(s):

Monica Kasting (HHS); Andrea DeMaria (HHS); Trexie Rudd (Pharmacy); Kaitlyn Koch (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7034**
*Presentation Time: April 11 in STEW 214B at 12:40pm-1:00pm*

## Upcycling Biomass to Sustainable Aviation Fuel via Far-Equilibrium Electrification

Innovative Technology/Entrepreneurship/Design

Author(s):

Simone Moulton† (Engineering, JMHC)

Abstract:

Promoting sustainable transportation is a promising way to combat climate change. In this aspect, one strategy is the production of aviation fuel from biomass feedstock. Cellulosic biomass is the most abundant natural feedstock on Earth and a promising substrate for the synthesis of sustainable aviation fuel (SAF), owing to its suitable chemical structure. Prior research on upcycling of cellulosic biomass has successfully produced value-added compounds such as 2,5-hexanedione and levoglucosenone. However, challenges in SAF synthesis, such as poor selectivity, limited reaction rates, and low yields, arise from limitations in conventional continuously heated thermochemical reactors powered by combustion-heating. These suffer poor process tunability, high carbon emission, and low energy efficiency. Herein, we develop a novel electrified reactor using millisecond-level pulsed heating to upcycle cellulosic biomass into SAF components, such as fully reduced and partially oxidized hydrocarbons. Our designed electrified reactor contains a carbon-based heating element for programmable Joule-heating. In a typical process, cellulose substrate is heated at an ultrafast heating rate (e.g., 104 K/s) to induce breakdown of the polymeric backbone; meanwhile a transient heating duration (e.g., ~100 ms) followed by fast quenching (e.g., 104 K/s) modulates the reaction progress, thereby improving selectivity while suppressing undesired secondary products. The pulse heating process is programmed and controlled using integrated circuit(s), where the parameters are screened based on kinetic analysis. The results obtained from this study will deepen the mechanistic understanding on cellulose pyrolysis under far-equilibrium conditions and provide a new pathway for producing SAF precursors.

Keywords: Sustainable Aviation Fuel; Cellulosic Biomass; Pyrolysis; Pulsed Heating; Far-Equilibrium Conditions

Mentor(s):

Tony Dong (Science); Tian Li (Engineering); Abhirup Sen (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7035**
*Presentation Time: April 11 in STEW 214C at 12:00pm-12:20pm*

## Digitalized Manufacturing of Fiber-reinforced Composite Patching for Steel Bridge Girder Repair

Innovative Technology/Entrepreneurship/Design

Author(s):

Clayton Cobb† (Polytechnic); Jeremy Rashkin† (Polytechnic); Chloe Graham† (Polytechnic)

Abstract:

Composite materials have recently gained attention for infrastructure repair and rehabilitation in the construction industry due to their high strength and stiffness, and their easier application compared to traditional infrastructure repair methods. In this study, the focus is on repairing steel bridge girders damaged by corrosion. Traditional repair methods of such damage typically require total replacement of steel members, often intrusive and cost inefficient. Recent exploration of composite applications has proven effective methods of repairing structures using patch repairs. This study investigates the optimization of composite patch repairs for damaged steel bridges through lab-scale testing. Lab scale models were made from 1018 low carbon steel. Based on previous studies, the chosen material most closely reflects the steel used on bridges and is easily machined to simulate corrosion damage. Test coupons were cut to dimensions 152 mm x 25 mm x 6.35 mm and then the center 50.8 mm on the front and rear face were machined to a minimum tapered cross-sectional thickness of 1.6 mm. To enhance bonding strength, the damaged areas were sandblasted and primed with Scotch Weld. Repairs were made using wet epoxy layup of fiberglass plies, cut to conform to the damaged area and ensure fiber orientation was parallel to expected load path. Compression tests were performed on the repaired test coupons revealing the increased strength of optimized patch repairs. With successful real-world application of optimized patch repair methods, bridge longevity, cost savings and increased usefulness of steel bridges could be achieved from its various benefits.

Keywords: Composite; Optimized Repair Patch; Digitized Manufacturing; Steel Corrosion Structure Repair; Steel To Composite Bonding

Mentor(s):

Garam Kim (Polytechnic); Sung Jun Choi (Polytechnic); Timothy Ropp (Polytechnic); Kyubyung Kang (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7036**
*Presentation Time: April 11 in STEW 214C at 12:20pm-12:40pm*

# Investigation on the Impact of Target Surfaces in Relation to Rotorcraft Fuel Tank Drop Test Certification Processes.

Innovative Technology/Entrepreneurship/Design

Author(s):

Matthew Elliott† (Polytechnic); Ryan Seller† (Polytechnic); Simon Lin† (Polytechnic)

Abstract:

The Federal Aviation Administration (FAA) requires original equipment manufacturers (OEMs) to certify their rotorcraft fuel tanks to reach the required safety standards. The FAAs' rigorous safety standards must be met by OEMs before the fuel tank can be incorporated into the rotorcraft. OEMs are required to perform free-fall drop tests from 50 feet without rupture or leakage of the fuel tank to be safety certified by the FAA. This study focused on the ever-growing issue in variation of testing methods between the various OEMs and the vague testing procedure. OEMs are currently using several different types of target surfaces including plywood, steel plates, grass patches, or concrete slabs. As a result, this research was focused on the varying amount of energy that was absorbed during the drop test for each of the common target surfaces. Wood, steel, concrete, and dirt were chosen as target surfaces to investigate the resulting impact forces produced by each material. To evaluate the energy dissipation, the contact time between the testing unit and target surface along with the total force was used to provide data on the effect of varying target surfaces. Conclusions were drawn that softer materials resulted in an increased impact time, therefore significantly reducing the resulting force exerted on the testing device. For the least amount of energy dampening for rotorcraft fuel tank drop tests, based on the results, steel is the recommended target surface.

Keywords: Drop Test; FAA; Target Surface; Rotorcraft; Fuel Tank

Mentor(s):

Garam Kim (Polytechnic); Jacob Montrose (Polytechnic); Waterloo Tsutsui (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7037**
*Presentation Time: April 11 in STEW 214C at 12:40pm-1:00pm*

## Acoustic-based sensing for detection of potato tuber

Innovative Technology/Entrepreneurship/Design

Author(s):

Stephane Duval† (Polytechnic); Parikshit Sah† (Polytechnic)

Abstract:

[Abstract Redacted]

Keywords: Sensor; Potato; Acoustic; Signal Processing; Pattern Recognition

Mentor(s):

Suranjan Panigrahi (Polytechnic)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7038**
*Presentation Time: April 11 in STEW 214D at 12:00pm-12:20pm*

**The Making of the BGA: Black Games Archive**

Social Sciences/Humanities/Education

Author(s):

Joanna Senff† (Liberal Arts)

Abstract:

This archival project seeks to compile a list of video games that are “textually, contextually, or representationally Black” (according to the definitions and guidelines created by Dr. Blackmon). It seeks to build a culturally informed database of video games that are “Black” in text, context, or characterization. The research includes building the database, editing and maintaining the website, recording gameplay, and researching and accumulating scholarly articles for the games as cultural artifacts. Ultimately, the research will provide a base for future needs and represent themes in our culture as the video game industry grows.

Keywords: Black Culture; Video Games; Database; Archive; Cultural Artifact

Mentor(s):

Samantha Blackmon (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7039**
*Presentation Time: April 11 in STEW 214D at 12:20pm-12:40pm*

**The Effectiveness of Protest Strategies: An ACT UP Analysis**

Social Sciences/Humanities/Education

Author(s):

Kris Sass† (HHS, Liberal Arts)

Abstract:

This project explores ACT UP's preferred method of direct action and how such activities circumvented the minimal reporting that was done by the mainstream news media on the AIDS epidemic. By examining ACT UP's 1988 Seize Control of the FDA action in comparison to their 1992 Ashes Action, this research illuminates how the direct action methodology was malleable and effective in conveying information and creating change, despite changes in the wider discussion of AIDS and within ACT UP. This research puts videos from the C-SPAN archive into conversation with changes in the epidemic and social views of homosexuality to build an understanding of the context ACT UP created their actions in and impacts they had. Ultimately, this shows how ACT UP used direct action—from setting their action at the FDA headquarters to explicitly descriptive chants to spreading the ashes of loved ones who died from AIDS on the White House lawn—in order to bring their message directly to readers and institutions despite the mainstream media overlooking the AIDS epidemic. As the media continues to be polarized in the twenty-first century, this research showcases strategies minority groups can use in order to prevail and make change in the face of social stigma, news media negligence, and neglect from the federal government.

Keywords: LGBTQ; AIDS; Activism; Mass Media; C-SPAN

Mentor(s):

Kathryn Brownell (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7040**
*Presentation Time: April 11 in STEW 214D at 12:40pm-1:00pm*

**Accurate Iron Quantification in Cells**

Life Sciences

Author(s):

Sidney Schwartz† (HHS)

Abstract:

The purpose of this study is to find an accessible way to quantify iron content in cells. The use of iron oxide nanoparticles has been hypothesized to have the ability to polarize macrophages to promote tumor suppression rather than tumor growth. The first step in testing this hypothesis is to measure how much iron is being absorbed into the cell. Two methods were used to analyze iron content in the cells. The first method uses X-ray flourescence (XRF). XRF works by bombarding the sample with high-energy X-rays, which ionize inner-shell electrons of atoms in the sample. As outer-shell electrons transition to fill these vacancies, characteristic X-ray photons are emitted. By detecting and analyzing these emitted X-rays, the amount of iron present in the sample is identified. For this experiment we seeded Gl 261 tumor cells into 4 T175 flasks. After cells were seeded 200 ug/mL of iron oxide nanoparticles were added to three of the flasks leaving one as control. Cells were collected by trypsinization and suspended in 600 uL of PBS. Iron content in these cells were measured using the XRF. The second method used to quantify iron in the cells is UV-Vis Spectroscopy. UV Spectroscopy uses ultraviolet light to determine the absorbency of a substance. The peak of Iron absorption is found at 348 nm which is the wavelength in which the data is collected. This protocol consisted of 6 T75 flasks of Gl 261 cells. 2 flasks for 0,2 and 8 Gy of radiation each with one containing iron. UV-Vis was then used to quantify the iron absorption in the cells. At this time, specific results and analysis have not been calculated.

Keywords: X-Ray Fluorescence; UV-Vis Spectroscopy; Gl 261 Cells; Tumor Suppression; Iron

Mentor(s):

Matthew Scarpelli (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7041**
*Presentation Time: April 11 in STEW 214A at 1:00pm-1:20pm*

## Placing Electric Vehicle Charging Stations: An Optimization Problem and Unsupervised Machine Learning Solution

Mathematical/Computation Sciences


Author(s):

Bharath Anand† (Engineering)



Abstract:

Electric Vehicles (EVs) offer a pathway to lower transportation costs and reduced emissions. However, supporting the projected rapid growth in EVs will require significant, carefully planned deployment of charging infrastructure. For example, the US is expected to have around 48 million EVs on the road by 2030, requiring 1.2 million new public charging stations (over 20 times the current number). Where should these stations be placed? My project formulates this question as a constrained optimization problem. The proposed formulation goes beyond previous efforts by co-optimizing multiple objectives such as minimizing average distance between users and their closest stations, maximizing coverage (users who have access to at least one station within a bounded distance) and balancing load (the number of users) across stations. My project also proposes computationally efficient solutions to this problem based on clustering, which is a class of unsupervised machine learning. I investigate the widely used K-means algorithm as well as variants such as Bisecting K-means and Constrained K-means, evaluating how they perform on the metrics of interest. I have developed a software tool, EVPlanner, that takes as input public Geospatial datasets (population density, EV registrations and current locations of charging stations), and generates optimized locations for EV charging stations. Based on 2023 data for the state of New York, EVPlanner cuts down distances to charging stations by 69.3%, reduces the number of users who are farther than 3 miles from a charging station by 53.5x and reduces the number of overloaded EV stations by 32.5%.



Keywords: Machine Learning; Clustering; Electric Vehicles; Charging Stations; Optimization


Mentor(s):

Ananth Grama (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7042**
*Presentation Time: April 11 in STEW 214A at 1:20pm-1:40pm*

## Spatial and Temporal Diffusion of Secondary Injury Markers following Localized Brain Injury In Vitro

Life Sciences

Author(s):

David Kim† (Engineering)

Abstract:

Traumatic brain injury (TBI) is a global health crisis. In the year 2019 alone, 27 million new cases of TBI were recorded resulting in 7 million lived years of partial or full disability. While TBI is caused by a physical primary injury (PI), immediately ensuing pathological biochemical cascades, known as secondary injury (SI) are thought to be responsible for many of the long-term physical, behavioral, and cognitive consequences of TBI. Critically, SI begins at the point of PI and is able to diffuse from the injury site, damaging otherwise healthy tissue. Further, many TBIs are mild and go undiagnosed allowing secondary injury to spread unimpeded. While the consequences of SI are well documented, the cellular and biochemical mechanisms leading to prolonged injury remain elusive. Therefore, unraveling the temporal course of SI is instrumental in developing therapeutic interventions post-TBI. This project investigated localized and diffuse increases in two key aspects of SI: oxidative stress (Acrolein) and inflammation (TNF-α). Primary murine cortical cultures were subjected to a cut injury before being fixed and immunocytologically stained at 15 minutes, 1 hour, and 24 hours post-injury. Using confocal microscopy and fluorescent intensity analysis, preliminary results show Acrolein and TNF-α increases across injured cultures, with higher concentrations closest to the injury site. Furthermore, Acrolein and TNF-α concentrations distant from the injury increase as post-injury incubation time is prolonged. By quantifying the distribution of Acrolein/TNF-α across varying temporal periods, this model could provide insights necessary to determine an optimal intervention window post-TBI.

Keywords: Trauma; Brain; In vitro

Mentor(s):

Riyi Shi (Veterinary Medicine); Timothy Beauclair (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7043**
*Presentation Time: April 11 in STEW 214A at 1:40pm-2:00pm*

**Material Stiffness Sensing using DEAs**

Innovative Technology/Entrepreneurship/Design

Author(s):

Pranav Parigi† (Engineering)

Abstract:

Mechanical stiffness of soft materials is vital to the design and understanding of soft robotics. Development of a small-scale sensor capable of continuous monitoring will allow detailed measurements of materials while continuously in use. The goal of this project is to utilize Dielectric Elastomer Actuators (DEA) to design a cantilever-style bending actuator to stress a material and measure its deformation. DEAs can “self-sense” which means the deformation of the actuator can be measured through variation of capacitance across it. Thus, the sensor is capable of actuating the target site and measuring deformation simultaneously. The sensor was first modelled to understand the deformation and blocking forces with different materials and thicknesses. The results of the model were used to fabricate an initial sample DEA. The sample is tested on a soft hydrogel material with known properties to validate results. In addition to the mechanical design an HV switching circuit is designed to actuate the system and measure the capacitance across the actuator to understand the self-sensing characteristics. The development of such a sensor is novel both in its application in sensing and in the use of DEA’s self-sensing and actuation properties simultaneously. Such a sensor can easily be scaled for different applications and use cases providing a platform for future soft robotic sensor development.

Keywords: Soft Robotics; Dielectric Elastomer Actuators; Artificial Muscles; Self- Sensing; Material Stiffness Sensing

Mentor(s):

Alex Chortos (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7044**
*Presentation Time: April 11 in STEW 214B at 1:00pm-1:20pm*

# Disrupting the Binary in Laboratory Paradigms: Validation of a New Measure of Emotional Variation in Cognitive Control

Social Sciences/Humanities/Education


Author(s):

Mads Owen† (HHS, Liberal Arts)



Abstract:

Background: Cognitive control supports goal-directed behavior. The ability to engage cognitive control varies across emotional contexts and variation predicts multiple types of psychopathology. In standard, well-validated emotional go/no-go (GNG) paradigms participants discriminate between emotional and neutral faces. These tasks include a neutral task condition that requires participants to discriminate male/female faces using assumptions based on binary gender. This opposes a fluid understanding of gender and risks alienating gender diverse research participants. Here, we seek to validate an alternative task requiring an age discrimination (young/old).

Method: N=30 children and N=30 college students will complete two counterbalanced GNG paradigms: the established gender and alternative age versions. Participants will also complete questionnaires, standardized assessments of executive functioning and intelligence, and a qualitative interview evaluating their experience in psychological research.

Results: Analyses will focus on validating the alternative GNG task and establishing improved research practices with gender diverse participants.



Keywords: Gender; Task Validation; Inclusive Paradigms; Cognitive Control


Mentor(s):

Sarah Karalunas (HHS); McKenzie Figuracion (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7045**
*Presentation Time: April 11 in STEW 214B at 1:20pm-1:40pm*

## The effects of COVID-19 vaccine on hormone levels in adolescence and disparity between sexes

Life Sciences

Author(s):

Prudence Regacho† (Science, JMHC)

Abstract:

Immunization is an effective way to prevent the contraction of the novel coronavirus disease (COVID-19). There is little scientific evidence regarding potential effects of the COVID-19 vaccine on changes in stress and reproductive hormones in youth during puberty. To fill this gap, we leveraged data from 53 adolescents (pre-test Mage=13.06, post-test Mage=13.47, ~36% female) who provided hair samples in spring 2020 and ~9 months later; 38 received the COVID-19 vaccine between assessments, 15 did not. Hair samples were assayed for cortisol (n=46), dehydroepiandrosterone (n=38), testosterone (n=39), estradiol (n=43), and progesterone (n=37). Using ANCOVA models, we tested whether changes in hormones differed for vaccinated vs. unvaccinated youth and tested for sex differences. We included the predictors: sex, time, vaccination status, two- and three-way interactions as well as covariates of race/ethnicity, family income, and age. No effects were detected for dehydroepiandrosterone [F(10)=.37, partial-eta-squared=.14, p=.95], testosterone [F(10)=.35, partial-eta-squared=.13, p=.96], and progesterone [F(10)=1.66, partial-eta-squared=.39, p=.15]. Boys had higher cortisol than girls [F(10)=2.11, partial-eta-squared=.36, p=.048] regardless of assessment time and vaccination status (main effect only). For estradiol there were interactions between time*vaccine status [F(1)=5.04, p=.03] and time*sex [F(1)=8.75, p=.006] such that average estradiol levels decrease in those unvaccinated but increase in those vaccinated with average levels in girls significantly increasing as expected but decreasing in boys. The results for estradiol suggest potential interference with pubertal development. Our results are preliminary due to the small sample size; therefore, larger sample sizes will be beneficial for confirming the influences of COVID-19 vaccination on hormone levels during puberty.

Keywords: COVID-19; COVID-19 Immunization; Hormones; Pubertal Development

Mentor(s):

Kristine Marceau (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7046**
*Presentation Time: April 11 in STEW 214B at 1:40pm-2:00pm*

## Latent Learning Trends Using AI and VR

Life Sciences

Author(s):

Leland Huey† (HHS, Science)

Abstract:

Technology is playing an increasing role in our lives. One form of technology, artificial intelligence (AI), has been particularly important in the context of education. This is no surprise, as AI offers many advantages as an education tool, for example, reducing costs while increasing the scalability of educational programs. Another form of technology that is becoming more important for learning is virtual reality (VR). VR can be used to simulate environments that are difficult, expensive, or impossible to attend person. This type of technology is especially valuable for learning occupational skills, as VR can simulate a wide array of, sometimes expensive, equipment that allows individuals to learn without putting valuable equipment or their safety on the line.

Even so, AI and VR learning are not what many consider to be ‘traditional’ teaching strategies. This study aims to determine the ways learning behavior changes based on a learner’s perceived source of performance feedback: from a human or an AI. This study uses data from a between-subjects experiment where 366 participants learned welding via a VR simulator and received feedback from the simulator’s AI program, a person, both the AI program and a person, or no feedback at all. We conducted a latent profile analysis of learners’ performance across six welding trials to examine different learning trajectories. We identified several distinct ways individuals learn a new occupational skill with VR. We are exploring predictors of these profiles to better understand how AI and human feedback influence learning patterns in technological learning environments.

Keywords: Interference Theory; IO Psychology; Artificial Intelligence; Virtual Reality; Learning

Mentor(s):

Jerod White (HHS); Tara Behrend (Michigan State University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7047**
*Presentation Time: April 11 in STEW 214C at 1:00pm-1:20pm*

## Noncanonical regulation of genes by KMT5C-H4K20me3 in EGFR inhibitor resistance in non-small cell lung cancer

Life Sciences

Author(s):

Alexandra Glaws† (Science)

Abstract:

Lung cancer is the leading cause of all cancer-related deaths, with non-small cell lung cancer (NSCLC) making up ~85% of lung cancer cases. Mutations in the epidermal growth factor receptors (EGFR) are associated with NSCLC development. Standard treatment for cancer patients involves targeting EGFR mutations with EGFR inhibitors (EGFRi). However, most patients develop resistance to EGFRi over time. Previous studies in this lab have shown that the loss of KMT5C drives resistance to EGFRi in EGFR-mutant NSCLC cells. Patient data further supports KMT5C transcript level is downregulated following resistance. KMT5C-mediated H4K20me3 is a repressive modification that is historically known for the involvement of heterochromatin formation and maintenance. Our preliminary data suggests KMT5C-H4K20me3 is also associated with the regulation of gene-rich euchromatin regions. The process by which KMT5C is recruited to heterochromatin is understood; however, KMT5C recruitment to gene-rich euchromatin regions remains unknown. We hypothesize that the KMT5C recruitment mechanism to euchromatin is distinct from the recruitment mechanism to heterochromatin. We plan to study the interactome of KMT5C using BioID, an unbiased proximity labeling technique using a mutant BirA (BirA*). We aim to identify complex factors that form with KMT5C and enable recruitment of KMT5C to its target genes in euchromatic regions that are involved in driving resistance to EGFRi. We will express KMT5C fused to BirA* under a doxycycline-repressible promoter to avoid any artifacts due to constitutive protein overexpression. Once validated, we will generate a cell line that stably expresses the vector to be used in the BioID.

Keywords: KMT5C; H4K20me3; Non-Small Cell Lung Cancer; EGFR Inhibitor Resistance; Gene Regulation

Mentor(s):

Andrea Kasinski (Science); Jihye Son (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7048**
*Presentation Time: April 11 in STEW 214C at 1:20pm-1:40pm*

## Diagnostic gas-phase ion-molecule reactions for the identification of hydroxy-substituted N-nitrosamines in tandem mass spectrometry

Physical Sciences

Author(s):

Daria Tsoneva† (Science)

Abstract:

N-Nitrosamines are a class of carcinogenic impurities that are strictly regulated in the pharmaceutical industry. In order to facilitate the development of safe pharmaceutical products, an accurate analytical method is needed to quickly identify the N-nitroso functionality in compounds present in complex mixtures. Tandem mass spectrometry (MSn) experiments based on collision-activated dissociation (CAD) are often used to identify drug impurities and drug metabolites. The main limitation of this method is that many compounds, including ionized N-nitrosamines, often fragment similarly to isomeric and related compounds. Diagnostic gas-phase ion-molecule reactions are a powerful alternative to MSn/CAD methods for the structural analysis of pharmaceutical compounds. This approach involves diffusing a neutral reagent, such as 2-methyxopropene (MOP), into an ion trap mass spectrometer and then observing reactions between analyte ions and the neutral reagent. In this work, a previous method based on diagnostic gas-phase ion-molecule reactions with MOP for the detection of protonated monofunctional N-nitrosamines is expanded to bifunctional hydroxy-substituted N-nitrosamines. Protonated N-nitrosamines without a nearby hydroxy group undergo diagnostic reactions with MOP, forming both a stable adduct (M + H + MOP) and an adduct that has eliminated 2-propenol (M + H + MOP – CH3C(OH)=CH2). However, hydroxy-substituted N-nitrosamines instead undergo diagnostic reactions that form an adduct that has eliminated methanol (M + H + MOP – CH3OH) and an adduct that has eliminated both methanol and acetone (M + H + MOP – CH3OH – (CH3)2CO). The ability to identify different N-nitrosamines and distinguish them from other nitrogen-containing compounds is a powerful tool for pharmaceutical analysis.

Keywords: Mass Spectrometry; Ion-Molecule Reactions; N-Nitrosamines; Pharmaceuticals

Mentor(s):

Hilkka Kenttamaa (Science); Annika Little (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7050**
*Presentation Time: April 11 in STEW 214D at 1:00pm-1:20pm*

## Exploring the Quantitative Impact Medical Marijuana Dispensaries Have on Residential Sale Prices in Oklahoma

Social Sciences/Humanities/Education

Author(s):

Joshua Clark† (Agriculture)

Abstract:

In this paper we aim to utilize econometric tools to assess sentiment among homeowners on the locations of licensed medical marijuana dispensaries in the state of Oklahoma. NIMBY is an acronym coined from the phrase “Not in my backyard” to describe negative sentiment from homeowners in response to a policy or significant change in the area around their property. We use a hedonic pricing model to assess how the number of dispensaries and their spatial relationship to a residential property impacts the price of the property holding constant other key variables. The model utilizes publicly available residential sales data obtained from six different county assessors in the state of Oklahoma. We find a positive and statistically significant, quadratic relationship between residential sale prices and the distance to a medical marijuana dispensary up to about a 5 kilometer distance, indicating that residents prefer the dispensaries to be away from their properties. Further investigation is ongoing to assess the robustness of this result. The results may have influence on the decision making of homeowners, dispensary owners, and legislators in the state of Oklahoma.

Keywords: Hedonic Pricing; Medical Marijuana Dispensary; NIMBY

Mentor(s):

Michael Delgado (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7051**
*Presentation Time: April 11 in STEW 214D at 1:20pm-1:40pm*

# What factors influence the willingness to pay and consumption frequency of different meats in Chinese consumers?

Mathematical/Computation Sciences

Author(s):

Jemima Baributsa† (Agriculture)

Abstract:

In recent years there has been an increase in finding new and sustainable ways of producing and consuming food. The meat industry has made developments in finding new production technologies. Consumers can adopt novel products containing plant-based, and lab grown meats. The purpose of this study was to analyze trends in the meat consumption of Chinese consumers. The data collected on this sample was done through a 2022 survey. The survey which included a mix of multiple choice and free response was sent to consumers in China because of the country's increase in meat consumption, which would impact global food production. Data collected on these consumers will be used to develop regression models in R version 4.2.1 to determine the effects that age, gender, lifestyle, education, and food perceptions have on the consumers' meat consumption habits. These key measures of demographic will also be used to determine the effect they have on the consumers' willingness to pay.  In previous studies, people have responded differently to different kinds of meat substitutes. Contexts including gender, political affiliation, and product familiarity influence the opinions of consumers. Cost becomes a crucial factor, as buyers show a clear willingness to pay more for products made ethically and with less impact on the environment. Problems with scalability, flavor enhancement, and affordability still exist, requiring constant research and technological improvement.

Keywords: Cell-Cultured Meat; Consumption Habits; Lab Grown Meat

Mentor(s):

Holly Wang (Agriculture); Yizhou Hua (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7052**
*Presentation Time: April 11 in STEW 214D at 1:40pm-2:00pm*

## Estimation of Genetic Parameters for Twinning Rate in Holstein Cattle

Life Sciences

Author(s):

Hsin-Yu (Sinyu) Hou† (Agriculture)

Abstract:

Twinning in dairy cattle is undesirable due to its negative consequences on cows and calves, such as reduced milk yield, increased risk of abortion, and retained placenta. This study aimed to estimate genetic parameters for twinning in Holstein cows. The dataset was derived from Holstein cattle raised on a commercial farm located in Indiana, and comprised 23,463 calving records from 12,477 cows born between 2011 and 2019. Births were classified as singlets or twins, and after the phenotypic quality control, twins accounted for 3.01% (707) of all births. The number of lactation and contemporary group (created based on calving year and season) were considered as categorical fixed effects in the statistical model, and cow age was used as a covariable. All animals were genotyped and/or previously imputed to 62,029 SNP (single nucleotide polymorphism) markers. Genotypic quality control was performed based on call rate, minor allele frequency, and monomorphic SNPs, resulting in 57,606 SNP markers and 12,477 cows remaining for the genetic analysis. Variance components were estimated using a threshold model under the Bayesian approach, considering 200,000 interactions, 50,000 burn-in, and 100 thin to ensure convergence. The genetic analysis was performed using the BLUPF90 family programs. The heritability estimated was 0.13, with the 95% highest posterior density (HPD) ranging from 0.08 to 0.18. The repeatability estimated was 0.22, with HPD ranging from 0.15 to 0.29. Although the heritability and repeatability estimated in this study were low, our results suggest that there is genetic potential to select against twinning in Holstein cattle.

Keywords: Heritability; Repeatability; SNP; Permanent Environment

Mentor(s):

Hinayah Rojas de Oliveira (Agriculture); Henrique Mulim (Agriculture); Jacquelyn Boerman (Agriculture); Luiz Brito (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7053**
*Presentation Time: April 11 in STEW 214A at 2:00pm-2:20pm*

**Mechanosynthesis of Urea-Gypsum Cocrystals**

Physical Sciences

Author(s):

Tovia Owens† (Agriculture, Engineering)

Abstract:

Leaching of fertilizers from agricultural land is a major source of fresh and saltwater pollution in the United States. Many attempts to address this directly reduce the solubility of the fertilizers, often either through mechanical compaction or the application of a variety of potentially polluting chemical coatings. An emerging alternative method is cocrystallization. Cocrystallization is a technique used widely in pharmaceutical applications to alter specific properties of compounds, often solubility. Chemical compounds are bonded together to form a crystalline lattice which inherits certain properties from the active and coforming reactants. This can be performed through thermomechanical means (e.g. milling and grinding) or direct growth of crystals from solution, and is a highly empirical process. Cocrystal studies have been performed on agricultural materials with the intention of reducing their solubility for fertilizer application. This study evaluates the effectiveness of mechanical cocrystal synthesis on reducing solubility using a 4:1 ratio of urea to anhydrous calcium sulfate. Milling is performed with a ball mill with varying frequencies and durations, and the results are evaluated for solubility and stability. Optimal samples will be further analyzed using PXRD, or powder x-ray diffraction, to determine percent crystal conversion.

Keywords: Agricultural Engineering; Cocrystals; Fertilizer Leaching; Urea; Gypsum

Mentor(s):

Kingsly Ambrose (Engineering); Vidya Nagaraju (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7054**
*Presentation Time: April 11 in STEW 214A at 2:20pm-2:40pm*

## Decoding fNIRS Neural Responses: A Machine Learning Approach

Innovative Technology/Entrepreneurship/Design

Author(s):

Dalton Aaker† (Engineering)

Abstract:

The aim of this project is to develop a machine learning model that accurately identifies positive auditory-evoked neural responses while controlling for factors that introduce noise to the neural signal and observe the effects of decoding these interferences. Human neuroimaging data collected via fNIRS from a single subject twice daily for five consecutive days was analyzed. The data followed a block-design paradigm with two conditions: meaningful auditory speech and silence serving as a baseline control. Hemoglobin concentration data was collected using a continuous-wave fNIRS system (NIRx NIRSport2) with specific source-detector pairs optimized for the regions associated with sound acquisition and language comprehension. Standard fNIRS data cleaning and preprocessing practices were applied, and Python's Sci-kit learn library was utilized for decoding and prediction on the extracted datasets. Estimators were trained on hemoglobin concentrations and applied stimuli, with cross-validation using leave one subject out. Some estimators required training on both physiological and fNIRS datasets, using a feature union technique to join the relevant features. Preliminary analysis revealed that the model achieved the strongest predictive ability using only the oxygenated hemoglobin signal but at low subject counts, the best decoding accuracies were achieved using a combination of Galvanic Skin Response (GSR) and oxygenated hemoglobin signals. In general, physiological data did not consistently improve decoding accuracy, except for GSR data. This study provides insights applicable to machine learning, neuroscience, and optical engineering and the ability to combine cofactors for maximum prediction capabilities in machine learning models is a key area of ongoing research.

Keywords: Machine Learning; Functional Near Infrared Spectroscopy; Galvanic Skin Response; Brain Computer Interface

Mentor(s):

Maureen Shader (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7055**
*Presentation Time: April 11 in STEW 214A at 2:40pm-3:00pm*

## Predicting EV Charging Station Demand: A Novel Approach Utilizing Traffic Flows

Innovative Technology/Entrepreneurship/Design

Author(s):

Hsin-Wei (Ryan) Hsieh† (Engineering); Hyunsang (Ethan) Cho† (Engineering); Jaewon Cho† (Engineering); Zachary Witeck† (Polytechnic); Byung Wook Kim‡ (Engineering); Hyunjun Park‡ (Engineering); Spencer Gries‡ (Engineering); Kisal Wijesooriya‡ (Science); Thilak Babu* (Engineering)

Abstract:

Despite the rapid growth in electric vehicle (EV) adoption and the corresponding need for extensive charging infrastructure, there remains a significant gap in the availability of granular, public data regarding the demand at individual EV charging stations. The scarcity of this data impedes reliable demand predictions for EV charging stations, leading to the risk of overcrowding that diminishes user experiences, and places heightened stress on power grids that amplify inefficiencies in energy distribution. Traditional forecasting approaches, while promising, struggle to address this issue effectively due to their high dependence on detailed, station-specific demand histories that are often unavailable. Instead of relying on such publicly unavailable data, our method infers charging demand by forecasting the number of EVs exiting the highway using a stacked neural network and time forecasting model. Upon forecasting, we achieved a prediction of traffic patterns with a WMAPE of less than 10%. Building on this forecasting accuracy, we then employ a rigorous demand modeling framework to calculate the charging station demands. This framework incorporates multiple factors, including predicted EV traffic volumes, observed charging behaviors (average session duration and peak charging times), EV charging prices, and power grid demand. Through this meticulous approach, we can generate reliable estimates of station-specific demand with the absence of such non-accessible data. In the future, we aim to develop an optimization model leveraging Real-Time Pricing (RTP) strategies which will dynamically adjust prices to balance demand with grid capacity, promoting off-peak charging, user convenience and improving energy distribution efficiency.

Keywords: Demand Forecasting; Traffic Flow Analysis; Stacked Neural Networks; Charging Station Optimization; Real-Time Pricing Strategies

Mentor(s):

Sivaranjani Seetharaman (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7056**
*Presentation Time: April 11 in STEW 214B at 2:00pm-2:20pm*

## Development and evaluation of a ferritin-Izumo1 protein vaccine for immunocontraception of wildlife.

Life Sciences

Author(s):

Gangmin Kim† (Pharmacy); Delilah Flora‡ (Science, JMHC)

Abstract:

[Abstract Redacted]

Keywords: Immunocontraception; Vaccine; Ferritin-Izumo1 protein; Antibody

Mentor(s):

Harm HogenEsch (Veterinary Medicine); Ahmed AbdelKhalek (Veterinary Medicine); Raluca Ostafe (Centers & Institutes)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7057**
*Presentation Time: April 11 in STEW 214B at 2:20pm-2:40pm*

# Examining Neuron Density in human-derived Cortical Organoids Carrying Epilepsy-Related SCN2A Mutation L1342P

Life Sciences

Author(s):

Hope Harlow† (Pharmacy)

Abstract:

Epilepsy is a neurological disorder causing the misfiring of neurons, leading to random, often unprovoked seizure episodes. The SCN2A gene, encoding Nav1.2, a sodium ion channel protein, is implicated in severe seizures and epileptic episodes in infancy. A specific mutation that affects the SCN2A gene is L1342P. There are six known reports of the Nav1.2-L1342P mutation, with patients presenting severe seizures and cortical atrophy. Cortical atrophy is the progressive shrinking of the cerebral cortex, commonly associated with neurological disorders, and can be recapitulated in vitro, using human-induced pluripotent stem cell (hiPSC)-derived technologies, such as cortical organoids. These are 3D models shown to produce structures similar to the cerebral cortex, which are an essential tool when studying neurological and developmental diseases in lab. In our project, we generated organoids carrying the L1342P variant as a tool to model and study the impact of the mutation on cortical development. Our objective was to determine the percentage of total neurons in organoids that contained and did not contain the Nav1.2-L1342P mutation. We hypothesized that organoids containing the mutation would have less neuron density than those that did not include the mutation. In this experiment, we collected 120-day-old organoids, froze them, sliced them at 40 µm thickness, and performed immunocytochemistry to label for different markers, including neuronal marker NEUN, somatodendritic marker MAP2, and nuclear stain DAPI, and acquired images with a ZeissLSM 800 confocal microscope. Our initial findings are consistent with our hypothesis, indicating that the Nav1.2-L1342P mutation has a lower density of neurons.

Keywords: Cortical Organoids; Disease Modeling; Epilepsy; Sodium Channel; Seizures

Mentor(s):

Yang Yang (Pharmacy); Maria Olivero-Acosta (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7058**
*Presentation Time: April 11 in STEW 214C at 2:00pm-2:20pm*

## Benchmarking Quantum Error Correction Codes Against Realistic Error Models for Superconducting Qubits

Physical Sciences


Author(s):

Santiago Lopez† (Science, JMHC); Jonathan Andrade Plascencia*



Abstract:

Quantum computers are highly susceptible to errors due to unintended interactions with their environment. It is crucial to correct these errors without gaining information about the quantum state, which would result in its destruction through back-action. Quantum Error Correction (QEC) provides information about occurred errors without compromising the quantum state of the system. However, the implementation of QEC has proven to be challenging due to the current performance levels of qubits — break-even requires fabrication and operation quality that is beyond the state-of-the-art. Understanding how qubit performance factors into the success of a QEC code is a valuable exercise for tracking progress towards fault-tolerant quantum computing. Here we present qec_code_sim, an open-source, lightweight Python framework for studying the performance of small quantum error correcting codes under the influence of a realistic error model appropriate for superconducting transmon qubits, with the goal of enabling useful hardware studies and experiments. qec_code_sim requires minimal software dependencies and prioritizes ease of use, ease of change, and pedagogy over execution speed. As such, it is a tool well-suited to small teams studying systems on the order of one dozen qubits.



Keywords: Quantum Physics; Quantum Error Correction; Quantum Computing; Simulation


Mentor(s):

Alex Ruichao Ma (Science); Gabriel Perdue (Fermi National Accelerator Laboratory)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7059**
*Presentation Time: April 11 in STEW 214C at 2:20pm-2:40pm*

## Cold Spot Crater Characterization on the Moon Using an Unsupervised Neural Network

Physical Sciences


Author(s):

Sara Cuevas-Quiñones† (Science, JMHC)



Abstract:

Craters provide windows into a planet's geology, and their morphologies provide important information into the properties of the body that was impacted and the processes that have occurred since the crater formed. While previous lunar crater classification has been done by hand, it can be time consuming given the sheer number of craters that are on the Moon. We propose the use of unsupervised machine learning techniques for a systematic, time efficient approach to crater characterization. Unsupervised machine learning techniques deal with finding patterns in unlabeled data. One of their main purposes is to achieve a form of dimensionality reduction, i.e., condensing data into less features while still retaining the most important aspects. Using the python deep learning packages Keras and Tensorflow, we construct an autoencoder to categorize the morphology of simple cold spot craters and explore the natural clustering that results when crater images are put through the autoencoder.

We compile remote sensing data, including visible, radar, and temperature images for 100 craters. 50 are cold spot craters, which are thermophysically distinct, and the other 50 are non-cold spot craters of similar size. These are then put through the autoencoder to evaluate the viability of using an autoencoder for automated detection of morphologies that distinguish cold spot craters.



Keywords: Craters; Planets; Machine Learning; Moon; Autoencoder


Mentor(s):

Ali Bramson (Science); Lior Rubanenko (Technion Institute of Technology)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7060**

*Presentation Time: April 11 in STEW 214C at 2:40pm-3:00pm*

**How skin color modulates behavioral fever in Northern leopard frogs**

Life Sciences


Author(s):

Ethan Guardado† (Liberal Arts, Science, JMHC)



Abstract:

With increasing rates of infection and subsequent mortality among amphibians globally, further understanding of how amphibians cope with infection is critical to orchestrating conservation. In particular, Batrachochytrium dendrobatidis (Bd) is responsible for many of these disease-related mortalities. One partially investigated method of clearing infections, including Bd, is behavioral fever, where amphibians will preferentially seek warmer temperatures to help clear infection. One factor that may modulate behavioral fever is skin coloration, which may cause amphibians to differentially absorb and reflect light's radiation, heating amphibians' bodies at different rates. This may modulate time length needed for increasing body temperature, which also has negative consequences like potential exposure to predators and dehydration. We investigated whether Northern leopard frogs (Lithobates pipiens) exhibited behavioral fever when inoculated with Bd and whether their skin coloration may modulate potential behavioral fever. First, we collected Northern leopard frog eggs and raised them to metamorphs in the field and lab. Then, we constructed in-lab temperature gradients for 20 metamorphs and monitored their temperature preference in these gradients while inoculated with Bd. Finally, we measured the percentage of black skin coloration via ImageJ. We found that the percentage of black skin coloration did not predict mean temperature preference among either uninfected or infected individuals. While these results do not show a relationship between skin coloration and temperature preference, they still expand insight further into how some frogs may cope with high-mortality diseases like Bd and inform future management and investigation of the dynamic between disease and amphibians.



Keywords: Disease; Amphibian; Behavior



Mentor(s):

Cat Searle (Science); Jonathan Lopez (Science)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7061**

*Presentation Time: April 11 in STEW 214D at 2:00pm-2:20pm*

## Impact of Freedom School At Purdue For Students K-5

Social Sciences/Humanities/Education

Author(s):

Teagan Drumm† (Education); Lauren Spedale* (Education)

Abstract:

We examine whether using a culturally diverse, literacy-focused program promotes both students' literacy and social justice awareness. Data were collected from Purdue's CDF Freedom School (FS), during a six-week summer program serving 26 students in grades K-5. The FS uses an integrated reading curriculum with the theme of "I Can Make a Difference" (ICMAD). Then, each week, subthemes address ICMAD in myself, my family, my community, my country, my world, and with hope, education, and action. Each week also includes a focus on creative writing, field trips, STEM engagement, and social action activities. Students (1-10 teacher-student ratio), work on literacy activities that include community, local and global social justice topics. Data were collected at the end of the 6-week program, from parents who were given a combination of quantitative and qualitative questions designed to document children's academic and personal development. The majority of parents (>88%) reported that their child demonstrated: (a) improvements in their reading skills; (b) greater confidence in reading; (c) efficacy about their ability to effect change; (d) appreciated the integration of social justice, history, and individual

development in the curriculum. This pilot study provides strong initial support for the assertion that the implementation of a multi- faceted approach to education that blends traditional academic subjects with lessons on social justice, history, and personal empowerment is both innovative and effective. This approach is essential to the development of academic skills and cultural awareness, as well as both critical to students' success in our interconnected global community.

Keywords: Education; Freedom School; Literacy; Diversity; Social Justice

Mentor(s):

Breanya Hogue (Education); Youli Mantzicopoulos (Education)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7062**
*Presentation Time: April 11 in STEW 214D at 2:20pm-2:40pm*

## A Metanalysis over Autism Spectrum Disorder and Math Word Problem Intervention

Social Sciences/Humanities/Education


Author(s):

Nicholas Cline† (HHS)



Abstract:

From 2000 to 2020, the prevalence of autism spectrum disorder (ASD) has risen dramatically from 1 in 150 to 1 in 36 (Centers for Disease Control and Prevention, 2021). This has fueled the development of new educational interventions for ASD students, with a primary focus on impacted skills like communication and language. However, ASD students, similar to their typical development (TD), peers also struggle with math skills. Yet, unlike TD students, ASD students are stereotypically portrayed as mathematically gifted. Consequently, fewer interventions target math learning for ASD students. Interestingly, even fewer address the intersection of mathematics understanding and language comprehension, i.e., word-problem solving. Word problems call for the application of mathematical knowledge to real-world situations. Thus, math interventions for students with ASD must focus on word problem comprehension to bridge the gap between language and mathematics skills.

A quantitative meta-analysis was conducted to identify current math word-problem interventions for ASD students. Studies were included in the review if they met the following criteria: must be published within 2003 to 2023 in the English language peer-review journal; at least one participant must have been diagnosed with ASD; intervention must have been used that focus on math word problems; participants must range from elementary to high school age; and the setting must be a control environment. 13 articles met the requirements. The quantitative analysis examines two different effect size measures: Tau-U and Percentage of non-overlapping data (PND).



Keywords: Autism Spectrum Disorder; Quantitative Analysis; Mathematics; Word Problem Solving; Metanalysis



Mentor(s):

Yan Ping Xin (Education)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7063**
*Presentation Time: April 11 in STEW 214A at 3:00pm-3:20pm*

**High-throughput platform for macromolecular transport screening**

Life Sciences


Author(s):

Crystal Jiang† (Engineering, JMHC)



Abstract:

Biotherapeutic medications have become increasingly numerous and effective, but they are difficult to administer orally due to the harsh gastrointestinal environment. While intravenous and intramuscular injections are effective routes of administration, subcutaneous injections have emerged, because they can be self-administered and are associated with increased patient compliance. However, transport of medications injected subcutaneously is not well-characterized. An effective and inexpensive method to screen macromolecular transport in subcutaneous tissue models is desired. Here, a high-throughput in vitro platform for studying macromolecular transport has been developed and optimized. The platform uses a 96-well Transwell plate with a hydrogel matrix set above a permeable membrane. This hydrogel is representative of the biological barriers to diffusion. The sink is filled with biological buffer and the macromolecule source is added above the matrix. Over 48 hours, macromolecules diffuse through the matrix, with samples of the sink collected every 12 hours. Analysis of recovery over time will allow extraction of diffusion coefficients and comparison between experimental conditions. Optimization studies involved considering factors affecting uniform diffusion, verifying assumptions, and creating a controlled environment. The unique characteristics and potential uses of the various pore sizes and membrane materials are additionally described here. The final results are a platform that utilizes readily available materials and requires minimal preparation and sample processing. It is configurable with various ECM-representative matrices, while still producing highly precise and reproducible results. implementation of this platform into general drug formulation understanding, as well as targeted drug screening will increase efficiency and improve patient outcomes.



Keywords: Macromolecular Transport; Hydrogel; Tissue Model


Mentor(s):

Julie Liu (Engineering); Paulina Babiak (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7064**
*Presentation Time: April 11 in STEW 214A at 3:20pm-3:40pm*

## An in vivo assessment of cardiac remodeling during chronic hypertension in pregnancy

Life Sciences

Author(s):

Sarah Grev† (Engineering)

Abstract:

Chronic hypertension occurs in 3-5% of pregnancies and may increase the risk of superimposed preeclampsia and peripartum cardiomyopathy [1]. However, our understanding of biomechanical cardiac adaptations to chronic hypertension during pregnancy is limited. To understand cardiac remodeling during hypertension with and without pregnancy, we assessed combined pressure and volume overload in a mouse model. We assessed an experimental group with hypertension during pregnancy (n=5) and a matched control group with hypertension alone (n=7). To induce hypertension, an osmotic pump containing angiotensin II was implanted subcutaneously in each mouse [2]. Blood pressure and 2D parasternal long axis and 4D short axis ultrasound images of the left ventricle were collected at baseline, after induction of hypertension, and pregnancy days e8.5, e12.5, e15.5, e17.5, and postpartum day 1. Left ventricle strain calculations were performed with a custom MATLAB graphical user interface. Preliminary findings in the experimental group suggest that circumferential and longitudinal strain will decrease by 30.59% and increase by 37.35%, respectively, and that ejection fraction will increase by 6.615%. We anticipate that cardiac function and mechanics will decrease more in the control group, although, further analysis is needed. Overall, this improves our understanding of cardiac remodeling when challenged with both volume overload (pregnancy) and pressure overload (hypertension). The results from this study have the potential to provide insights into the management of chronic hypertension during pregnancy and improve outcomes for both mother and child.

[1] Seely, E.W., & Ecker J., Circulation, 2014

[2] Okuno, K, et al, Hypertension, 2023

Keywords: Hypertension; Pregnancy; Cardiac Remodeling; Ultrasound

Mentor(s):

Craig Goergen (Engineering); Elnaz Ghajar-Rahimi (Engineering); Adalyn Meeks (Engineering); Kyoko Yoshida (University of Minnesota); Molly Kaissar (University of Minnesota)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7065**
*Presentation Time: April 11 in STEW 214A at 3:40pm-4:00pm*

## Enhancing Solid Propellant Burning Rate Predictions through Machine Learning Modeling

Physical Sciences

Author(s):

Camille Jorenby† (Engineering, JMHC)

Abstract:

Solid propellants are crucial to the aerospace and defense industries and their success. Further research into energetic materials allows for further developments in these fields and can improve propellant burn longevity or energy, and increase the reliability of these products. Characterizing burning rate as a function of pressure is one of the key steps in design and test of solid propellant systems. Recently, machine learning has been leveraged to predict ballistic properties of solid propellants. Machine learning may be useful as a tool to predict solid propellant burning rate by using burning rate data that is available in open literature. In an active learning loop, this work focuses on improving the certainty of a machine learning model in predicting burning rate by iteratively collecting burning rate data on various propellant formulations. The machine learning model informs testing by determining which propellant formulations result in the most uncertain burning rate predictions. These propellants are prepared and tested to collect burning rate data at quasi-static pressures. The test data is collected through tests conducted in a Crawford Bomb, where burns are recorded on a high speed camera to record specific characteristics of each sample's burn. The burning data is processed through several programs and added to the burning rate database of the machine learning model to improve future predictions on similar propellant formulations, allowing for further development of propellants and adjacent systems.

Keywords: Solid Propellants; Burning Rates; Machine Learning

Mentor(s):

Steven Son (Engineering); Shane Oatman (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7066**
*Presentation Time: April 11 in STEW 214B at 3:00pm-3:20pm*

## The International Congress of Women and Transnational Advocacy Networks

Social Sciences/Humanities/Education

Author(s):

Annelise May† (Liberal Arts)

Abstract:

Was the 1915 International Congress of Women and its successors a Transnational Advocacy Network (TAN) and did it present the common boomerang pattern? Drawing on the information about why the International Congress of Women was held, what resolutions they created, and what the actors at the International Congress of Women did in the following years of the war. Through reading accounts of the International Congress of Women, the International Congress of Women's resolutions and manifestos, and other research, the International Congress of Women was a Transnational Advocacy Network because it included domestic NGOs who worked together on a common issue by sending delegates to countries, collecting data, testifying before the United States's Congress, and implementing the inverse boomerang pattern. Throughout the International Congress of Women and its aftermath, the women utilized information politics, accountability politics, symbolic politics, and leverage politics.

Keywords: International Congress of Women; Transnational Advocacy Network; International Relations; NGOs

Mentor(s):

Melissa Will (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7067**
*Presentation Time: April 11 in STEW 214B at 3:20pm-3:40pm*

## Constructing Carol: Racial Science, Eugenics, Biological Essentialism, and Carcerality

Social Sciences/Humanities/Education


Author(s):

August Trepanier† (Liberal Arts)



Abstract:

“The Use of Punishment as a Treatment Modality: a Case Report” by Jeffrey Brandsma and Leaonard Stein details the use of hospital-setting electroshock “therapy” on a woman named Carol, an “organically damaged, moderately retarded adult.” Through the example of Carol, authors Brandsma and Stein defend punishment and the generalized use of electroshock as therapeutically important. Though published in 1973, aspects of their argument bear historical salience. I argue that historical concepts of biological essentialism, carcerality, eugenics, and scientific theories about violence and criminality importantly inform the argument written by Brandsma and Stein. I trace 19th and 20th century historical and ideological movements using primary and secondary source authors such as Beth Richie, Joel Braslow, John Down, Fancis Galton, and Cesare Lombroso. Brandsma and Stein ultimately present an evolved view on persistently violent ethics and actions, and reject Carol’s personhood and autonomy. Understanding historical ideological themes, and their evolving presence is vital for recognizing and interrupting ongoing use of electro-shock, aversion therapy, restraint and seclusion, and other institutional punishment against autistic people and people with intellectual and developmental disabilities now.



Keywords: Electroshock; Eugenics; Disability; Carcerality; Essentialism



Mentor(s):

Yvonne Pitts (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7068**
*Presentation Time: April 11 in STEW 214B at 3:40pm-4:00pm*

## Examining how Mitochondrial Content Differences in Twin Plant Sperm Cells Impact Double Fertilization

Life Sciences

Author(s):

Keila Jellings† (Agriculture, Science)

Abstract:

In flowering plants, double fertilization involves a precise control of two fusion events between twin sperm cells and each of the female gametes, the egg cell and central cell giving rise to a zygote and the embryo-nourishing endosperm. However, a long-standing question in plant reproduction is whether the two sperm cells produced by flowering plants are inherently predetermined to fuse with a specific gamete.

Mitochondria play a central role in the metabolism of all cells, generating ATP as the primary energy source, and as a byproduct they produce Reactive Oxygen Species (ROS). They also contribute to maintaining Ca2+ cytoplasmic homeostasis. Both Ca2+ and ROS are crucial for cellular signaling. Our previous work revealed that mitochondrial content is different between twin sperm cells, leading to the hypothesis that such cellular differentiation may have implications in sperm cellular metabolism, signaling, as well as its fusion fate or potential to activate the egg cell.

To test this hypothesis, we used a sperm-specific mitochondrial fluorescent marker line in combination with genetic mutants that affect sperm cell morphology, function, or fate to examine mitochondria dynamics during pollen tube growth and double fertilization. These experiments will provide new insights into functional differences between twin sperm and how this contributes to their roles in double fertilization.

Keywords:

Mentor(s):

Leonor Boavida (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7069**

*Presentation Time: April 11 in STEW 214C at 3:00pm-3:20pm*

# Scaling limit of asymptotically-free self-interacting random walks to Brownian Motion perturbed at Extrema

Mathematical/Computation Sciences

Author(s):

Xiaoyu Liu† (Science, JMHC)

Abstract:

We show convergence of a family of one-dimensional self-interacting random walks to Brownian motion perturbed at extrema under the diffusive scaling. This completes the functional limit theorem in [KMP23] for the asymptotically free case when 0<p≤1/2.

The approach is to approximate the total drift experienced by the walker via analyzing directed edge local times, described by the branching-like processes. The analysis depends on the diffusion approximation of the branching-like processes obtained in the Ray-Knight type framework.

Keywords: Self-Interacting Random Walk; Branching Like Process; Functional Limit Theorem

Mentor(s):

Jonathon Peterson (Science); Thomas Mountford (Swiss Federal Institute of Technology Lausanne)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7070**
*Presentation Time: April 11 in STEW 214C at 3:20pm-3:40pm*

**A Genomic Analysis of the Global House Dust Mite Allergen Diversity**

Life Sciences

Author(s):

Sarah Bennett† (Science, JMHC)

Abstract:

Pyroglyphid house dust mites are a prevalent source of indoor allergens and are found globally, affecting about 30% of the world population. Although currently a number allergens have been discovered in  three house dust species, for which genomic data are available, the global diversity of allergen groups is unknown. Our study has sequenced genomes of 48 species of house dust mites to deduce genes encoding thirty-eight allergen groups, and analyze global allergen diversity. The DNA samples come from mite colonies collected globally in North America, South America, the Caribbean, Europe, Southeast Asia, Africa, Australia, and New Zealand. DNA was extracted using the ultra-low input DNA methodology; 55 Illumina libraries were generated to get 55 mite species at a coverage of 20x for each individual (1920 mite individuals total). To infer allergen-encoding genes, the sequence data was mapped using two genomic reference sequences with gene boundaries confirmed by transcriptomic data. Two complementary mapping analyses were done at the nucleotide and protein levels. Our annotated genomes will be deposited into GenBank. Our project will allow for better understanding of the allergy sensitization patterns and will improve allergy vaccine therapies, which will account for the actual diversity of house dust allergens.

Keywords: Dust Allergens; House Dust Mites; Genomic Sequencing

Mentor(s):

Qixin He (Science); Pavel Klimov (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7071**
*Presentation Time: April 11 in STEW 214C at 3:40pm-4:00pm*

**Quantifying the impact of cone opponency on predictions of color discrimination.**

Life Sciences


Author(s):

Lilianne Brush† (Science, JMHC)



Abstract:

[Abstract Redacted]



Keywords: Receptor Noise Limited Model; Photoreceptors; Color Vision; Computational Modeling


Mentor(s):

Esteban Fernandez-Juricic (Science); Carlay Latour Teed (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7072**

*Presentation Time: April 11 in STEW 214D at 3:00pm-3:20pm*

# Does Consuming Mushrooms with a Healthy Mediterranean-style Dietary Pattern Affect Indexes of Brain Health in Adults?

Life Sciences

Author(s):

Nok In Chan† (HHS, JMHC)

Abstract:

Objectives:

Consuming a Mediterranean-style healthy dietary pattern (MED) or mushrooms may independently improve indexes of brain health. We assessed the effects of including mushrooms with a MED diet on changes in indexes of brain health. We also assessed if the healthfulness of participants' diets (self-chosen vs MED) influenced changes in indexes of brain health.

Methods:

For this randomized controlled-feeding trial, 60 adults (60% females; aged 46 ± 12 y; BMI 28.3 ± 2.8 kg/m2, mean ± SD) without diagnosed depression consumed a MED diet with (MED-mushroom) or without (MED-control) mushrooms for 8 weeks. The MED-mushroom group consumed 84 g/d of Agaricus bisporus (white button) 4 d/week and Pleurotus ostreatus (Oyster) 3 d/week. Brain health-related outcomes included questionnaires-based assessments of anxiety, depression, mood, and general well-being, and investigator-administered assessment of cognition. The healthfulness of participants' self-chosen diets (Healthy Eating Index, HEI, range 0-100 au) was estimated using the Automated Self-Administered 24-hour (ASA24) assessment tool.

Results:

Mushroom consumption did not influence any study outcomes. Consuming a MED diet improved vigor-activity (p=0.035) and indexes of immediate memory, including list learning (p<0.001) and story memory (p=0.045) tasks. Participants' HEI increased from 57 ± 12 au at baseline to 83 au during the intervention. The change in HEI did not predict the change for any brain health-related outcome.

Conclusion:

Unrelated to the healthfulness of self-chosen diets, adopting a Mediterranean-style dietary pattern with or without mushrooms may improve vigor-activity and immediate memory among adults.

Keywords: Health Eating Index; Vigor; Cognition; Anxiety and Depression; Mood

Mentor(s):

Wayne Campbell (HHS); Dan Foti (HHS)

**Talk Presentation Abstract Number: 7073**
*Presentation Time: April 11 in STEW 214D at 3:20pm-3:40pm*

# Developmental Exposure of Human Induced Pluripotent Stem Cell-derived Cortical Cultures to Methylmercury Induces Persistent Functional Effects

Life Sciences


Author(s):

Madeleine Strom† (HHS)



Abstract:

Methylmercury (MeHg) exposure during early neurodevelopment has long been associated with neurological impairments, yet the underlying mechanisms and long-term consequences remain elusive. Particularly, the cortical region of the developing brain is most vulnerable to MeHg-induced persistent functional effects. This study investigates the hypothesis that developmental MeHg exposures cause persistent changes in spontaneous network activity in cortical glutamatergic human-induced pluripotent stem cell (hiPSC) cultures.

This study modeled early developmental exposures utilizing male and female hiPSC-derived cortical glutamatergic neuron models. Cultures were exposed to environmentally relevant MeHg concentrations of 0.1 µM and 1.0 µM during development. Once fully matured, cells were plated onto microelectrode arrays at day 110 of differentiation, and spontaneous neuronal activity was assessed.

Because MEA electrical activity patterns take time to develop, calcium spiking patterns were utilized as an early predictor for MEA activity and reflected the significant (p<0.05) increase in burst (B) and decrease network burst (NB) frequency in MEA data. Normalized multi-information analysis revealed an increase in synchrony in 0.1µM MeHg-exposed cultures, and a decrease in 1 µM cultures.

Findings indicate that early developmental exposure to MeHg in mature hiPSC-derived cortical cultures results in a persistently altered electrical and physiological behavior in fully matured cultures. Understanding these persistent electrophysiological effects holds significant implications for neurodevelopmental exposure to MeHg.



Keywords: Neurotoxicity; Neurodegeneration; Neurodevelopmental Exposure; Environmental Exposure; Metals



Mentor(s):

Aaron Bowman (HHS); Anke Tukker (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7074**
*Presentation Time: April 11 in STEW 214D at 3:40pm-4:00pm*

## Designing, Implementing, and Evaluating a Sex Trafficking & Domestic Violence Training Program for Licensed Salon Professionals in Indiana

Social Sciences/Humanities/Education

Author(s):

Juliana St. Denis† (Polytechnic, JMHC); Abhinaya Nagalla† (Polytechnic); Ashton Allen† (Polytechnic, JMHC); Jordan Cooley† (Polytechnic, JMHC); Alexandria Bedard† (HHS); Sophie Shank‡ (HHS, JMHC); Evan Coblentz‡ (Agriculture, JMHC)

Abstract:

Background/Purpose

Sex trafficking victims often have touchpoints with salons for waxing, styling, and other body modification services required by traffickers. Some states have laws requiring salon professionals to receive domestic violence-related training; however, no state requires training on identifying sex trafficking. Previous research highlights the desire for comprehensive and collaborative training from salon professionals, policymakers, and law enforcement.

Approach

This project will use mixed-methods pilot study data to develop educational training program materials with feedback from subject matter experts; implement training with a small sample of licensed salon professionals; and collect initial and longitudinal evaluation data to determine efficacy and usability in the field.

Desired Outcomes

Salon professionals should have increased confidence in their ability to identify victims and gain a deeper understanding of how violence can manifest. Additionally, professionals will learn how to safely interact with victims of violence and direct them to available community-based resources. Following program evaluation, intervention content and mode of dissemination will be refined to its most optimal level for future distribution.

Implications

Project outcomes will inform statewide dissemination of a training program and support the introduction of a state-wide policy requiring sex trafficking and domestic violence training as part of state licensure for all salon professionals in Indiana. This work is designed to increase the identification of victims of violence and connection to community resources and support.

Keywords: Sex Trafficking; Domestic Violence; Salon Professionals; Intervention; Policy

Mentor(s):

Kathryn Seigfried-Spellar (Polytechnic); Andrea DeMaria (HHS); Alexandra Hughes-Wegner (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7075**

*Presentation Time: April 11 in STEW 214A at 4:00pm-4:20pm*

## Water Quality Assessment of Air Conditioning Condensate for Onsite Use

Innovative Technology/Entrepreneurship/Design

Author(s):

Jackie De Leon† (Engineering, JMHC)

Abstract:

As water scarcity worsens globally, unconventional water sources like condensate from air conditioning (AC) units hold promise for distributed water; however, contamination risks from such atmospheric water sources have been minimally explored. The team collected data from over 80 samples across 13 air-handling units (AHU) in four locations to assess the water quality in AC condensate collections. Concentrations of opportunistic pathogens Legionella pneumophila and Mycobacterium spp., which can cause public exposure risks, were collected along with measurements of heterotrophic plate counts (HPC), pH, trace metals, and microbial community diversity. Microbial instability and potential for opportunistic pathogen growth was indicated by HPC counts from 100-104 CFU/L, positive culture pathogen detections, and qPCR. Potential for introduction of contaminants from plumbing components was indicated by low pH (average 6.4) and heavy metal detections, including Pb and Cu. Resultantly, disinfectants and corrosion controls are suggested to reduce operational risks. Overall, this work provides guidance to inform fit-for-purpose AC condensate management needs.

Disclaimer:

The views expressed in this presentation are those of the author and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Keywords: Air Conditioning; Condensate; Water Reuse; Cooling Towers; Risk Assessment

Mentor(s):

David Warsinger (Engineering); Andrew Fix (University of Maryland); Andrew Freeman (University of Illinois)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7076**
*Presentation Time: April 11 in STEW 214A at 4:20pm-4:40pm*

## Demonstrating Space Planning Possibilities using Trend and Outlier Analysis of International Space Station Data

Mathematical/Computation Sciences

Author(s):

Davi Carvalho† (Engineering); Chirag Pimpale† (Engineering)

Abstract:

The International Space Station (ISS) offers invaluable opportunities for researching the challenges of the space environment, including microgravity, meteoroid impacts, and more. Given the complexity of the ISS and its surrounding environment, understanding its system behaviors and predicting trends can be exceptionally challenging. To advance our knowledge of these aspects of the ISS and future space missions, we have developed a tool to automatically extract target information from an ISS daily log dataset and perform analysis. This dataset, spanning approximately 10 years, contains daily logs of activities on the ISS recorded by human experts. In this study, we select two types of activities from this data set; maintenance activities and technological upgrades. Our tool automatically pinpoints the dates of occurrences of these events and applies regression algorithms to create models so that we can learn from this valuable data. In the end, three goals are realized: (1) forecasting trends in specific activities, (2) identifying anomalous events in the ISS's history, and (3) tracking the implementation of technological advancements on the ISS. Our modeling approach demonstrates the potential of data-driven analysis in supporting the planning of activities on the ISS and other deep-space missions.

Keywords: International Space Station; Data Analysis; Trend Forecasting

Mentor(s):

Xiaoyu Liu (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7077**
*Presentation Time: April 11 in STEW 214A at 4:40pm-5:00pm*

**Engineered Collagen Polymeric Materials Maintain Tissue Volume and Support Regenerative Remodeling after Volumetric Muscle Loss**

Innovative Technology/Entrepreneurship/Design

Author(s):

Joshua Sexton† (Engineering, JMHC)

Abstract:

Volumetric muscle loss (VML), the traumatic or surgical loss of significant muscle volume (20% or more), poses a significant medical challenge. While current standard of care involves various combinations of autologous muscle grafting, bracing, and physical therapy, affected individuals often suffer from long-term physical deformities and compromised muscle strength, mobility, and function. Therefore, a need exists for therapies that help restore muscle volume and function. Previous tissue defect and reconstruction studies have documented that collagen polymeric biomaterials maintain their structural and physical properties, while supporting regenerative remodeling in absence of a material-mediated foreign body response or bioresorption. This study evaluates collagen polymeric materials representing various fibrillar densities for their ability to restore muscle structure using an established VML rat model. Materials were applied to full-thickness defects (30% volume) within the hindlimb flexor muscle (tibialis anterior; TA). After 2- and 8-weeks, the TA was harvested and processed for histological analysis to determine muscle geometry and tissue response. Gross and histological results showed that the collagen biomaterials assisted in restoring muscle shape and volume. Also, the biomaterials supported regenerative remodeling, marked by cellularization, vascularization, and new muscle formation, which occurred at rates dependent on the material's fibril-density. Unlike conventional implantable biomaterials, there was no evidence of immune-mediated fibrous capsule formation or biodegradation. Overall, study results demonstrate the potential of collagen polymeric materials to assist muscle volume restoration and regenerative healing after VML in a rodent model. Additional studies are underway to determine time-dependent restoration of neuromuscular function from a multi-scale perspective.

Keywords: Volumetric Muscle Loss; Polymeric Collagen; Tissue Restoration; Translational Biomedical Engineering Research; Immunohistochemistry

Mentor(s):

Sherry Harbin (Engineering); Stacey Halum (Indiana University); Lujuan Zhang (Indiana University Purdue University Indianapolis); Rachel Morrison (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7078**
*Presentation Time: April 11 in STEW 214B at 4:00pm-4:20pm*

**Nitrous Oxide and its Agents of Influence**

Physical Sciences


Author(s):

Lila McMahill† (Agriculture)



Abstract:

Nitrous oxide ($N_2O$) is a greenhouse gas that is significantly more potent than carbon dioxide ($CO_2$). $N_2O$ breaks down in atmosphere with ultraviolet light into $N_2$ (nitrogen) and O (oxygen). The oxygen reacts with $O_3$ converting it to $2O_2$. Due to this reaction, the ozone layer is being depleted by $N_2O$ which is why it is important to understand and regulate $N_2O$ emissions. Although, $N_2O$ only makes up about 6% of all synthetic greenhouse gas emissions, one pound of $N_2O$ warms the atmosphere 300 times more than $CO_2$. $N_2O$ is a substantial greenhouse gas that should be monitored and studied extensively. This research analyzes the flux of $N_2O$ in the winter of 2022-2023 and compares it with various variables to gain a deeper understanding of what factors influence the flux. The study has sought to understand how CO flux, temperature, dew point, wind speed, wind direction, precipitation, and pressure can affect the flux of $N_2O$, a significant greenhouse gas. Using quantitative methods to obtain data points and computer programming to analyze that data, we were able to test hypotheses. We hypothesize that there is a correlation between temperature, dew point, and $N_2O$ flux. We also hypothesize that there is a correlation between CO and $N_2O$ flux build up in certain wind directions. Additionally, we hypothesize that precipitation and pressure affect the flux of $N_2O$. Testing these hypotheses helps us gain a deeper understanding of what effects $N_2O$ fluxes.



Keywords: Nitrous Oxide; Greenhouse Gas Emissions; Global Warming; Atmosphere; Flux



Mentor(s):

Rich Grant (Agriculture)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7079**
*Presentation Time: April 11 in STEW 214B at 4:20pm-4:40pm*

## Systematic Development and Optimization of Helix Stabilized Stapled Peptides for Inhibitory Use Against the Viral Oncoprotein, HPV-E6

Life Sciences

Author(s):

Elizabeth Andersen† (Science); Karthik Arcot‡ (Science); Sophie Zhou‡ (Engineering)

Abstract:

Human papillomavirus (HPV) remains the most common sexually transmitted infection in the United States, with over 80 million cases. High-risk strains of HPV, most notably HPV-16 and HPV-18, are the cause of >90%  of cervical cancers and are associated with other epithelial cancers. While prophylactic vaccines are available, these will not lower the incidence of cancer in already infected individuals and must be administered in childhood to have maximal benefit. Due to a staggering 10–20-year delay between HPV infection and the onset of cancer, it is unlikely that current prophylactic methods will lower cancer rates in the near-term and most public health benefits will only be realized after many decades. For patients with active cervical cancer, current standard care practices utilize gonadal toxic chemotherapeutics and highly invasive surgical procedures that greatly diminish patients' quality of life. For these reasons, there is a need for milder cervical cancer treatments and methods to counteract oncogenic mechanisms in HPV infected individuals. One such oncogenic mechanism involves the HPV protein, E6, which binds to a host ubiquitin ligase, E6AP, and promotes the degradation of the tumor suppressor, P53. Previous research efforts have identified a specific helical domain, within the structure of E6AP, that influences the binding of E6. Due to the intrinsic disorder of this helical domain in the unbound state, it is hypothesized that a helix stabilized stapled peptide, which mimics this binding domain, can be probed for inhibitory use. Our work explores whether a stapled peptide will outcompete E6AP for binding to E6, potentially preventing the docking, ubiquitination, and subsequent degradation of the P53. If successful, these peptides may present new drug leads for treatment of HPV-related malignancies.

Keywords: HPV; Viral Oncoprotein, E6; Stapled Peptide-Based Inhibitors; Peptide Synthesis; Drug Discovery

Mentor(s):

Jo Davisson (Pharmacy); Vallabh Suresh (Pharmacy); Dino Petrov (Pharmacy)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7080**
*Presentation Time: April 11 in STEW 214C at 4:00pm-4:20pm*

**ARTEMIS: AI-driven Robotic Triage Labeling and Emergency Medical Information System**

Innovative Technology/Entrepreneurship/Design

Author(s):

Revanth Krishna Senthilkumaran† (Engineering, JMHC); Mridu Prashanth† (Science)

Abstract:

Mass casualty incidents (MCIs) pose a significant challenge to emergency medical services by overwhelming available resources and personnel. Effective victim assessment is key to minimizing casualties during such a crisis. We introduce ARTEMIS, an AI-driven Robotic Triage Labeling and Emergency Medical Information System. This system comprises a deep learning model for acuity labeling integrated with a robot that performs preliminary injury severity assessment and assigns appropriate triage labels. The ground truth standard we used to evaluate results was the ESI 5 level triage system. A dataset from Yale Medicine was used to train classification models, including a Neural Network, a Random Forest, a Gaussian Naive Bayes, and a Support Vector Machine. We have also developed a Graphical User Interface that is updated in real-time and is accessible to first responders. To validate our proposed algorithmic triage protocol, we used the Unitree Go1 quadruped equipped with sensors for vital sign acquisition. The robot identifies humans, interacts with them, gets vitals and information, and assigns an acuity label. Simulations of an MCI in software and a controlled environment outdoors were conducted. The system achieved a triage-level classification accuracy of over 85% on average and 99% for level 1, the most critical among triage labels. This showcases the model's potential for accurate triage classification in healthcare applications.

Keywords: Robotics; Emergency; Medical; Mass Casualty Incident (MCI); Human-Robot Interaction

Mentor(s):

Aniket Bera (Science); Kshitij Tiwari (Science); Hrishikesh Viswanath (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7081**
*Presentation Time: April 11 in STEW 214C at 4:20pm-4:40pm*

## Exploring Protein-bound Chlorophyll a's Vibrational Spectrum at Room Temperature Through Microsampling and Isotope Substitution

Physical Sciences

Author(s):

Sarah Alvarez† (Science); Sajal Salim* (Science)

Abstract:

Photosynthetic proteins have been optimized by evolution to provide for organisms' growth and survival; however, they are inefficient on a large scale, which is needed for biofuel production. By understanding the optical properties of chlorophyll-protein interactions we can manipulate these interactions and make light harvesting more efficient through site-directed mutagenesis. This research focuses on isolating the vibrational spectrum of chlorophyll a in a model protein environment. We focus in particular on the 1650-1700 cm-1 region, which provides us with information about chlorophyll-protein hydrogen interactions. Unfortunately it is masked by a protein peak, thus making it difficult to analyze the vibrational spectra of chlorophyll a. Current experiments use isotope substitution and microsampling to eliminate the protein vibrational signal and provide a clean window on chlorophyll vibrational properties in native proteins.

Keywords: Vibrational Spectroscopy; Mutagenesis; Chlorophyll; Photosynthesis

Mentor(s):

Mike Reppert (Science); Jacob Wat (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Talk Presentation Abstract Number: 7082**
*Presentation Time: April 11 in STEW 214C at 4:40pm-5:00pm*

## Cellular Activation is Sensitive to Abundance and Distribution of Rare Lipids

Life Sciences

Author(s):

Alex Alonzo† (Science, JMHC)

Abstract:

The plasma membrane (PM) serves as the physical barrier between cellular machinery and the local environment. Composed primarily of phospholipids, the PM is a complex reaction landscape for interactions between proteins, sugars, small molecules, and lipids, and serves to coordinate external stimuli into intracellular responses. Phosphatidylinositol phosphate (PIPs) lipids profoundly impact cellular signaling outcomes despite comprising less than 2 percent of all PM lipids. PIP identities, determined by phosphorylation states, are regulated by enzymes. Dysregulation in signaling pathways involving PIPs are recognized to have deleterious outcomes and is implicated in many disease states. Surprisingly, a fundamental understanding of the distributions and dynamics of PIPs remains limited. We hypothesize that a nanoscale mapping of unique PIP structures and behaviors, previously limited by the resolution of available tools, is required for a holistic understanding of PIP signaling. We utilize a novel, peptide-based sensor to quantify absolute densities of PI-(4,5)-P2 lipids in model and live cell membranes. These measurements are supported by an orthogonal colorimetric biochemical assay to measure phosphate content in lipid samples. Our work is poised to add to the current literature in ways that further explain the relationship between PIP signaling and cellular outcomes by means of direct visualization of unique PIP structures and their diffusion, interconversion, clustering, and more.

Keywords: PIP Lipids; PIP Signaling; Colorimetric Assay; TIRF Microscopy

Mentor(s):

Shalini Low-Nam (Science); Joy Wu (Science); Vinay Menon (Vanderbilt University)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

# THE LLLC COLLOQUIUM
## THE LITERATURE, LINGUISTICS, LANGUAGES, & CULTURE COLLOQUIUM

*LLLC Colloquium presentations are delivered in Stewart Center, Room 218 on April 11, 2024.*

10:00 LOL or MDR: The Importance of Slang When Teaching a Second Language
**8000** *Emma Niecikowski†*
Mentor(s): Jessica Sturm

10:20 “Short” Verb Movement in Gan Hakka
**8001** *Yongjia Deng†*
Mentor(s): Elena Benedicto

10:40 Healing Words: A Comparative Exploration of Physician Writers Across Cultures and Centuries
**8002** *George Francis†*
Mentor(s): Olga Lyanda-Geller

11:00 Metamorphoses I.294: Context and Implications in Roman Literature
**8003** *Sophia Cross†*
Mentor(s): Marianne Blickenstaff

11:20 Expanding Russian Vocabulary through Acquisition of Rocket Propulsion Technology Terminology
**8004** *Pavit Hooda†*
Mentor(s): Olga Lyanda-Geller

11:40 Italian Neorealism Influence in Mexican Cinema
**8005** *Nicandro Diaz Butron†*
Mentor(s): Elena Coda

12:00 Preserving Your Language: Native Speakers in Another Linguistic Environment
**8006** *Elina Gorenstein†*
Mentor(s): Olga Lyanda-Geller

12:20 Anton Chekov’s Observation of Suffering on the Island of Sakhalin
**8007** *Emily Gervais†*
Mentor(s): Olga Lyanda-Geller

12:40 Understanding Factors Contributing to the Housing Shortage at Purdue University
**8008** *Aaron Gonzalez†*
Mentor(s): Michael Johnson

1:00 Choice of Classifier Handshape in Motion Predicates in ASL
**8009** *Daniella Simon†; Isabella Davis†*
Mentor(s): Elena Benedicto; Kathleen Wagner

1:20 Eugenics and Transhumanism in 20th and 21st Century Literature
**8010** *Emmy Gottsman†*
Mentor(s): Maren Linett

1:40 Systemic Racism in the Education of Latinos
**8011** *Marilu Perez Castro†*
Mentor(s): Cara Kinnally

2:00 Analyzing Social and Cultural Determinants of Cancer Outcomes in Latinx Communities
**8012** *David Arteaga†*
Mentor(s): Cara Kinnally

2:20 Analysis of Trends and Contents of Russian and Ukrainian Economic Vocabularies of 1990s - 2010s
**8013** *Davyd Revenko†*
Mentor(s): Olga Lyanda-Geller

2:40 Migration Patterns in Renaissance Venice
**8014** *Alexandra Neikirk†*
Mentor(s): Elena Coda

3:00 Purdue Empowers Stress Management Among Students
**8015** *Marie-Alexan Gnagne†*
Mentor(s): Michael Johnson

3:20 The Language of Thought: How Language Affects Thought in Dystopian Literature
**8016** *Tessa Stahly†*
Mentor(s): Elena Coda

3:40 Expressions of "fire" in English, Russian, and Spanish
**8017** *Rowan Thornton†*
Mentor(s): Amina Gabrielov

# VIRTUAL PRESENTATIONS

*Presentations available on Spring Conference website April 9-16, 2024.*
*Posters sorted by last name of first author within each session.*

9000 *Hassan Alalawi†; Varun Vaidyanathan†; Yue Yin†; Derek Chi†*
Mentor(s): Mark Johnson; Ryan Montsma; Cole Nelson

9001 *Sydney Bansback†*
Mentor(s): Kim Kinzig; Brent Bachman

9002 *Ishaan Bhatt†; Rithvik Raja‡; Aryan Kadakia‡; Raam Diora‡*
Mentor(s): Mark Johnson

9003 *Macy Blucher†*
Mentor(s): Michael Johnson

9004 *Eric Butz†*
Mentor(s): Sidney Ducleroir

9005 *Ziwen Cai†*
Mentor(s): Smriti Bhatt

9006 *Jaehong Choi†; Rohan Joshi†; Wen-Bo Hung†; Yunlin Zhang†*
Mentor(s): Mark Johnson; Ryan Montsma; Jude Pinto; Maxwell Michalec

9007 *Ava Flynn†; Moeyad Omer†; Zion Hackett†; Grant Congdon†; Mia Wilhite†; Divya Manvikar†; Myra Khare†*
Mentor(s): Aaron Lottes; Andrew Sivaprakasam

9008 *Maelyn Fulton†*
Mentor(s): A.J. Schwichtenberg; Amy Janis; Moon West

9009 *Huimin Gai†; Qiaoqiao Wang†*
Mentor(s): Yu-Chin Chiu

9010 *Shrienidhi Gopalakrishnan†; Vinay Gupta‡*
Mentor(s): Brian Lee

9011 *Renee Hallstein†*
Mentor(s): Lynda Peter; Youn Choi

9012 *Hyun (Eric) Kang†*
Mentor(s): Tillmann Kubis; Logan Melican

9013 *Claire Kim†; William Kwon†*
Mentor(s): Mark Johnson; Matthew Swabey; Cole Nelson

9014 *Woosik Kim†; Guo Yu†; Mengting Xu†*
Mentor(s): Qi Guo

9015 *Garrett Lail†; Jonathan Huang*; Sudhanva Donakonda**
Mentor(s): Cole Nelson

9016 *Yuechan Li†*
Mentor(s): Abolfazl Hashemi; Shivam Bhat; Zijian He

9017 *Jessica Lyng†; Rongbo Hu†; Sophie Duan*; Qinjia Xu*; Rika Chang**
Mentor(s): Abolfazl Hashemi; Zijian He

9018 *Rahul Menon†; Benjamin Miller†; Andrew Liu†; Sangjin Lee†; Ansh Gangapurkar†; Hyun (Eric) Kang†*
Mentor(s): Tillmann Kubis; Logan Melican

9019 *Seungkeun Oh†; Yen-Jung Chen**
Mentor(s): Shreya Ghosh

9020 *Sammie Okodaso†; Olusegun Ogunwemimo†*
Mentor(s): Mark Johnson; Jude Pinto; Maxwell Michalec

9021 *Ben Owen†; Yunhao Lan†*
Mentor(s): Ryan Montsma

9022 *Jadden Picardal†; Jin Hyun Kim†; Saandiya KPS Mohan‡; Leo Chen‡; Adarsh Veerapaneni‡; Zilu (Johnny) Jin‡; Ata Ulas Guler‡; Alicia Zhou‡; Amy Tong‡*
Mentor(s): Dave Barbarash

9023 *Alana Powell†*
Mentor(s): Kathryn LaRoche

9024 *Sohan Pramanik†*
Mentor(s): David Warsinger; Sudharshan Anandan

9025 *MD Sadman Rafi†; Milen Mundackal Manoj†*
Mentor(s): Mark Johnson; Jude Pinto

9026 *Luca Simoni†; Hunter Mccollough†; Pranay Jaggi†*
Mentor(s): Mark Johnson; Abinands Ramshanker; Ann Zi Lau; Fan Jing Hoon

9027 *Devin Singh†*
Mentor(s): Jenna DiVincenzo

9028Ω *Nicole Stepp†*
Mentor(s): Andrea DeMaria

9029 *Riley Tague†; Elaine Huang‡*
Mentor(s): Jennifer Smith; David Ray Miranda; Jasmine Begeske

9030 *Tri Than†*
Mentor(s): Abolfazl Hashemi; Sravani Ramishetty

9031 *Paul Michael Vasquez†; Trisha Suresh†; Joshua Fan‡*
Mentor(s): Greg Michalski

9032 *Enze Wang†*
Mentor(s): Chunyi Peng; Shaan Shekhar

9033 *Advay Welling†; Sarthak Tandon**
Mentor(s): Blake Wilson; Vahagn Mkhitaryan

9034 *Epiphany White†*
Mentor(s): Thomas Beechem; Fernando Vega

9035 *Lilian Zhao†*
Mentor(s): David Whittinghill


## CELEBRATE PURDUE'S THINKERS, CREATORS, & EXPERIMENTERS

April 18, 2024 from 11:00 a.m. – 1:00 p.m. in the Purdue Memorial Union South Ballroom

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement
Ω Interdisciplinary Project; Ψ Archival Project; Δ Digital Humanities Project

**LLLC Presentation Abstract Number: 8000**
*Presentation Time: STEW 218A at 10:00am-10:20am*

## LOL or MDR: The Importance of Slang When Teaching a Second Language

Social Sciences/Humanities/Education

Author(s):

Emma Niecikowski† (Science)

Abstract:

Slang is one of the most commonly used forms of communication online across languages. However, most slang known to native speakers (L1 speakers), is unknown to those learning it as a second language (L2) due to the lack of slang teachings in traditional language courses. This project analyzed the importance of teaching slang to L2 learners, as well as what methods are best for implementing it into curriculum. As cultural awareness and fluency are imperative to learning a second language, studying slang will further these goals. Today, even government officials can be found using slang on social media, and much of slang originates from unique groups within a language's culture such as the origination of French slang "verlan" from Arab and North African French communities. Therefore, understanding slang will improve L2 cultural competencies and world-readiness beyond language assessments in classrooms. However, teaching slang with textbooks is difficult as slang becomes easily outdated; furthermore, many linguistic textbooks have implicit biases such as teaching slang that is offensive towards women's bodies. The use of online resources also has limitations due to the lack of teacher interaction. Teaching slang, while beneficial, must be done in a culturally sensitive and relevant way. One such way is to engage in the L2 culture's social media posts or read contemporary literature rather than just classics. This way, interaction in real-time will help L2 learners integrate popular slang in real-time and immerse themselves in an L2's culture beyond just knowing the most formal forms of conversation.

Keywords: Slang; Second Language; Teaching; Native Speaker; Linguistics

Mentor(s):

Jessica Sturm (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8001**
*Presentation Time: STEW 218A at 10:20am-10:40am*

### “Short” Verb Movement in Gan Hakka

Social Sciences/Humanities/Education

Author(s):

Yongjia Deng† (Liberal Arts)

Abstract:

Hakka is a modern variety of Chinese spoken in various provinces of southern China and among Chinese diaspora communities. It belongs to the Sino-Tibetan language family, specifically classified as part of the Gan–Hakka–Xiang group. Gan Hakka, a Sinitic variety in China and a main variety of Hakka, now ranks among those languages cited as being endangered by UNESCO’s Atlas of the World’s Languages in Danger (Moseley 2010). Inspired by Haegeman(2020) and Hornstein(2005), this paper makes a claim from two perspectives about the existence of “short” verb movement (SVM) of Gan Hakka sentences. First, it motivates the overt raising of two-stem intransitive V0 to the next higher head position (Asp0); crucially, this head movement does not affect the whole two-stem intransitive unit but just the V-root. Second, the article shows that this head movement does not raise the V head on the way to T0. This final point will be confirmed by the behavior of transitive verbs.

Keywords: Gan Hakka; Short Verb Movement

Mentor(s):

Elena Benedicto (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8002**
*Presentation Time: STEW 218A at 10:40-11:00*

## Healing Words: A Comparative Exploration of Physician Writers Across Cultures and Centuries

Social Sciences/Humanities/Education


Author(s):

George Francis† (Engineering)



Abstract:

Each patient comes with their own individual story, which shapes the physician’s diagnostic journey. Physicians across time and culture draw from their medical experience to craft stories that address recurring issues or personal encounters.

In 20th-century Russia, Bulgakov, Chekhov, and Veresaev emerged as prominent figures whose medical backgrounds profoundly influenced their literary endeavors. Whether it be Bulgakov's autobiographical masterpieces, such as A Young Doctor’s Notebook, Chekhov's poignant short stories and plays like Uncle Vanya, or Vikenty Veresaev's introspective novels, such as Memoirs of a Physician, they each intricately wove medical insights into their narratives, reflecting the social and political turmoil of their time.

Transitioning to 21st-century India, the landscape of physician-writers continues to evolve with figures like Abraham Verghese, Siddhartha Mukherjee, and Taslima Nasrin. Verghese's The Covenant of Water explores ethical dilemmas and cultural disparities in healthcare, while Mukherjee's The Emperor of All Maladies illuminates the history of cancer with scientific rigor and narrative finesse. Furthermore, Nasrin, informed by her experiences in healthcare settings, tackles societal taboos and women's rights in works like My Girlhood.

Despite temporal and cultural disparities, common threads emerge in the works of these physician-writers. Ethical dilemmas, existential inquiries, and the intrinsic humanity of medical practice resonate across borders and centuries. This comparative analysis aims to deepen our understanding of the enduring dialogue between medicine and literature, highlighting the differences in the focus of their works that emerge when physicians of difference cultures and time periods wield the pen.



Keywords: Physician Writers; Health Literacy; Cultural Disparities; Medical Ethics



Mentor(s):

Olga Lyanda-Geller (Liberal Arts)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8003**
*Presentation Time: STEW 218A at 11:00am-11:20am*

## Metamorphoses I.294: Context and Implications in Roman Literature

Social Sciences/Humanities/Education

Author(s):

Sophia Cross† (Liberal Arts, JMHC)

Abstract:

In Ovid's retelling of the Greek flood myth, line 1.294 of Metamorphoses contains an unusually syncopated verb which could conceivably be a reference to the Genesis account of the flood. In this paper, three previous classicists and their stances on the plausibility of this pun on Mt. Ararat being intentional are analyzed in the broader context of the Roman attitude toward Jewish religion. Considering the grammar of the Latin itself, the availability of Greek translations of Genesis at the time, and the tone of contemporary references to Judaism in Roman literature, the paper attempts to synthesize the available information on Roman perception of the mythology of the Torah. This synthesis is conducted in order to establish the unlikeliness of the pun being a mere coincidence or copying error, and to posit possible motivations behind the deliberate reference to a specific detail from Jewish mythology, keeping in mind the learned allusions typical of Ovidian poetry and the antisemitic biases present in his Alexandrian source material. Although the true intention of Ovid's allusion can never be proven absolutely, having been lost to time, several narrative decisions made by the author and the context of pervading xenophobia at that time make it plausible that the nod to Genesis had derogatory undertones, included as an implicit claim of Roman cultural superiority by Ovid.

Keywords: Ovid; Genesis; Metamorphoses; Roman Literature; Flood Myth

Mentor(s):

Marianne Blickenstaff (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8004**
*Presentation Time: STEW 218A at 11:20am-11:40am*

## Expanding Russian Vocabulary through Acquisition of Rocket Propulsion Technology Terminology

Social Sciences/Humanities/Education

Author(s):

Pavit Hooda† (Engineering, JMHC)

Abstract:

Expanding a learner's vocabulary and improving their reading skills are important objectives when studying a language. To facilitate the process, it is beneficial to bring relevant and interesting context to the language. This aids one's recall of vocabulary as the relevant context allows an individual to relate the language to their unique subject area of interest. This research presentation shares an elementary-level Russian learner’s experience in reading, translating, and learning from a Russian propulsion textbook titled, 'Zhidkostnye raketnye dvigateli' ['Liquid Rocket Engines'] by the author M. V. Dobrovolsky in the year 2005. Propulsion facts and formulas will be interpreted from this textbook with a beginner level of knowledge of the Russian language. This textbook is well known in the world of aerospace engineering to be an excellent source for the principles of rocket propulsion. Not only will this effort expand my Russian vocabulary, but it will also provide a deeper understanding of the elements of Soviet propulsion technology that made it unique. The result of this work will be in the form of a bilingual Russian-English glossary (or an annotated glossary) of terms, formulas, and principles of rocket propulsion as learned from this textbook.

Keywords: Rocket Propulsion; Russian Language; Engineer Linguistics; Space Race; Translation

Mentor(s):

Olga Lyanda-Geller (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8005**
*Presentation Time: STEW 218A at 11:40am-12:00pm*

## Italian Neorealism Influence in Mexican Cinema

Mathematical/Computation Sciences

Author(s):

Nicandro Diaz Butron† (Engineering, Liberal Arts)

Abstract:

Italian Neorealism, emerging in the mid-1940s, transformed cinema by portraying everyday life through narratives featuring ordinary people. This presentation explores the profound influence of Italian Neorealism on Mexican cinema, introducing ways Mexican directors have embraced and adapted this film movement to reflect their socio-political context. Furthermore, key elements of Neorealism, such as the use of non-professional actors, location shooting, and a focus on societal issues, have been integrated into Mexican films throughout time.

Italian Neorealist films like "Rome, Open City" (1945) and "Bicycle Thieves" (1948) have their Mexican counterparts, emphasizing the shared themes of oppression, totalitarianism, and the struggles of the working class. "Redes" (1936), an early Mexican work in a Neorealist style, portrays the exploitation of poor fishermen and the importance of an ordinary object. Other contemporary Mexican films, including Alfonso Cuarón's "Roma" (2018), represent how relevant Neorealism is in Mexican cinema. This film explores, with an unfiltered lens, political and social issues, such as the student massacres orchestrated by the ruling party. The neorealist influence extends to other films such as "Chicuarotes" (2019) and "I'm No Longer Here" (2020), demonstrating the important and current impact of Neorealism on modern Mexican themes.

The exploration of everyday elements and themes in Mexican Neorealist-style films, such as indigenous languages, political symbolism, and the portrayal of death, highlights the influences of Neorealism in capturing and showing the public the authenticity of Mexican everyday life. The presentation concludes by reflecting on the ongoing presence of Neorealism in Mexican cinema, shaping narratives that address contemporary issues and maintain a connection to the genre's roots.

Keywords: Neorealism; Films; Cinema

Mentor(s):

Elena Coda (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8006**
*Presentation Time: STEW 218A at 12:00pm-12:20pm*

## Preserving Your Language: Native Speakers in Another Linguistic Environment

Social Sciences/Humanities/Education


Author(s):

Elina Gorenstein† (Agriculture, Liberal Arts)



Abstract:

This project aims at tracking some of the most and the least persistent phonetic, semantic and morphological features in the speech of bilingual or multilingual speakers. The project is juxtaposing languages from different language families, namely, Ossetian (Eastern Iranian language) and Russian (Eastern Slavic language). We are assessing the pronunciation and intonation patterns of native speakers of Ossetian who have spent a considerable amount of time in another linguistic environment (Russian). Preliminary results show that the most affected phenomena are intonation patterns and certain “illegal”, or impossible (by Russian standards) phoneme combinations present in Ossetian, such as [td] and [nm]. The project suggests that L1 (native language) intonation becomes heavily influenced by the L2 (learned language). Our hypothesis is that illegal phoneme combinations in L2 present in L1 become more difficult to pronounce in L1, while illegal phonemes in L2 present in L1 are not affected.



Keywords: Linguistics; Russian



Mentor(s):

Olga Lyanda-Geller (Liberal Arts)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8007**
*Presentation Time: STEW 218A at 12:20pm-12:40pm*

## ANTON CHEKOV'S OBSERVATION OF SUFFERING ON THE ISLAND OF SAKHALIN

Fine Arts

Author(s):

Emily Gervais† (Liberal Arts)

Abstract:

While most famous for his fiction short stories, Chekhov utilized journalistic skills and medical science to expose a grueling lifestyle and violation of basic human rights during his 1890 visit to Sakhalin Island in a nonfiction account. In his book Sakhalin Island written and published in 1891–1893, he records the island's separation from western Russia and the suffering of the populace, which deepened the themes he developed in his earlier works and provided motifs for the short publications he would compose after his return. This project pursues an analysis of Sakhalin Island, Chekhov's journalistic strategies, his styles prior to and following his visit, and his evolution in motifs. Through this analysis, the relation between human isolation and its social effects, plus its influence on Chekhov's works, will be explored. Sakhalin Island as an environment functions as a microcosm for the interactions between groups and their perceptions of outsiders as alien or foreign. Human isolation only serves to further increase this dynamic, and this theme is expressed by multiple Chekhovian characters and settings.

Keywords: Chekhov; Island; Human Rights; Russia; Isolation

Mentor(s):

Olga Lyanda-Geller (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8008**
*Presentation Time: STEW 218A at 12:40pm-1:00pm*

## Understanding Factors Contributing to the Housing Shortage at Purdue University

Social Sciences/Humanities/Education

Author(s):

Aaron Gonzalez† (Exploratory Studies)

Abstract:

The limited housing at Purdue University has become a pressing issue that is impacting students and the local community. Despite efforts to address this problem, there remains a lack of comprehensive understanding in relation to many factors that is adding to this shortage.

This preliminary research project seeks to explore the complexities of the housing problem at Purdue and additional factors beyond those already acknowledged. Specifically, the objective of this research project is to investigate and clarify the complex factors that are adding to the housing situation at Purdue university. By attaining insight into these factors, this study seeks to provide a thorough understanding of the basic issues and potential solutions to lighten the housing crisis. This research will use a mixed-method approach, which will include questionnaire surveys. Data that will be collected by a thorough review of existing literature on housing at Purdue and explore relevant theories and frameworks.This research project adds value by employing a mixed-method approach to comprehensively explore the housing shortage at Purdue University, identifying both acknowledged and overlooked factors. Through this approach, it aims to provide valuable insights for students, the local community, and policymakers, facilitating the development of targeted solutions to alleviate the housing crisis.

Keywords: Housing, shortage, apartment, dorms, and Purdue University

Keywords: Housing; Dorm; Shortage; Apartment; Purdue University

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8009**
*Presentation Time: STEW 218A at 1:00pm-1:20pm*

## Choice of Classifier Handshape in Motion Predicates in ASL

Social Sciences/Humanities/Education

Author(s):

Daniella Simon† (Liberal Arts); Isabella Davis† (HHS, Liberal Arts)

Abstract:

In American Sign Language (ASL), the expression of motion predicates, defined here as predicates that denote the displacement of an entity in space from point A to point B (i.e., vectorization), involves the use of classifiers that represent different types of referents, namely human, animate, or inanimate referents. As established in prior literature, the argument that denotes a referent is that which undergoes the displacement (i.e., the undergoer), which is coindexed with the classifier handshape. The aim of the study is to describe and analyze the choice of classifier handshape used for these referents in motion predicates. The data were collected from 3 native signers of ASL, who were asked to sign “what happened” in a set of animated clips which depicted the movement of an undergoer. Their narration of these events were captured in video recordings which were then transcribed and coded using Kimmelman (2023) guidelines in the open-source software ELAN. Preliminary analysis of the data suggests that: 1) each signer has unrestricted access to a variety of classifier handshapes for each referent; 2) for a referent of any type (human, animate, inanimate), any classifier handshape choices available to the signers may be used; 3) the movement of the classifier handshape denotes the path, not manner, of the referent which coincides with its displacement vector; and 4) in tandem with the unrestricted access to classifier handshapes signers may choose from, signers demonstrate some degree of preference over the handshape they assign to each referent.

Keywords: Classifiers; ASL; Morphosyntax; Motion Predicate; Vectorization

Mentor(s):

Elena Benedicto (Liberal Arts); Kathleen Wagner (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8010**
*Presentation Time: STEW 218A at 1:20pm-1:40pm*

**Eugenics and Transhumanism in 20th and 21st Century Literature**

Social Sciences/Humanities/Education

Author(s):

Emmy Gottsman† (Science)

Abstract:

Eugenics and transhumanism are the major topics to be explored in Dr. Maren Linett’s book in progress, Making Us New: From Eugenics to Transhumanism in Modernist Culture. Eugenics, originating in the late 19th to early 20th centuries, has been used as a tool of prejudice and discrimination against many minority groups. Individuals who have subscribed to this thought system have used eugenics as a method to achieve the “superior race,” or a race consisting of characteristics that eugenicists believed to be desirable. Sprouting from eugenics, transhumanism looks beyond human characteristics, and discusses how humans may evolve past their current physical or mental state.

In her work, Dr. Linett aims to discover the relationships between eugenics and transhumanism as well as the many ways eugenic thought manifested in the early 20th century. I researched relevant information and quotes for Dr. Linett. My research fell into two main categories: Jean Toomer and modernist literature. For this project, I researched unpublished manuscripts by Jean Toomer, modern books about the history of eugenics, and critiques of modernist authors in order to compile information about eugenics and transhumanism. In my presentation, I will discuss the details of my work using background information about the work and the author, as well as a description of its relevance. This project focuses on thoughts around eugenics and serves to help describe the harm that eugenics has imposed on a multitude of people.

Keywords: Eugenics; Transhumanism; Jean Toomer; Modernist Literature; 20th century eugenics

Mentor(s):

Maren Linett (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8011**
*Presentation Time: STEW 218A at 1:40pm-2:00pm*

**Systemic Racism in the Education of Latinos**

Social Sciences/Humanities/Education

Author(s):

Marilu Perez Castro† (Liberal Arts)

Abstract:

The educational development of Latino children often falls behind that of their peers. Research has found that schools with 90% or more students of color spend $733 less per student every year than schools with a predominantly white student body (Spatig-Amerikaner 2012). This disparity can be attributed to the continued segregation of school districts as well as the lack of state funding among districts with many students of color. Historically, the United States has racially segregated schools across the country. For Mexican and other Latino children, school segregation was common throughout the Southwest. This presentation aims to examine systemic racism that Latin Americans experience in American education, specifically the challenges that Mexicans in the United States have faced in the past, their struggle to improve their educational resources, and how systemic racism continues to affect this community today. Exploring the challenges that this community has faced in the past will allow us to better examine the relationship between racism and education in the United States.

Keywords: Systemic Racism; Education; Racial Segregation

Mentor(s):

Cara Kinnally (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8012**
*Presentation Time: STEW 218A at 2:00pm-2:20pm*

## Analyzing Social and Cultural Determinants of Cancer Outcomes in Latinx Communities

Social Sciences/Humanities/Education

Author(s):

David Arteaga† (Science)

Abstract:

Improved cancer survival rates in the United States reflect the advancements made in biomedical research and therapeutic development. Disappointingly, these advancements are often inaccessible to minority groups resulting in disparities in cancer outcomes. Many minority groups lack access to quality education, resulting in lower levels of health literacy and understanding of cancer risk factors and prevention. Here, I aim to understand the cancer problem by analyzing the social and cultural determinants of health driving cancer disparities in Latinx communities. The largest direct barrier to receiving cancer and preventive care is lack of health insurance. 19% of Hispanic/Latinx Americans lacked healthcare insurance in 2022, whereas 7% of white people were uninsured. This combined with lower salaries and lower high school graduation rates, prevents Hispanic/Latinx people from affording preventative care and understanding healthcare systems. All these barriers intersect and delay the diagnosis of new cancer cases resulting in advanced stages of disease and poor outcomes. I also explored the religious and philosophical beliefs passed down in Hispanic/Latinx communities and how they affect cancer outcomes. One example, Fatalismo, is the belief that fate determines everything and cannot be altered by man. Fatalismo presents an obstacle when encouraging Hispanic/Latinx communities to seek preventive care, contributing the late-stage diagnosis of cancer. The social and cultural determinants of health intersect and further separate Hispanic/Latinx communities from receiving quality healthcare, which highlights the need for widespread systemic changes in how healthcare systems engage with underserved communities.

Keywords: Cancer Disparities; Social Determinants of Health; Cultural Factors Affecting Cancer

Mentor(s):

Cara Kinnally (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8013**
*Presentation Time: STEW 218A at 2:20pm-2:40pm*

## Analysis of Trends and Contents of Russian and Ukrainian Economic Vocabularies of 1990s - 2010s

Social Sciences/Humanities/Education

Author(s):

Davyd Revenko†

Abstract:

Building upon the discoveries from the earlier stages of the project, this research delves deeper into the intricate realms of economic and business dictionaries in the Russian and Ukrainian languages. This lexicographic project focuses on published economic vocabularies spanning the periods from the 1990s to the mid-2010s. These vocabularies serve as the cornerstone of our comparative analysis, enabling us to discern prevailing trends in the evolving terminologies encapsulated within. Our results demonstrate changes in the scope and applicability of terms and expressions, based on the period of publication, the primary purposes, and the targeted reading audiences of these lexicons.

Keywords: Vocabulary; Lexicon; Russian; Ukrainian; Economic and Business

Mentor(s):

Olga Lyanda-Geller (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8014**
*Presentation Time: STEW 218A at 2:40pm-3:00pm*

## Migration Patterns in Renaissance Venice

Social Sciences/Humanities/Education

Author(s):

Alexandra Neikirk† (Agriculture)

Abstract:

The Republic of Venice’s domination of maritime trade during the Renaissance has been captivating cultural scholars for centuries. Venice’s ability to control physical trade throughout the Mediterranean and Middle East is incredibly impressive, but something lesser known is its influence on the movement of people. In my presentation, I will expand on migration patterns between Venice and its Greek territories. I will explore how these separate movements of people were different in their settlement patterns while sharing some common traits. I will focus specifically how different it was for Greeks to integrate into Venetian society compared to Venetians in Greek territories. Overall, this exchange of people between Venice and Greece helped expand cultural influences and economic growth for the migrants, the Venetian Republic and the Greek islands.

Keywords: Venice; Greece; Migration; Renaissance

Mentor(s):

Elena Coda (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8015**
*Presentation Time: STEW 218A at 3:00pm-3:20pm*

## Purdue Empowers Stress Management Among Students

Social Sciences/Humanities/Education

Author(s):

Marie-Alexan Gnagne† (Science)

Abstract:

This research project aims to establish awareness among college students and staff about the impactful effects of poor mental health and how stress management can reduce stress levels in students, specifically with the intervention resources Purdue University provides their students. I investigate the effectiveness of the resources Purdue gives back to their students, such as CAPS, Peer Success Coaching, Online Therapy (TAO), and more. I gathered primary sources and knowledge around these interventions and determined the most effective approach Purdue provides their students to manage stress. This analysis required developing an understanding of the ways these resources are presented and delivered to appropriately conclude the best interventions at Purdue for stress reduction. I conducted semi-structured interviews with the directors and authoritative figures controlling these resources, and gathered insights for interpretation. After receiving the data from these interviews, I grouped the analyses and made conclusions on the effectiveness of these resources, as well as using the power of numbers within the statistics identified. With diagnosed anxiety and OCD, I struggle with stress daily and wanted to research a subject of great importance to me. Involved with the stress management resources provided by Purdue such as CAPS therapy, the Disability Resource Center, and Academic Success Coaching, I wanted to become more informed on how I could better myself as a Purdue student mentally and academically. I chose to research stress management interventions, specifically how Purdue empowers stress-reduction resources on their campuses, and determined which of these resources are the most beneficial.

Keywords: Stress; Management; Interventions; Efficacy

Mentor(s):

Michael Johnson (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8016**
*Presentation Time: STEW 218A at 3:20pm-3:40pm*

## The Language of Thought: How Language Affects Thought in Dystopian Literature

Social Sciences/Humanities/Education

Author(s):

Tessa Stahly† (Liberal Arts)

Abstract:

Dystopian literature, as a genre that deals largely in the explorations of life under totalitarian regimes, also explores the relationship between the languages of oppression and freedom. These elements are closely interconnected, and can exist in both subtle and obvious forms. George Orwell's Newspeak in 1984 is an obvious example of the intricate relationship between a highly restrictive government and the language of the regime, affecting both the actions and subconscious thought of citizens and followers. In contrast, the mechanical language of Yevgeny Zamyatin's We is a subtle suggestion of the logical and rational ideals of the state in power and sharply contrasts the emotional and erratic language of the dissenters.

In this presentation I will explore the interconnected relationship between language and thought through the differences between the language of the state and the language of dissent in 1984 and We. Both 1984 and We place these two forms of language in opposition of one another, portraying how closely connected language is to understanding the world. I will first discuss how these two novels explore the relationship between the regime and the dissenters, before exploring how language is used as an intentional tool to demonstrate the ideological differences between the control of the state and the individuality of the dissenters. To conclude, I will discuss how these works of literature reflect the common yet subtle occurrence of restricting language in totalitarian states in order to curb the desire to rebel in their people.

Keywords: Comparative Literature; George Orwell; Yevgeny Zamyatin; Dystopian Literature; Totalitarianism

Mentor(s):

Elena Coda (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**LLLC Presentation Abstract Number: 8017**
*Presentation Time: STEW 218A at 3:40pm-4:00pm*

## Expressions of "fire" in English, Russian, and Spanish

Social Sciences/Humanities/Education

Author(s):

Rowan Thornton† (Liberal Arts)

Abstract:

For this project I will compare concepts of and expressions for "fire" in 3 different Indo-European languages: Russian, Spanish, and English. The idea came from the fact that in English we use one general root, “fire” to describe a wide variety of concepts that have differentiated terms in Russian and Spanish. The project explores the range of meanings of "fire" and considers the different root of all terms. The goal of the project is to create a vocabulary list that contrasts the connotations and origins of the different terms for “fire” especially to benefit second language learners and to educate learners on the cultural influences on each language, which will also result in a small discussion on linguistic relativity and the relationship between language and thought in respect to “fire” vocabulary. I will do this by consulting native speakers and dictionaries about word connotations as well as histories about different cultural traditions relating to “fire”.

Keywords: Russian; Spanish; Vocabulary

Mentor(s):

Amina Gabrielov (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9000**
*Presentation Time: April 9-16 on the Conference website*

## QSPI Implementation for the AFTx07

Innovative Technology/Entrepreneurship/Design

Author(s):

Hassan Alalawi† (Engineering); Varun Vaidyanathan† (Engineering); Yue Yin† (Engineering); Derek Chi† (Engineering)

Abstract:

Our project refines the AFTx07 microprocessor's SPI subsystem to include QSPI capabilities, enabling faster interfacing with high-bandwidth off-chip flash memory. This development not only streamlines data transfer rates but also broadens the microprocessor's application potential in demanding environments. By harnessing SystemVerilog for a synthesizable and integrable SPI core, the upgraded interface promises to elevate the AFTx07's performance, facilitating the creation of more sophisticated and efficient applications.

Keywords: MSPI; QSPI; Flash Memory; Microcontroller; Optimized Throughput

Mentor(s):

Mark Johnson (Engineering); Ryan Montsma (Engineering); Cole Nelson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9001**
*Presentation Time: April 9-16 on the Conference website*

## Early Food Insecurity: The Impact of Adolescent Food Insecurity on Early Adulthood Anxiety-Like Behaviors

Social Sciences/Humanities/Education

Author(s):

Sydney Bansback† (HHS)

Abstract:

Food insecurity, as defined by the USDA, is when a household is unable to obtain a nutritious supply of food for each member. 17 million households in the US were food insecure at some point in 2022 of which 8.5% had children in the household. The physical long-term effects of food insecurity have been explored; however, the psychological impact is not as well understood. Previously, our lab has modeled the psychological effects of food insecurity during different developmental stages in rats. Our data suggested that food insecurity throughout childhood, adolescence, or both, led to more anxiety-like behaviors in early adulthood. This study sought to replicate the finding that male rats who experience food insecurity throughout adolescence exhibit anxiety-like behaviors in early adulthood. 14 male rats were assigned to one of two groups: 1) control rats were given ad libitum access to standard rat chow throughout the duration of the study; and 2) food insecure rats were given a random feeding schedule only during “adolescence” (PND 46-60). Then, 12 days later (PND 72), all rats were subjected to the elevated-plus maze (EPM). The difference in time spent in the closed arms between groups was not statistically significant. However, interestingly, the effect size was large and opposite of our hypothesis, suggesting that food insecure rats may spend less time in the closed arms, but with our current sample size, we failed to detect this effect. In future studies, we plan to increase our sample size to more adequately test this hypothesis.

Keywords: Food Insecurity; Adolescence; Rat Model; Anxiety-Like Behavior; Elevated Plus Maze

Mentor(s):

Kim Kinzig (HHS); Brent Bachman (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9002**
*Presentation Time: April 9-16 on the Conference website*

## Digital Mux Verification

Mathematical/Computation Sciences

Author(s):

Ishaan Bhatt† (Engineering); Rithvik Raja‡ (Engineering); Aryan Kadakia‡ (Engineering); Raam Diora‡ (Engineering, JMHC)

Abstract:

This project focused on ensuring a digital multiplexer (mux) works perfectly using a method called Universal Verification Methodology (UVM). We wanted to ensure that the mux we're working on is reliable and does what it's intended to do. To obtain background information about the project, the team began by reading the UVM tutorial posted on the SoCET GitHub and watching object-oriented programming and basics of UVM videos through Verification Academy. This project aims to design and implement a digital multiplexer testbench through meticulous verification, debugging, and testing. The initial step was learning about Universal Verification Methodology (UVM). After grasping UVM basics, the team members developed a test plan to test the digital mux code. The test plan for the digital mux was created through an analysis of Digital Mux schematics and analyzing the variables associated with each test case to see how the test case can be appropriately executed and verified. we also analyzed the weight distribution between each test case to determine how important each test case is. Following this, a test bench diagram was designed based on UVM criteria, ensuring a thorough and systematic approach to verification. Incorporating the UVM Environment and the UVM Test components within this test bench was a process that we had to learn, design, and implement. This project contributes significantly to SoCET by enhancing its test case design and implementation framework, ensuring the digital mux performs its intended functions highly. Verification plays a pivotal role in confirming that all requirements and specifications are met, thus upholding the SoCET department's commitment to excellence and surpassing expected standards. After planning, we designed a test bench following UVM rules. This was key to ensuring our testing was organized and covered everything needed. Our work helps SoCET improve at designing tests and ensuring everything in the digital mux is up to standard. Testing is a big deal in our project because it's how we know our mux meets all the requirements we set for it. We're following our test plan closely, testing every part of the mux, and expecting it to perform well in hopes of reaching a high testing coverage. As we conclude the project, the final results will vary through comprehensive testing based on our test plan's eight sections. The digital mux will demonstrate exceptional performance, meeting all predefined specifications and requirements. In

Keywords: Testplan; Test Bench; DUT; UVM; Agents

Mentor(s):

Mark Johnson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9003**
*Presentation Time: April 9-16 on the Conference website*

## Understanding How College Students View and Use Mental Health Resource

Social Sciences/Humanities/Education


Author(s):

Macy Blucher† (HHS)



Abstract:

Colleges all over the world have been trying to help their students when it comes to mental health for years. But how much are students using those resources provided and what do they think of them? This project is intended to be a preliminary investigation and research into the answer to this question, specifically in the context of Purdue University. Research for this project was done through a survey of Purdue students of all ages and majors and a specific interview with a student who has utilized the Purdue counseling program (CAPs). The outcomes of this research were expected to show that most students don't use or seek to use the resources provided by a college. The significance of this research comes from the fact that it can help Purdue improve their mental health resources. As well it can also give Purdue administration a view and usage of the resources provided and in turn help them to know how much resources they should give the resources they do or don't have. This can help other colleges comparable to Purdue with these the best. These results can also help colleges similar to Purdue with resources.



Keywords: Mental Health; Preliminary Investigation; Preliminary Research; Mental Health Resources; Purdue



Mentor(s):

Michael Johnson (Liberal Arts)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9004**
*Presentation Time: April 9-16 on the Conference website*

## Importance of Catching Z's

Social Sciences/Humanities/Education

Author(s):

Eric Butz† (Exploratory Studies)

Abstract:

In the demanding landscape of higher education, the importance of sleep cannot be overstated. Sleep research has shown that it is vital for cognitive functions, memory, and learning retention, all of which are needed for academic success among college students. Outside of academics, Sleep is important in other things like regulating your mood, reducing your unwanted stress, and enhancing your overall mental health, which are all prominent factors in the college demographic facing academic pressure and transitional challenges college students. However, college students usually face many limiting factors to getting this optimal sleep, including things like irregular schedules, a large academic workload, technology use light nights and social life. Recognizing the importance of sleep hygiene and implementing a regular sleeping schedule to make sure that someone gets their needed amount of sleep is sufficient to keep up in the world of sleep and it befits them with things like academic success and overall physical and mental health in the long run compared to someone that is not sleeping nearly as much. This abstract understands the need for awareness and intervention on the sleep-related challenges that all college students suffer from at some point in their college careers, and how to avoid these obstacles for young students.

Keywords: Sleep; Importance; Academic; Student; College

Mentor(s):

Sidney Ducleroir (Liberal Arts)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9005**
*Presentation Time: April 9-16 on the Conference website*

**Deep Learning Based access control model's application in IoT**

Mathematical/Computation Sciences


Author(s):

Ziwen Cai† (Polytechnic)



Abstract:

The proliferation of Internet of Things (IoT) devices has brought unprecedented challenges in providing and maintaining secure and efficient access control. Previously, several access control models have been developed for IoT based on traditional access control models, such as attribute-based access control (ABAC), role-based access control. These traditional access control models rely on the system administrator's expertise to design access control policies and rules; furthermore, these models do not have the ability to self-adapt the rules based on the ongoing system environment and users' and devices' behavior. Recently, a deep learning-based access control (DLBAC) model has been developed which uses neural network to make access control decisions. The goal of DLBAC is to automate the access control approach with no or minimal involvement of administrator. In this paper, we investigate the application of a DLBAC model in IoT. Currently, DLBAC is designed for general access control needs, however, there is a need to enhance DLABC for addressing access control requirements of a rapidly evolving and dynamic IoT domain. Therefore, our research focuses on practical applications of DLBAC within IoT environments, particularly focusing on customization and real-world deployment by tuning the model's meta-attributes to accommodate the dynamic nature of IoT devices and deploying it in a smart home use case scenario to demonstrate its applicability and feasibility. DLBAC model's application is smart home scenario demonstrates promising potential for its widespread adoption in securing IoT systems in general.



Keywords: Access Control; IoT Security; Deep Learning; Machine Learning; Cyber Security



Mentor(s):

Smriti Bhatt (Polytechnic)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9006**
*Presentation Time: April 9-16 on the Conference website*

## JTAG for AFTx08 Digital Design

Innovative Technology/Entrepreneurship/Design

Author(s):

Jaehong Choi† (Engineering); Rohan Joshi† (Engineering); Wen-Bo Hung† (Engineering); Yunlin Zhang† (Engineering)

Abstract:

As technology develops, the number of transistors on chips approximately doubles every two years based on Moore's law, so IC complexity needs good ability for debugging. Additionally, advanced packaging techniques like ball grid arrays are more common which is difficult to fully test via physical wiring. These two factors increase the difficulty of testing the connection between each module on the board. Traditional in-circuit test methods like the bed of nails test, which involves connecting multiple pins onto physical contact points on the chip, are not able to test modern chips anymore because connecting wires to hundreds of physical test points are not feasible. JTAG was created to solve this testing problem. Joint Test Action Group (JTAG) is an IEEE standard (1149.1) that test interconnects on printed circuit boards at the integrated circuit level without the need of physical access.  Nowadays, its application has been expanded to in-system programming and software debugging.

We designed a JTAG module with additional support for programming and debugging the AFTx08 integrated circuit designed by the SoCET team. It supported all mandatory instructions defined in the standard and added custom instructions for programming and debugging through the system AHB bus. Additionally, since the JTAG module and the system bus were in different clock domains, clock domain crossing was implemented to synchronize the signals/data. In addition, to send the signals from the host to our chip, we developed a software adapter that handled the encoding/decoding for sending/receiving JTAG signals.

Keywords: SoC; Debug; Digital Design; Design Verification; Boundary Scan

Mentor(s):

Mark Johnson (Engineering); Ryan Montsma (Engineering); Jude Pinto (Engineering); Maxwell Michalec (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9007**

*Presentation Time: April 9-16 on the Conference website*

## Ulcer Prevention Sensor Pad

Innovative Technology/Entrepreneurship/Design

Author(s):

Ava Flynn† (Engineering, JMHC); Moeyad Omer† (Engineering); Zion Hackett† (Engineering); Grant Congdon† (Engineering, JMHC); Mia Wilhite† (Agriculture, JMHC); Divya Manvikar† (Engineering); Myra Khare† (Engineering)

Abstract:

Patient immobility in hospital settings is a significant contributor to pressure ulcers, affecting up to three million patients annually in the United States alone.  Moisture, frictional forces, cardiovascular disease, and malnutrition promote the development of these ulcers. However, frequent movement within patient bounds can prevent initial ulcer formation. To combat this problem, a device was developed to track body position over time through a sensor pad with the goal of limiting prolonged periods in one position. This pad combines force, pressure, temperature, and humidity sensors in an alternating diamond formation to concentrate sensors around typically affected areas. Temperature and humidity sensors were included in addition to force and pressure sensors to enable analysis of key bodily environments, thereby reducing the frequency of excessive humidity around certain areas known to be conducive to ulcer formation. By monitoring pressure, temperature, and humidity measurements of bed-bound patients, this device can predict when and where patients are at risk for ulcer formation, and notify healthcare workers to shift patient position, thereby preventing ulcer development. The current prototype has been successfully designed and is in the process of being tested and validated before upscaling and planning for potential clinical trials. In the future, this device will be resized to fit standard hospital bed dimensions to allow for widespread use. Furthermore, assessment of functionality in monitoring full body positions will be conducted through repeated trials. Overall, this study aims to assist healthcare workers in preventing pressure ulcer formation.

Keywords: Sensor Array; Bed Pad; Pressure, Temperature, Humidity

Mentor(s):

Aaron Lottes (Engineering); Andrew Sivaprakasam (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9008**
*Presentation Time: April 9-16 on the Conference website*

## Angelman and Fragile X Syndromes – Early Sleep Patterns

Social Sciences/Humanities/Education

Author(s):

Maelyn Fulton† (HHS)

Abstract:

Background: Angelman Syndrome (AS) and Fragile X Syndrome (FXS) are rare genetic neurodevelopmental disorders in which sleep problems are common. Up to 80% of children with AS or FXS have parent-reported sleep problems (Budimirovic et al., 2022; Goldman et al., 2011).

Objective: To expand our understanding of early sleep patterns in AS and FXS, the present study used a descriptive approach with parent report (PR) dairy, actigraphy, and Emfit (mattress sensor) sleep estimates.

Methods: A small cohort of AS (n = 5) and FXS (n = 4) infants/toddlers, M(SD) = 13.7 months (7.2), completed a two-week in-home sleep assessment with the three sleep measures simultaneously. Sleep estimates included 24-hr sleep duration, bedtime, waketime, and the night-to-night variability in each of these estimates.

Results: Compared to the FXS group, the AS had greater variability (via PR) and shorter sleep duration (via PR and actigraphy). Despite this, all participants slept within American Academy of Sleep Medicine recommendations for their age (Paruthi et al., 2016).

Conclusions: Differences between the AS and FSX groups for sleep duration likely reflect base group differences in age (the AS group was older) but the higher rates of parent-report variability in the AS group may reflect a distinct difference.  Future studies should build on this work by assessing additional sleep parameters (e.g., active vs. quiet sleep).

Keywords: Angelman Syndrome; Fragile X Syndrome; Sleep Patterns; Infants and Toddlers; Actigraphy

Mentor(s):

A.J. Schwichtenberg (HHS); Amy Janis (HHS); Moon West (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9009**
*Presentation Time: April 9-16 on the Conference website*

**Testing the punishment influence on human proactive and reactive meta-control.**

Social Sciences/Humanities/Education

Author(s):

Huimin Gai† (HHS); Qiaoqiao Wang† (Education)

Abstract:

Metacontrol, the individual's regulation and control of cognitive control strategies, is key to understanding human cognitive functioning. This research proposal aims to provide insight into the use of behavioral strategies in decision-making processes, attention allocation, and behavioral adjustment by demonstrating how punishments influence the reactive and proactive meta-control strategies adopted by individuals when faced with a cognitive challenge. We hypothesize that punishments will significantly influence individuals' strategy selection and switching costs when faced with complex cognitive tasks. This proposal will implement a series of experiments designed to explore the specific effects of punishments on participant reaction time, accuracy, and overall task performance using the task-switching paradigm. The experiments will use images categorized by animacy and size, supplemented by color cues (blue frame for animacy and red frame for size comparison), and provide immediate feedback on the correctness of participants' responses. In the control condition or “baseline” condition(B), no punishment will be applied to participants' responses. Feedback will be adjusted according to the participant's performance in the punishment conditions(i.e., participants in the punishment condition receive an add-on trial each time they receive “incorrect” or “too slow” feedback). Participants are randomly assigned to either BP(basis then punishment) or PB(punishment then basis). The plan is to recruit a total of 160 students to participate. After this study, our future implication is to study how rewards can influence people’s switching costs.

Keywords: Meta-Control; Task-Switching; Punishments; Cognitive Control; Switching Costs

Mentor(s):

Yu-Chin Chiu (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9010**
*Presentation Time: April 9-16 on the Conference website*

## SCALE: RH Machine-learning based optimization of materials for microelectronics

Mathematical/Computation Sciences

Author(s):

Shrienidhi Gopalakrishnan† (Engineering); Vinay Gupta‡ (Science)

Abstract:

The purpose of this research is to explore the topic of radiation damage and its effect on material degradation. The effects of radiation damage can be seen in many places, from nuclear systems to space. Current simulation techniques are both expensive and difficult to use. This project aims to utilize machine learning to improve radiation damage simulation. To address these issues, we will first download Geant4 (software toolkit for the simulation of the passage of particles through different materials) through nanoHUB, which is a platform that serves as a collaborative environment where researchers can access a variety of computational and simulation tools. Then, we create a machine learning model that will use data from Geant4 to predict the result of radiation damage. I am working with Geant4 in a Windows environment and am analyzing the data after it has been extracted from the Geant4 model. Our results show that we can successfully install Geant4 on nanoHUB. We also notice that after data extraction is complete, we can effectively analyze this data to develop our machine learning model.  We expect to train the model and similarly release it publicly to the scientific community, allowing quick and accurate data with respect to radiation damage. Based on this work, we will contribute to the research society by giving access to a tool that provides a quick and accurate radiation damage simulation.

Keywords: Machine Learning; Radiation Damage

Mentor(s):

Brian Lee (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9011**
*Presentation Time: April 9-16 on the Conference website*

**PFAS Fate and Transport in a Field Study with land applied biosolids**

Life Sciences

Author(s):

Renee Hallstein† (Agriculture)

Abstract:

During the summer of 2023 and the 23-24 school year I worked as a research assistant in Lee Lab on Purdue campus. This environmental fate lab conducts research into PFAS and UOC contamination of groundwater, soil, and biosolids for environmental impact and human health. This study examined soils from a farm in Virginia that uses biosolid application for nutrient release. Soils with applied biosolids can have PFAS transport. This study aims to understand PFAS fate and movement in soil, groundwater, and surface runoff.

Keywords: PFAS; Soil; Groundwater; Extraction; SPE/EZPFC Manifold

Mentor(s):

Lynda Peter (Agriculture); Youn Choi (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9012**

*Presentation Time: April 9-16 on the Conference website*

## Machine Learning Support for Semiconductor Nanodevice Design Research

Mathematical/Computation Sciences

Author(s):

Hyun (Eric) Kang† (Science)

Abstract:

In recent years, the semiconductor industry has encountered significant challenges in enhancing the efficiency and accuracy of simulations for nanodevice design and optimization. This research addresses these challenges using NEMO5, a nanoelectronics simulation tool developed at Purdue to generate and optimize device-specific basis representations for semiconductor band structure calculations. By tailoring basis sets to the unique characteristics of each device, our approach improves simulation efficiency and accuracy. To validate and refine these optimized basis representations, we conduct simulations on Purdue's Negishi computing cluster. This approach not only supports ongoing semiconductor research but also caters to the practical needs of industry applications, providing a robust framework for the development of next-generation semiconductor devices.

Furthermore, this study spearheads the development of a substantial database designed to facilitate the training of machine learning models. These models are tasked with the automated generation of basis sets, thereby bypassing the need to calculate a band structure every time. By integrating machine learning techniques with quantum mechanical calculations, we aim to significantly reduce the computational cost associated with semiconductor device simulation. This research not only presents a novel methodology for the optimization of nanoscale simulations but also contributes to the broader field of computational materials science by enhancing the precision and efficiency of nanodevice design processes.

Keywords: Semiconductor; Machine Learning; Optimization; NEMO5; Nanodevice

Mentor(s):

Tillmann Kubis (Engineering); Logan Melican (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9013**
*Presentation Time: April 9-16 on the Conference website*

# Modification of Boot Loader for AFTx07 Chip

Innovative Technology/Entrepreneurship/Design


Author(s):

Claire Kim† (Engineering); William Kwon† (Science)



Abstract:

The AFTx07 chip is a general purpose microcontroller developed by Purdue SoCET. The purpose of this project is to improve the boot loader for the future AFT iterations. In general, the boot process consists of three main components: on-chip code, host-side interaction, and communication protocol. The on-chip code executes hardware initialization; the host-side interaction involves loading firmware updates, configuring device settings, or troubleshooting connectivity issues; and the communication protocol defines how data is exchanged between the device and host-side. Users interact with the boot process indirectly through the host-side or by using custom software to manage device configuration or trouble shooting. There are four core improvements to be implemented once the current limitations of the bootloader were understood: integrate ELF-file-loading capabilities, support for new AFTx07 features such as QSPI flash, add debugging support, and improve the host-side UX for developers. Particularly, allowing the host-side to understand ELF-files promotes UX for developers since they are a common file format, increasing efficiency by supporting faster program-uploading and retaining debugging information. This called for necessary software modifications like integrating open-source packages and software, which will boost productivity and provide robust baselines. Testing was done by running the revised boot loader on a full-chip simulator, and end-to-end functionality was verified using an FPGA-emulated version of the chip.



Keywords: Boot Loader; AFTx07; FPGA; Chip



Mentor(s):

Mark Johnson (Engineering); Matthew Swabey (Engineering); Cole Nelson (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9014**
*Presentation Time: April 9-16 on the Conference website*

## FoldTac: Compact Visual Tactile Sensing via Folded Light Transport

Innovative Technology/Entrepreneurship/Design

Author(s):

Woosik Kim† (Engineering); Guo Yu† (Engineering); Mengting Xu† (Engineering)

Abstract:

One major challenge faced by robots is their limited tactile perception, which hampers their ability to handle fragile objects and detect slipping movements effectively. This research endeavors to address this challenge by developing a vision-based haptic sensor capable of providing robots with crucial information about the objects they manipulate. We constructed a prototype sensor using elastomer material and conducted data collection by illuminating the elastomer with laser light while applying pressure at various points. A Multilayer Perceptron (MLP) model has been developed to predict the pressing locations on the elastomer based on images of the light patterns at the endpoint of the elastomer. The model has been trained and tested to achieve a decent accuracy. The research tackles the challenge of tactile sensing in robotics by designing a vision-based haptic sensor. Future enhancements may involve extending the model's capabilities to predict force information associated with applied pressure, further advancing the sensor's utility in robotic applications.

Keywords: Vision-Based Haptic Sensor; Multilayer Perceptron

Mentor(s):

Qi Guo (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9015**

*Presentation Time: April 9-16 on the Conference website*

## Performance Modeling for AFTx07 System-on-Chip

Mathematical/Computation Sciences

Author(s):

Garrett Lail† (Engineering); Jonathan Huang* (Engineering); Sudhanva Donakonda* (Engineering)

Abstract:

Implementing a system-on-chip is a time-consuming and highly specialized task. Alterations to an architecture are costly, and can be performed only with extensive knowledge about the system. A simpler method to evaluate architectural options is a lower fidelity, but rapidly alterable software model. This model must closely approximate the performance of the real system while significantly lowering the complexity of modifying and analyzing it. The primary aim of the SoCET Performance Modeling project is to take the AFTx07 system-on-chip and provide the means to explore and guide future architectural enhancements through reliable software simulation. This project utilizes the gem5 simulator for the development of an AFTx07 system simulation. Evaluating the accuracy of the model involves correlating simulation results against real hardware results using established system benchmarks such as the Embench test suite. Additionally, another aim of the project is to characterize Embench using gem5, which will provide insights into current AFTx07 performance. Future objectives include modifying both model and hardware parameters, then correlating the performance change for the software-simulated and hardware-simulated versions to determine whether the model remains indicative of hardware performance even as the system changes. Once validated, the model can be used to rapidly explore architecture choices without needing to implement them in hardware.

Keywords: System-On-Chip; Gem5; Simulation; Computer Architecture

Mentor(s):

Cole Nelson (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9016**
*Presentation Time: April 9-16 on the Conference website*

## RoboMaster Hero Robot Shooting System Tuning

Innovative Technology/Entrepreneurship/Design

Author(s):

Yuechan Li† (Polytechnic)

Abstract:

A hero robot is an offensive robot in RoboMaster competitions which features a 42mm projectile launcher at a maximum speed of 16 m/s. Through a combination of mechanical design and software calibration, we optimize shooting accuracy, speed, and reliability, and propose a method of precision tuning to enhance robotic capabilities.

Keywords: RoboMaster; Projectile; Control

Mentor(s):

Abolfazl Hashemi (Engineering); Shivam Bhat (Science); Zijian He (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9017**

*Presentation Time: April 9-16 on the Conference website*

**DC-DC Converter Design and Development for Auto-Aim Testing**

Innovative Technology/Entrepreneurship/Design


Author(s):

Jessica Lyng† (Engineering); Rongbo Hu† (Engineering, Liberal Arts); Sophie Duan* (Engineering); Qinjia Xu* (Engineering); Rika Chang* (Engineering)



Abstract:

The purpose of this design project was to develop a DC-DC converter based on the SY8501 to power LEDs for use in the Purdue Robomasters robots. The PCBs that were completed were used for testing by other sub-teams in the club to ensure that the auto-aiming system of the robot correctly aims at the opposing team's color. The converter changes the DC voltage of the input without the use of an inverter, and instead uses two MOSFETs, which are in the SY8501, to work as switches controlled by a signal wave. The wave changes the open time of said switches to convert the voltage. This project was started in mid-October 2023 and finished in early February 2024, with the calculations and schematic design for the PCB being done over the course of approximately two months. Calculations included finding out what resistor values would work best to provide the intended voltage output from an input of 24 V, and the schematic design was not to determine how small the PCB could be made without compromising the integrity of the design. Initial soldering to test the design was done personally, but for subsequent PCBs, the task was handed off to more junior members of the team to provide a learning experience on what the team does. Once the first PCB was soldered, the result turned out to be what was intended—a DC-DC converter which divided the input voltage (24 V) into two for the red and blue LEDs (2.5 V each).



Keywords: DC-DC Converter; Auto-Aim; MOSFET; SY8501; Robomasters



Mentor(s):

Abolfazl Hashemi (Engineering); Zijian He (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9018**
*Presentation Time: April 9-16 on the Conference website*

## Machine Learning Support for Semiconductor Nanodevice Design Project

Innovative Technology/Entrepreneurship/Design

Author(s):

Rahul Menon† (Science); Benjamin Miller† (Engineering); Andrew Liu† (Science); Sangjin Lee† (Science); Ansh Gangapurkar† (Science); Hyun (Eric) Kang† (Science)

Abstract:

The electron band structure plays an important role in the semiconductor creation in the way that it sets definitions for the varied behavior of a semiconductor. This project thus explores the correlation of manipulating different semiconductor properties for the development of more efficient technologies. In the past, this process involved the crafting of multiple test semiconductors with varying properties. However, this method was prone to significant drawbacks in the likes of cost and hardware. To combat this, our study proposes the use of computer simulations instead, which incorporates both machine learning and matrix manipulation to efficiently predict changes in semiconductor properties, leading to quicker innovation. With more efficient semiconductors, we can achieve a more powerful device that draws less power to do so.

This research reaches conclusions by using various matrix properties from data that is given to the algorithm, such as material, charge density, and transmission. Using Schrödinger's equation, eigenvectors that correspond to an electron's wave function's propagation throughout a device is found. However, calculating Schoedinger's equation for large amounts data required too much time, albeit having full accuracy. However, from observation, not all of these points were relevant to the transport properties, and thus, a change of basis using mode-space showed a different representation using the eigenvectors. This allows for smaller matrices, which gives comparable high-quality results in significantly reduced time frames. This enhancement not only speeds up the research process but also paves the way for the quicker innovation of semiconductor technologies.

Keywords: Electron Band Structure; Semiconductor; Machine Learning; Mode Space

Mentor(s):

Tillmann Kubis (Engineering); Logan Melican (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9019**
*Presentation Time: April 9-16 on the Conference website*

**AI drone**

Innovative Technology/Entrepreneurship/Design

Author(s):

Seungkeun Oh† (Engineering); Yen-Jung Chen* (Engineering)

Abstract:

As Artificial Intelligence (AI) models continue to develop, there’s growing interest in autonomous driving and maneuver fields. Especially in the field of autonomous navigation, the application of Artificial Intelligence (AI) in drone technology has become important, particularly for enhancing efficiency and reliability in rescue operations within inaccessible environments. This research focuses on utilizing Deep Q-Networks (DQN) for reinforced learning in drone navigation, aimed at identifying and aiding individuals in hard-to-reach areas.

This research has three goals: to navigate, identify (Object Detection), and perform escape operations in various harsh environments autonomously. By using reinforcement learning, we have developed a reward-based algorithm to optimize the drone's navigation performance across varied environmental conditions. The algorithm's design is focused on enhancing the drone's object detection performance and its ability to assist endangered individuals while safely escaping from hazardous environments. Through the integration of DQN in the AirSim environment, our model achieves meaningful improvement in the drone's decision-making process, enabling a nuanced understanding and interaction with the environment that surpasses traditional navigation methods.

Not only does this research contribute to the existing AI drone researches but also achieves efficiency in research by training our model in a virtual environment using the reward-based algorithm mentioned above. This research believes that this research could be used for life-saving applications.

Keywords: AI; DQN; Reinforced Learning; Drone; Navigation

Mentor(s):

Shreya Ghosh (Engineering)

**Virtual Presentation Abstract Number: 9020**
*Presentation Time: April 9-16 on the Conference website*

## GPIO Verification

Innovative Technology/Entrepreneurship/Design


Author(s):

Sammie Okodaso† (Engineering); Olusegun Ogunwemimo† (Engineering)



Abstract:

This project aims at using formal verification test benching to ensure the correct functionality of a GPIO design as a part of the APB subsystem of a microcontroller. To achieve this, I would be creating a test plan, a test bench flow diagram, and test benches. The test bench should test all possible situations including edge and corner cases. These would be outlined in the test plan. The test bench serves as a map to show the process of testing and creating the environment. To create the test bench, I would be using the Universal Verification Methodology framework. Success of the project depends on the test coverage of the test benches.



Keywords: UVM; Environment; Testbenches



Mentor(s):

Mark Johnson (Engineering); Jude Pinto (Engineering); Maxwell Michalec (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9021**
*Presentation Time: April 9-16 on the Conference website*

# RISC-V 16-bit FPU

Mathematical/Computation Sciences

Author(s):

Ben Owen† (Engineering, JMHC); Yunhao Lan† (Engineering)

Abstract:

Our group focused on designing, testing, and implementing a half-precision floating-point unit (FPU) on AFTx07, the new RISC-V-based microcontroller currently developed by the System-On-Chip Extension Technologies team. An FPU is commonly used as a way to perform decimal number computations at a hardware level, resulting in much faster processing of these mathematical computations compared to software emulation. Although the most common implementation of an FPU is a single-precision (32-bit) unit, our team started with a more simple half-precision (16-bit) implementation.

Due to SoCET's requirements, we are beginning by only implementing floating-point addition, subtraction, and multiplication, saving both space on the microprocessor and development time. We used SystemVerilog to describe the hardware necessary for the protocol, utilizing the digital libraries in FuseSoC to implement simple lower-level modules and ensure smoother integration with the rest of the AFTx07 design. Our design implements the IEEE floating-point specification, ensuring predictable behavior compared to other microcontrollers. Verification of the hardware was performed using SystemVerilog test benches to ensure that the design worked in various real-world scenarios, such as overflow/underflow conditions, infinitesimal values, and other complex number representations.

Keywords: FPU; RISC-V; Verilog

Mentor(s):

Ryan Montsma (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9022**
*Presentation Time: April 9-16 on the Conference website*

## How would AI Non-Playable Characters react to changes in visual stimuli when navigating complex terrain?

Innovative Technology/Entrepreneurship/Design

Author(s):

Jadden Picardal† (Engineering, JMHC); Jin Hyun Kim† (Engineering); Saandiya KPS Mohan‡ (Engineering); Leo Chen‡ (Engineering); Adarsh Veerapaneni‡ (Engineering); Zilu (Johnny) Jin‡ (Science); Ata Ulas Guler‡ (Engineering); Alicia Zhou‡ (Science); Amy Tong‡ (Engineering)

Abstract:

Current artificial intelligence driven-game environments fall short in capturing the complex learning mechanisms of AI Non-Playable Characters within highly variable environments. This project aims to bridge this gap by exploring the nuanced process of artificial intelligence driven tools that can simulate human senses, specifically vision, in realistic digital models. This will be done through an examination of AI Non-Playable Characters (NPCs) in Unreal Engine (UE) and their navigation strategies in response to real-time changes in visual stimuli. Variable factors such as distance estimation, occlusion handling, and the environmental context's influence on decision-making during navigation tasks will be explored, emphasizing the ability of NPCs to learn and adapt in complex settings.

To help achieve this understanding, UE's Environmental Query System (EQS) will be utilized. The EQS provides tools for developing complex simulations such as a Pathfinding Test, AI Perception Component, and an AI Navigation system, which respectively determine the best available path for an NPC, work as a form of spatial and contextual memory, and demonstrate practical entity collision prevention methods.

The integration of these components will aid in simulating varied NPC personas and physical preferences that mimic real-world interactions and perceptions by examining how variation will influence the simulation outcomes, aiming to contribute to a more comprehensive understanding of AI responses to visual stimuli changes and advancing the development of more realistic and adaptive simulations in Unreal Engine, opening up potential opportunities for improved design feedback to create realistic architectural simulations demonstrating use of designed spaces.

Keywords: Environmental Query System; Sensory Stimuli; AI Non Player Character; Unreal Engine; Game Development

Mentor(s):

Dave Barbarash (Agriculture)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9023**
*Presentation Time: April 9-16 on the Conference website*

## “There is nothing they could do for me”: Patient experiences with miscarriage in the Midwest before and after Dobbs

Social Sciences/Humanities/Education


Author(s):

Alana Powell† (HHS)



Abstract:

Background: Miscarriage is an extremely common reproductive health experience; approximately 20% of pregnancies in the United States end in miscarriage. Abortion and miscarriage use the same medications and procedures for routine care. In June 2022, the Supreme Court decision in Dobbs vs. Jackson Women’s Health Organization gave states the power to legislate abortion, and many states moved to restrict or eliminate access to abortion entirely. Experts have expressed concern that the Dobbs decision will limit access to essential miscarriage care, but to date, this has not yet been rigorously explored.

Aims: We documented the experiences of patients obtaining miscarriage care in four distinct policy environments before and after the Dobbs decision to understand how abortion restrictions impact other pregnancy-related care and develop strategies for improving miscarriage care and information in health care settings.

Methods: We are carrying out semi-structured, in-depth interviews with people in Indiana, Illinois, Kentucky, and Missouri who sought miscarriage care before (n=15 in each state) and after (n=15 in each state) the Dobbs decision. We are engaging in a process of content and thematic analysis.

Contribution: This study is designed to help us understand the impact of abortion restrictions on the provision of miscarriage care across the Midwest and to fill a much-needed gap in literature by centering women’s voices in research about miscarriage in the United States. Miscarriage remains an understudied topic and current legislative changes in the state and across the country mean that studying this issue is both timely and critical.



Keywords: Miscarriage Care; Pregnancy Loss; Dobbs v. Jackson; Womens Health Disparities; Emergency Department Care



Mentor(s):

Kathryn LaRoche (HHS)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9024**
*Presentation Time: April 9-16 on the Conference website*

## Acoustic/photocatalytic air purification systems for HVAC applications

Innovative Technology/Entrepreneurship/Design

Author(s):

Sohan Pramanik† (Engineering)

Abstract:

Indoor air pollution refers to harmful contaminants in the air inside buildings and structures. Processes like combustion produce pollutants that cause significant mortality, even exceeding that from smoking. Furthermore, bioaerosols in the air can transmit diseases such as COVID-19. Current limitations of conventional filtration techniques focus on particles in 0.1-0.3 micron range. Acoustic waves provide a solution by enhancing the capture efficiency of air filters. When acoustic pressure waves interact with bioaerosol particles, they can generate forces which improve particle capture by fiber filters. We aim to develop acoustically enhanced filtration technologies, with a focus on heating, ventilation and air conditioning (HVAC) systems. Many airborne pathogens are not efficiently removed by conventional HVAC filters. We will construct a bench-scale test apparatus to evaluate the filtration efficiency of a fiber filter combined with acoustic actuation. This will allow us to optimize design parameters like acoustic frequency, sound pressure level and orientation relative to the filter to investigate acoustic wave particle interaction. Our research will demonstrate the potential for acoustics to improve air quality and public health through enhanced filtration, as successful implementation in HVAC systems could significantly reduce indoor exposure to hazardous air pollutants and infectious bioaerosols.

Keywords: Bioaerosols; Heating, Ventilation, and Air Conditioning; Acoustic Actuation; Wave Particle Interaction; Fiber Filter

Mentor(s):

David Warsinger (Engineering); Sudharshan Anandan (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9025**

*Presentation Time: April 9-16 on the Conference website*

## Verification for APB Requester

Innovative Technology/Entrepreneurship/Design

Author(s):

MD Sadman Rafi† (Engineering); Milen Mundackal Manoj† (Engineering)

Abstract:

This study focuses on the verification of an Advanced Peripheral Bus (APB) requestor through the utilization of RTL diagrams. The APB requestor plays a critical role in facilitating communication between various peripherals and the central processing unit (CPU) within a system-on-chip (SoC) architecture. The verification process aims to ensure the functionality and reliability of the APB requestor in adhering to the APB protocol specifications. Leveraging RTL diagrams, this research analyzes the design implementation of the APB requestor, scrutinizing its interaction with peripheral devices and the CPU. By employing advanced verification techniques and methodologies, including simulation and formal verification, the study aims to detect and rectify potential design flaws and ensure the robustness of the APB requestor. The findings contribute to enhancing the overall performance and efficiency of SoC designs by guaranteeing the seamless operation of the APB requestor in diverse computing environments.

Keywords: Verification; UVM; APB; SystemVerilog; SoCET

Mentor(s):

Mark Johnson (Engineering); Jude Pinto (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9026**

*Presentation Time: April 9-16 on the Conference website*

## Implementing DFT for a SoC

Innovative Technology/Entrepreneurship/Design

Author(s):

Luca Simoni† (Engineering); Hunter Mccollough† (Engineering); Pranay Jaggi† (Engineering)

Abstract:

In previous tapeouts from, AFTx01 through AFTx06, system on chip (socET) has not utilized design for test (DFT) with automatic test pattern generation. DFT is a crucial process of adjusting the chip layout in order to increase the observability and testability of the system. This is done through the utilization of scan chains, on chip clock-controllers (OCC) and automatic test pattern generation. Scan chains are series of flip flops that are tied together that can be written to through the automatic test pattern. This allows for observability of stuck at faults bridging faults delay fault and transition faults. OCC allow for the system to clock at different rates including slower speeds. This is useful when the system has to propagate through the scan chain combinational logic and allows for an accurate response to the ATPG. Our goal is to utilize the various tools present in DFT to increase the overall testability and observability of the AFTx07. We will be utilizing the fusion compiler and other DFT tools from Synopsys to accomplish this task.

Keywords: DFT; ATPG; OCC; Scan Insertion; System on Chip

Mentor(s):

Mark Johnson (Engineering); Abinands Ramshanker (Engineering); Ann Zi Lau (Science); Fan Jing Hoon (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9027**
*Presentation Time: April 9-16 on the Conference website*

## Programming Language Design for Developing Extensible and Maintainable Hardware Designs

Mathematical/Computation Sciences

Author(s):

Devin Singh† (Engineering)

Abstract:

Modern hardware design involves the generation of billions of transistors through the use of hardware description languages (HDLs) which generate circuit designs from textual code. However, the most widely used HDLs today are inflexible, weakly typed, and can synthesize contradictory circuits between hardware vendors. Due to the immense costs associated with migrating existing tooling infrastructure for compilation of HDLs into individual gates and transistors, decades of programming language research has been lost on the hardware world. We incorporate modern programming language type systems and analysis techniques into a behavioral modeling HDL to provide stronger guarantees about the hardware generated from our language. Software constructs such as structures and functions are modeled during hardware simulation to provide well-defined behavior as hardware constructs. Linear types are employed to ensure that shared hardware resources such as write ports are used exactly once to obey physical hardware restrictions. Restrictions on clock instantiation will allow for simple clock domain analysis to prevent timing errors in synthesized hardware. This language will compile down to existing HDLs in order to be usable within the existing tooling infrastructure while preserving the stronger typing and data flow guarantees. The language will be evaluated using performance metrics from the simulation of small circuits. We expect our stronger guarantees to allow for more aggressive optimizations at the gate level.

Keywords: HDL; Circuit Generator; Behavioral Modeling; Programming Languages

Mentor(s):

Jenna DiVincenzo (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9028**
*Presentation Time: April 9-16 on the Conference website*

## Understanding pregnancy, birth, and postpartum experiences among women living in Florence, Italy

Social Sciences/Humanities/Education

Author(s):

Nicole Stepp† (HHS)

Abstract:

Background: In Italy, cultural, economic, and social norms greatly affect women's pregnancies, birthing experiences, and postpartum life, significantly influencing their birth plans and decisions. Understanding these factors is crucial due to the country's declining birth rates over the past few decades.

Objective: This study aimed to understand pregnancy and postpartum experiences, including healthcare decisions, birth planning, parental leave policies, breastfeeding, and social/cultural influences, among a sample of women in Florence, Italy.

Methods: Researchers conducted 24 in-person interviews in English in May 2023. Participants included women living in or near Florence, Italy, aged 18 and over, who had given birth in Italy. All interviews were transcribed verbatim and analyzed using thematic analysis, involving coding, pattern review, and mind mapping to identify common themes among participants.

Results: Results showed positive pregnancy experiences were correlated with comfortable and supportive atmospheres, natural techniques, and maternal empowerment. Negative experiences emerged due to poor provider communication, COVID-19 regulations, and stress. Body image was positive during pregnancy but challenging postpartum, noting weight gain and a decreased sense of attractiveness after birth. Cultural pressure to breastfeed conflicted with a lack of private spaces. Lastly, participants desired improved paternal leave policies, healthcare, psychological care, and community support.

Conclusions: This study emphasizes the importance of healthcare services considering cultural influences and prioritizing women's well-being in navigating family planning decisions, including pregnancy, birth, and breastfeeding. Understanding and addressing these factors can help develop more effective strategies and policies to promote reproductive health and address low fertility rates in Italy.

Keywords: Birth; Pregnancy; Postpartum; Parental Leave Policies; Italian Culture

Mentor(s):

Andrea DeMaria (HHS)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9029**
*Presentation Time: April 9-16 on the Conference website*

## Family Engagement: Reflecting on the Importance of Building Positive Relationships

Social Sciences/Humanities/Education

Author(s):

Riley Tague† (HHS, JMHC); Elaine Huang‡ (Liberal Arts)

Abstract:

Positive teacher-student-family relationships are associated with positive effects on teacher efficacy and student outcomes (McGrath & Van Bergen, 2015).  Students with disabilities are at higher risk for more negative school outcomes, but may benefit the most from positive relationships (Murray, 2002). To prepare preservice teachers to develop positive relationships with students and families, it is vital for teacher preparation programs to incorporate opportunities during their field experiences (Willemse et al., 2018). This poster will discuss data collected during the 2022-2023 academic year regarding a course assignment for pre-service teachers across teacher education in which they participated in activities to build relationships with students/families and then reflect upon those experiences. Codebooks were developed to analyze student reflections, and each reflection was qualitatively coded by two independent coders. Researchers analyzed the codes within and across data and common themes were identified. Results indicated the importance of including families, effective communication, and building relationships with families.

Keywords: Pre-Service Teacher; Positive Relationships; Students with Disabilities; Family Engagement

Mentor(s):

Jennifer Smith (Education); David Ray Miranda (Education); Jasmine Begeske (Education)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9030**
*Presentation Time: April 9-16 on the Conference website*

**Multi-agent RL for Drone Swarm Navigation**

Mathematical/Computation Sciences


Author(s):

Tri Than† (Engineering)



Abstract:

The goal of the Multi-agent RL for Drone Swarm Navigation is developing software and an emulation package to facilitate the testing and the development of the new multi-agent Reinforcement Learning (RL) algorithms. RL is a type of machine learning algorithm where an agent learns to make decisions by interacting with an environment. The agent receives feedback in the form of rewards or penalties based on the actions it takes. The goal of reinforcement learning is for the agent to learn a policy, which is a mapping from states to actions, that maximizes the cumulative reward over time.Multi-agent RL can help with number emerging applications, for example aiding autonomous navigation via a swarm or drone.

The Unreal Engine simulation will be implemented to enable high-fidelity experimentation. As the Unreal Engine simulation is under progress of testing and new multi-agent RL algorithm is under developed, Unreal Engine simulation are tested by implementing Deep Q Learning, DeepREINFORCE, DeepPPO algorithm with single agent and multi agents to observe the behavior of drone in different environments and analyze the performance the RL algorithms in term of the safe flights and loss iteration. Therefore, the goal of this project this semester is implementing Unreal Engine simulation, analyzing RL algorithms in different environments in single agent and multi agents cases.



Keywords: Reinforcement Learning; Drone Navigation; Simulation; Machine Learning; Unreal Engine



Mentor(s):

Abolfazl Hashemi (Engineering); Sravani Ramishetty (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9031**
*Presentation Time: April 9-16 on the Conference website*

## Computer Simulations of Air Quality

Mathematical/Computation Sciences

Author(s):

Paul Michael Vasquez† (Engineering); Trisha Suresh† (Engineering); Joshua Fan‡ (Science)

Abstract:

According to the American Lung Association, “63.7 million people lived in counties that experienced unhealthy spikes in particle pollution, the most reported in the last 10 years” (Dale, 2023). Air pollution and air quality is a growing issue in the world's current climate. As technology rapidly progresses, the simulation of air quality is crucial for comprehending the global issue of pollution and ensuring that we inhabit a healthy environment. In this paper, I model the ocean ecosystem with the aid of the University of York’s Master Chemical Mechanism (MCM) and their Atchem2 software (open source modeling tool for atmospheric chemistry). We scraped data from various peer-reviewed journals to create mechanisms for the different chemical reactions and used that data in Atchem2. This involved Excel formatting, Python programming and statistical R programming to create various config files and facsimile files that are accessible by Atchem2. We sought to achieve data on different chemical concentrations overtime for certain species and expected to see evidence of day and night cycles in the data. In conclusion, this paper’s contributions will be processed data of volatile organic compounds (VOCs) within the context of ocean ecosystems. This data can be used to generate conclusions of atmospheric conditions and air quality.

Keywords: Atmosphere; Air; Simulation; Programming

Mentor(s):

Greg Michalski (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9032**
*Presentation Time: April 9-16 on the Conference website*

**Watch Our Your Phone Calls: Inference Attacks Over Encrypted 5G Calls**

Mathematical/Computation Sciences

Author(s):

Enze Wang† (Science)

Abstract:

[Abstract Redacted]

Keywords: Machine Learning; 5G; Communication Security

Mentor(s):

Chunyi Peng (Science); Shaan Shekhar (Science)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9033**
*Presentation Time: April 9-16 on the Conference website*

## Computational Electromagnetics and Green's Function Source Optimization of Variational Quantum Algorithms

Mathematical/Computation Sciences

Author(s):

Advay Welling† (Science); Sarthak Tandon* (Engineering)

Abstract:

Contributing authors:

Blake Wilson (PhD candidate, ECE department), Vahagn Mkhitaryan (Post Doctoral, ECE department), Alexandra Boltasseva (ECE Professor & Researcher), Sabre Kais (Researcher), Alexander Kildishev (ECE Professor & Researcher), Vladimir Shalaev (ECE Professor & Research)

Y-branch waveguides are key components of optical integrated circuits (PICs), providing efficient routing of optical signals. Optimization of this design plays an important role in increasing machine performance, reducing material losses and improving efficiency. This abstract investigates the Y-branch waveguide optimization process through S-matrix analysis and eigenmode calculations. The optimized S-Matrix offers a more accurate model for waveguide behaviour, facilitating the design of efficient optical devices.

In this paper, work will be focused on arbitrary distributions of random waveguides. Through the use of sin and cosine fourier transforms of waveguides, optimizing the choice of eigenmodes to create output with minimal crosstalk should be achievable. The plan is to optimize the choice of eigenmodes through Boltzmann Sampling and overlap integrals. To achieve this, a python package 'nanomcmc' which is used for Boltzmann Distributions will be implemented. The input for all code will be energy functions that will be sampled on.

Another assigned task is to implement Green's Function Source Optimization to account for all the inhomogeneous differential equations that will be dealt with throughout the course of the paper, ensuring the math is taken care of.

Keywords: Quantum Algorithms; Machine Learning; Electromagnetics; Waveguides; Green's Function

Mentor(s):

Blake Wilson (Engineering); Vahagn Mkhitaryan (Engineering)

† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9034**
*Presentation Time: April 9-16 on the Conference website*

# Unraveling Defects in Hafnium-Zirconium Oxide

Physical Sciences


Author(s):

Epiphany White† (Engineering)



Abstract:

[Abstract Redacted]



Keywords: Hafnium–Zirconium Oxide; Defects; Photoluminescence



Mentor(s):

Thomas Beechem (Engineering); Fernando Vega (Engineering)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

**Virtual Presentation Abstract Number: 9035**
*Presentation Time: April 9-16 on the Conference website*

## Modeling Energy Flow in Social-Ecological Systems

Mathematical/Computation Sciences


Author(s):

Lilian Zhao† (Science)



Abstract:

This project aims to derive an effective computational model for simulating energy dynamics in ecosystems encompassing both natural and human processes. Our research runs in parallel with the development of a playable society simulator designed to examine the sustainability of different socio-political ideologies. The model is meant to inform the energy-based economy within the game and help players better visualize and understand how energy moves and transforms within a closed system. By integrating aspects of environmental and urban models, we describe how energy is first introduced by the sun, brought into initial energy reserves in the form of natural resources, and converted into human consumable forms, resulting in waste output and ultimately causing environmental effects like climate change and pollution. Through analysis of the mathematical relationships between variables, we can potentially gain new insights into the ecological footprint of economic policies.

Existing data on energy consumption and production will determine what energy cost is associated with player actions like growing food, building infrastructure, and planting forests. After obtaining a scientifically supported, parametrically scalable model, we aim to simplify the model to be easily understandable to the average player. By creating a model capable of simulating societal evolution and growth over time, we can investigate ecological balance and coexistence with the Biosphere, finite resources, and the ecological sustainability of societal systems.



Keywords: Simulation Modeling; Ecosystem Modeling; Energy Flow in Ecosystems; Ecological Sustainability of Societal Systems; Energy-Based Economy



Mentor(s):

David Whittinghill (Polytechnic)


† Presenting Undergraduate Author; ‡ Contributing Undergraduate Author; * Undergraduate Acknowledgement

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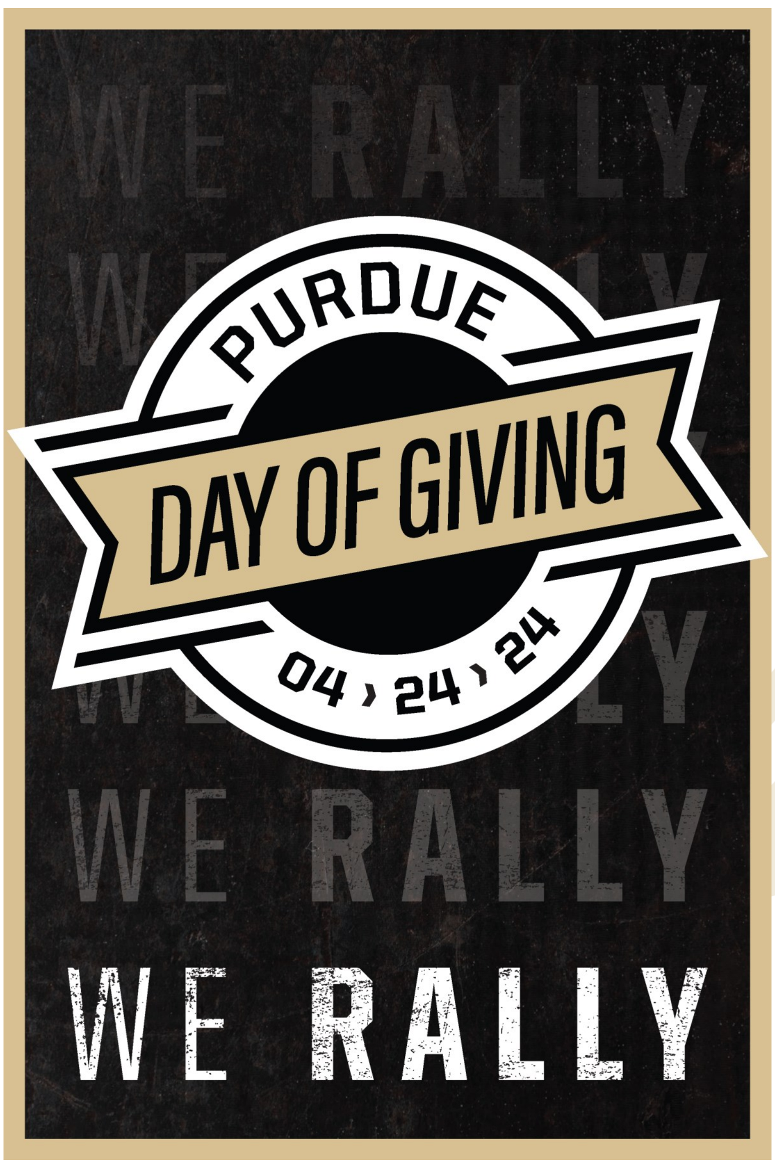


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