4th Annual
PASSHE Undergraduate Research Conference in Science, Technology, Engineering and Mathematics

Hosted by
Millersville University

November 4, 2017
A Message from the Provost

November 4, 2017

Welcome to Millersville University and the 4th Annual PASSHE Undergraduate Research Conference in Science, Technology, Engineering, and Mathematics.

As a proud member of the Pennsylvania State System of Higher Education, we are pleased to host this year’s conference, which showcases the work of over 40 students from six State System universities.

Many of the issues facing the world and its inhabitants today can only be resolved through contributions made by members of the STEM community. Therefore, it is imperative that institutions of higher education promote engineering, science and technology programs which foster an environment of undergraduate research, creativity, and scholarship. Additionally, focusing on the education and preparation of professionals in these fields is paramount in allowing the United States to be competitive both domestically and abroad.

The mentoring relationship forged by faculty plays an integral part in a student’s academic, professional, and personal development. I would like to personally thank those who have dedicated their time and effort to our young scholars and helped to ensure the continued success of this STEM conference.

Congratulations to all our presenters!

Sincerely,

Vilas Prabhu

Vilas A. Prabhu, Ph.D.
Provost and Vice President
For Academic Affairs
4th Annual
PASSHE Undergraduate Research Conference in Science, Technology, Engineering and Mathematics

AGENDA

8:30 – 9:15 am  Registration  
Student Memorial Center, Room 114

9:15 – 9:30 am  Welcome  
Student Memorial Center, Room 114

9:30 – 10:30 am  Oral Presentation Sessions  
I: Student Memorial Center, Room 118  
II: Student Memorial Center, Room 18  
III: Student Memorial Center, Room 24

10:30 – 10:45 am  Break

10:45 am – 12:15 pm  Poster Session  
Student Memorial Center, Room 114

12:15 – 12:20 pm  Closing Remarks  
Student Memorial Center, Room 114
Oral Session I (9:30 – 10:30 am, Student Memorial Center, Room 118)  
Session Chair: Dr. Martin Buckley, Slippery Rock University of Pennsylvania

PRESENTATION 1 (9:30): Toxic Waters: Survivorship of Four Species of Crustacean Larvae Under Hypoxic Conditions  
Presenter: Amanda Schultz, Kutztown University of Pennsylvania  
Mentor: Dr. Wendy Ryan, Kutztown University of Pennsylvania  
Area: Biology

Abstract: Dissolved oxygen levels in the ocean are reaching new lows due to increased human activities. In these areas oxygen levels can dip to as low as 18.75 µmol/L, altering communities and causing die-offs. Zooplankton play a critical role in the marine environment by providing a link at the lowest level of the food chain. Understanding more about their lifestyle, specifically their tolerance for hypoxia, is vital as their habitat changes. The survivorship of the larvae of four species of marine crustaceans under hypoxic conditions was examined to better understand how these species will adapt to the worsening conditions. Larvae were caught and allowed to respire in sealed vials fitted with optical DO sensors until they reached a minimum O_2 level of 10 µmol/L. Survivorship was recorded and correlated with size according to wet weight. Of all organisms sampled (n = 134) only 7 died with notable metabolic differences recorded between species.

Keywords: plankton; larvae; crustaceans; crabs; shrimp; hypoxia; anoxia; survivorship; agricultural; runoff; die-offs; human impact

PRESENTATION 2 (9:45): Characterization of the Microbiome of American Dog Tick Mouthparts  
Presenter: Danielle Swingle, East Stroudsburg University of Pennsylvania  
Mentor: Professor Nicole Chinnici, East Stroudsburg University of Pennsylvania  
Area: Biology

Abstract: American Dog ticks are medically important vectors, which transmit the diseases Tularemia and Rocky Mountain spotted fever. The tick mouthparts are largely involved in the process of transmitting pathogenic bacteria from the tick to the host. Although extensive research has been conducted on whole ticks and tick guts, there is little information to be found about the microbiome of the mouthparts alone. This study used DNA extraction, PCR amplification, and first generation sequencing technology to characterize the microbiome of American dog tick capitulums, which were collected in East Stroudsburg, PA. The bacterial genera identified include Streptococcus, Psuedomonas, Chryseobacterium and Curtobacterium. This specific information can be added to the existing base of knowledge on the tick microbiome, and aid in environmental control of ticks, the monitoring of infectious areas, and the prediction of emerging tick-borne pathogens.

Keywords: tick; microbiome; bacteria; dog; pathogen; microbiology
PRESENTATION 3 (10:00):  High Prevalence of Bartonella spp. found in Pennsylvania Black Bears

Presenter:  Kristine Bentkowski, East Stroudsburg University of Pennsylvania
Mentor:  Professor Nicole Chinnici, East Stroudsburg University of Pennsylvania
Area:  Biology

Abstract: Over the last decade tickborne diseases have been increasing in the United States among human and wildlife populations. Tick-borne diseases such as Bartonella spp. and Anaplasma phagocytophilum are becoming more prevalent. In this study American black bears (Ursus americanus) were tested for tickborne pathogens transmitted by black legged ticks (Ixodes scapularis). Black bear samples were tested for the prevalence of Babesia spp., Bartonella spp., and A. phagocytophilum through PCR analysis. Results indicated 69.3% (n=70/101) of bears tested positive for Bartonella spp. and 1.99% (n=2/101) were positive for A. phagocytophilum. No co-infections were detected. This study is the first to document a high prevalence of Bartonella spp. in Pennsylvania black bear populations.

Keywords: Bartonella spp.; black bears; Anaplasma phagocytophilum; Babesia spp.; PCR

PRESENTATION 4 (10:15):  Analyzing the effects of salinity on the oxygen metabolism of Palaemonetes spp.

Presenter:  Celina Dickison, Kutztown University of Pennsylvania
Mentor:  Dr. Wendy Ryan, Kutztown University of Pennsylvania
Area:  Biology

Abstract: For many marine organisms the ion concentration in their tissues is often times lower than the concentration in their environment. Palaemonetes spp., also known as shore shrimp, are osmoregulators, regulating ion transport via their gills. Due to climate change, fresh water from melting glaciers may potentially decrease the salinity in the estuaries these shrimp inhabit. Palaemonetes spp. are a keystone species in these communities through their role as a transferor from producers.

We hypothesized that when the salinity was beyond the range of 31 ppt, the oxygen uptake of these zooplankton would increase, reflecting a higher energy demand. However, after Palaemonetes spp. were exposed to salinities from 10 to 45ppt for 150 mins in a sealed vial, they showed no significant change in oxygen use (one-way ANOVA F(5,89) = 1.08, p = 0.376). It appears as if Palaemonetes spp. may not be affected by short term salinity changes in their environment, although further experimentation is needed.

Keywords: plankton; shrimp; salinity change; oxygen consumption
Oral Session II (9:30 – 10:30 am, Student Memorial Center, Room 18)
Session Chair: Dr. Yun Lu and Dr. Francis Vasko, Kutztown University of Pennsylvania

PRESENTATION 1 (9:30):
Edge-Distinguishing Chromatic Number
Presenter: Grant Fickes, Kutztown University of Pennsylvania
Mentor: Dr. Wing Hong Tony Wong, Kutztown University of Pennsylvania
Area: Mathematics

Abstract: Let G denote a simple graph consisting of vertices and edges, where each edge connects two distinct vertices. When we color the vertices of G, each edge will then be labeled by the colors of the two vertices it connects. For example, if an edge connects a red vertex and a blue vertex, then this edge is labeled by {red, blue}. We call the coloring of G “edge-distinguishing” if all the edge labels are distinct, and the minimum number of colors that we need to create an edge-distinguishing coloring is called the “edge-distinguishing chromatic number” (EDCN) of G. In previous literature by Al-Wahabi et al., the EDCN was found when G was a path and a cycle. In this presentation, I will expand their ideas to find the EDCN when G is a spider graph.

Keywords: graph theory; vertex coloring; edge-distinguishing chromatic number; spider graph

PRESENTATION 2 (9:45):
Investigations of Fibonacci Inequalities
Presenter: Zachary Smith, California University of Pennsylvania
Mentor: Dr. Leandro Junes, California University of Pennsylvania
Area: Mathematics

Abstract: I will be discussing my solution to an open problem from the journal Fibonacci Quarterly using techniques from number theory. My solution has been submitted and is currently being reviewed.

Keywords: Fibonacci numbers; elementary number theory; mathematics
PRESENTATION 3 (10:00): A Population-Based Metaheuristic Approach for Solving the Multi-Demand Multidimensional Knapsack Problem
Presenter: Charles Saternos, Kutztown University of Pennsylvania
Mentor: Dr. Yun Lu and Dr. Francis Vasko, Kutztown University of Pennsylvania
Area: Mathematics

Abstract: The Multi-Demand Multidimensional Knapsack Problem (MDMKP) is a combinatorial optimization problem with real-world applications that is extremely difficult to solve due to conflicting constraints. In this study, we adapt a population-based (a collection of solutions) metaheuristic to efficiently generate near-optimal solutions to the MDMKP. This metaheuristic, called Jaya (victory in Sanskrit) was introduced in 2016 by Rao to solve continuous nonlinear engineering design problems. Since the MDMKP is a binary optimization problem (variables are bit strings, not continuous variables), we made modifications to the Jaya metaheuristic in order to effectively solve the MDMKP. For test purposes, we use 810 large MDMKP instances available to researchers on the web. In this talk, we will report empirical results we obtained from solving these 810 MDMKP instances using our new Jaya-based metaheuristic approach. Our results will be compared to the optimal (if known) or best known results for these problems.

Keywords: multi-demand multidimensional knapsack problem; population-based metaheuristics; combinatorial optimization

PRESENTATION 4 (10:15): Predicting Outcomes of College Football Games
Presenter: Quyen Do, Millersville University of Pennsylvania
Mentor: Dr. Trent Gaugler, Lafayette College
Co-Authors: Keri D'Angelo, The College of New Jersey, Jamie Kunzmann, Stony Brook University, and Josh Radack, Lafayette College
Area: Mathematics

Abstract: It is common to try to predict who will win a football game, and pro-football-reference.com produced a well-known model (called the PFR model) for predicting such outcomes for NFL games. Their model relies heavily on the point spread that sportsbooks use to balance the wagering on the game. Our focus will be on FBS college football games, and we seek to compare this PFR model to new logistic regression models built using data from 2008 to 2016. In addition to asking who will win the game, it is sometimes more interesting to ask if the favored team will win by a certain margin. We also use variants of our models to address these questions. We finally discuss applying these predicted probabilities for use with the Kelly Criterion for simultaneous wagering on outcomes of FBS games.
Oral Session III (9:30 – 10:30 am, Student Memorial Center, Room 24)
Session Chair: Dr. Carrie Smith, Millersville University of Pennsylvania

PRESENTATION 1 (9:30):
Quantifying Threats to Endangered Species to Improve Conservation Efforts
Presenter: Delaney Costante, Millersville University of Pennsylvania
Mentors: Dr. Aaron Haines, Millersville University of Pennsylvania, and Dr. Matthias Leu, College of William & Mary
Co-Authors: Kayli Thomas, Alexander Sandercock, Jessica Evans, Tyler Treakle, Isabel Ritrovato, Maggie Hollingsworth, Courtney Check, Ann Marie Rydberg, and Rachel Caron
Area: Biology

Abstract: The purpose of this study was to quantify threats facing U.S. species listed as ‘Threatened’ or ‘Endangered’ (n = 1356) under the Endangered Species Act. Federal Register Documents were reviewed to identify threats that impacted species at their time of listing and how they have changed over time. Threats were separated into six broad categories: habitat modification, overutilization, pollution, species-species interactions, demographic stochasticity, and environmental stochasticity. The results show that habitat modification has been the most pervasive threat, and is increasing in frequency. Overutilization is a less common threat, and has been consistently declining. Species-species interactions and environmental stochasticity have drastically increased in frequency since the beginning of the act. Today, species are facing more threats at their time of listing in comparison to when the ESA began. Based on these trends, we provide recommendations on how to improve the recovery process for endangered species.

Keywords: endangered species act; conservation; management; environment

PRESENTATION 2 (9:45):
The Cycle Never Ends: The Risk Factors for Adolescent Girls and the Preventions Needed to Avoid Juvenile Delinquency
Presenter: Logan Neiman, Millersville University of Pennsylvania
Mentors: Dr. Carrie Smith and Dr. Frederika Schmitt, Millersville University of Pennsylvania
Area: Sociology

Abstract: The number of adolescent girls in the criminal justice system has been increasing dramatically. In this paper I will examine what scholars believe are the frequent reoccurring risk factors such as child maltreatment, sexual and physical abuse and personal relationships that lead adolescent girls into juvenile delinquency, and the adequate prevention programs needed to help these girls avoid the criminal justice system overall. In conclusion I will also discuss future research agendas.

Keywords: adolescents; girls; juvenile delinquency; criminal justice system; preventions
PRESENTATION 3 (10:00):  Forgotten Victims: Effects of Maternal Incarceration on Children and What Can Be Done to Save Them

Presenter:  Abigail Jefferys, Millersville University of Pennsylvania
Mentors:  Dr. Frederika Schmitt and Dr. Carrie Smith, Millersville University of Pennsylvania
Area:  Sociology

Abstract:  With an ever-increasing number of mothers being sent to prison, it is also becoming increasingly important to measure and respond to the effect that imprisonment has on their children. This paper addresses several differing short- and long-term effects of maternal imprisonment, along with possible preventative measures that could be implemented in order to avoid negative outcomes for these children. Overall, this paper summarizes why it is becoming so important to focus on the needs of this particularly vulnerable group of children.


Presenter:  Amanda Sleinkofer, Millersville University of Pennsylvania
Mentor:  Dr. Jeff McQueen, Environmental Modeling Center, National Centers for Environmental Prediction, NOAA
Co-Authors:  Ho-Chun Huang, Jianping Huang, Ricardo Sakai, Belay Demoz, Yonghua Wu, Jorge Gonzalez-Cruz
Area:  Environmental Science

Abstract:  NOAA’s National Air Quality Forecasting Capability (NAQFC) is designed to provide numerical guidance of ozone and particulate matter for the United States. NAQFC predictions are generated twice per day at 12 km resolution through 48 hours and distributed at http://airquality.weather.gov. The Community Model for Air Quality (CMAQ) is used and driven by the NOAA/NWS North American Model (NAM) weather predictions. The NAM and CMAQ were upgraded in 2017 in part to reduce a warm temperature bias in summer. CMAQ was also upgraded in June 2017. By increasing the cloud’s opaqueness, the NAM 2 m temperature and often CMAQ ozone improved. In this study, the NAM’s ability for predicting near surface and boundary layer meteorological were evaluated. Ceilometer data was used to evaluate planetary boundary layer height predictions. In addition, the NAM CONUS Nest (3 km), was evaluated for its utility to driving air quality predictions.
Poster Session (10:45 am – 12:15 pm, Student Memorial Center, Room 114)

POSTER 1: Effects of Pet Location on Narcissism and Happiness
Presenter: Randi Levers, California University of Pennsylvania
Mentor: Dr. Rebecca Regeth, California University of Pennsylvania
Area: Psychology

Abstract: Participants of all ages, male and female, completed surveys and demographic information to determine whether people who kept their pets outside were more narcissistic than those who kept their pets inside and if the number of pets a participant owned contributed. Researchers also looked for gender differences and whether or not pet ownership had a significant role in a participant's happiness. Researchers found that there was no correlation between narcissism and number of pets one owned. Where a pet was kept, inside or outside, showed little to no effect on a person’s happiness although those with indoor pets scored slightly higher on the happiness scale. There also wasn’t a significant difference in gender when it came to pet location. Altogether the findings show that is minor differences within participants but they are not high enough to warrant any type of relationship.

POSTER 2: Real-Time Three-Dimensional Position Measurement using Multi-axis MEMS Accelerometers
Presenter: Angelo Vardaxis, Kutztown University of Pennsylvania
Mentor: Professor Eric Laub, Kutztown University of Pennsylvania
Area: Engineering & Engineering Technology

Abstract: A three-dimensional position measurement instrument has been built using Sparkfun ADXL335 3-axis MEMS accelerometers. This instrument measures linear and rotational accelerations in three-dimensions in real-time, to actively track and record its position in three-dimensions. A National Instruments USB-6009 multifunction DAQ device is used for data acquisition. Control software is created in LabVIEW to convert raw data from the DAQ device into accelerations. A simple Euler’s algorithm then calculates the current position of the instrument, all in real time. In addition to designing the instrument, a separate testing rig has been created to characterize and calibrate the accelerometers to optimize the performance and accuracy. Applications of this instrument could include contour mapping of surfaces, tracking of animals, navigation, and length, area and volume measurement in three dimensions.

Keywords: accelerometer; position measurement; three-dimensions; MEMS; LabVIEW; data acquisition; three-axis; acceleration
POSTER 3:  A Look at Personal Exposure to Particulate Matter from Indoor Sources
Presenter:  Amira Price, Millersville University of Pennsylvania
Mentor:  Dr. Daniel Albert, Millersville University of Pennsylvania
Area:  Chemistry

Abstract: Exposure to particulate matter (PM) has many harmful health effects. The objective of this research was to examine how much exposure to PM one has during indoor activities and ways in which exposure can be remediated. To examine how much exposure one would have to particulates while performing activities at home, simulations were run of cooking, burning a candle, vacuuming, and ironing. A Nephelometer was used to measure light scattering during the performance of each activity and converted to a concentration of PM. Burning a candle was found to produce the largest amount of particulates, ranging from peak exposures of 9-136 μg/m³. Methods for remediation of exposure were tested and resulted in mitigation to a range of 0-11 μg/m³. The results of the simulations provide a look at the amount of PM one is exposed to while performing daily activities and the measures that can be taken to reduce exposure.

Keywords: particulate matter; indoor air quality

POSTER 4:  Examining the effect of Resveratrol Treatment on a Fruit Fly Model for TPI Deficiency
Presenter:  Annette Choi, Slippery Rock University of Pennsylvania
Mentor:  Dr. Martin Buckley and Dr. Stacy Hrizo, Slippery Rock University of Pennsylvania
Co-Author:  Austin Shirk, Slippery Rock University of Pennsylvania
Area:  Biology

Abstract: TPI (triosephosphate isomerase) deficiency is a progressive and devastating neurological disease that leads to neuromuscular degeneration and decreased longevity in the patient. There is currently no treatment for this disease. Interestingly, a missense mutation in the Drosophila TPI gene (TPI<sup>sgk</sup>) causes analogous symptoms in flies (paralysis due to extreme heat or mechanical stress). Previous studies have demonstrated that mutations in TPI cause increased oxidative stress in the Drosophila. Intriguingly, stress phenotypes in the mutant flies worsened with exposure to oxidizing agents. In contrast, treatment with reducing agents improved the paralysis phenotypes. These findings indicate that the TPI<sup>sgk</sup> mutant has a oxidized redox state that contributes to pathogenesis of the disease. Thus, anti-oxidants may be a class of compounds to treat familial TPI deficiency. To test this hypothesis, in this study, we are examining the impact of the anti-oxidant resveratrol (found in red grapes) on the paralytic phenotypes found in TPI<sup>sgk</sup> flies.
POSTER 5:  **Expression Patterns of Premigratory NCCs in between Two Waves of Migration in Slider Turtle (Trachemys scripta)**

Presenter:  **Moira Dougherty**, Millersville University of Pennsylvania  
Mentor:  **Dr. Judith Cebra-Thomas**, Millersville University of Pennsylvania  
Area:  Biology

**Abstract:** Turtle ventral plastron bones develop similarly to facial bones, suggesting they are produced by neural crest cells (NCCs). In vertebrate embryos, a wave of NCCs migrate away from the neural tube (developing central nervous system) and differentiate into peripheral nerves, pigment cells, cartilage and bone. Turtle embryos undergo a second migration of skeletogenic (bone-forming) trunk NCCs that move ventrally to form the plastron bones. The question is whether these late-emerging NCCs result from dormant premigratory NCCs that are not depleted at the end of first wave of NCC migration. A subset of genes expressed as proteins in the NCC precursors are thought to control NCC differentiation and migration. I am examining the expression of Sox9, Sox10 and FoxD3 by immunofluorescent staining with specific antibodies. I plan to determine whether all or a subset of these markers persists after the first wave suggesting the premigratory population is maintained.

**Keywords:** turtles; plastron; neural crest cells; neural crest specifiers; neural crest migration; immunofluorescence

POSTER 6:  **Determining the Reaction Characteristics of Azobenzene on ZrO$_2$ Nanoparticle Thin Films**

Presenter:  **Jenna Kanyak**, Kutztown University of Pennsylvania  
Mentor:  **Dr. Darren Achey**, Kutztown University of Pennsylvania  
Area:  Chemistry

**Abstract:** Nanoparticle thin films are commonly utilized in devices that convert solar energy into chemical energy that can be extracted at a later time. The ability to store large amounts of energy in chemical bonds is crucial to supplying power in a renewable energy future. With that in mind, it is imperative to understand how the characteristics of molecules change when they are attached to the surface of nanoparticles in comparison to when they are in solution. Azobenzene is a molecule that is known to visibly change from one orientation to another when exposed to heat and light, making it an ideal candidate to test such characteristics. The rate at which azobenzene changes its orientation along with the extent of such change when exposed to heat and light provides useful insight as to how the molecule acts differently in solution compared to when attached onto the surface of a nanoparticle.

**Keywords:** chemistry; nanoparticles; materials
POSTER 7: Exploring the Regioselective Diels-Alder Reaction Scope of 1,4-Naphthoquinones
Presenters: Gillian Good and Weihao ‘Howard’ Ma, Millersville University of Pennsylvania
Mentor: Dr. Steven Merwin Kennedy, Millersville University of Pennsylvania
Area: Chemistry

Abstract: Altersolanol P (AP), a new member of the altersolanol family of compounds, is the inspiration for multiple synthetic studies in our laboratory. The altersolanols, and structurally similar compounds, exhibit antibacterial activity. Recently, we reported our work toward the regioselective synthesis of intermediates en route to altersolanol derivatives via lewis acid catalyzed Diels-Alder reactions of the natural products isoprene and Juglone (5-hydroxy-1,4-naphthalenedione). Epoxidation or dihydroxylation of the resulting adducts is expected to provide a small library of altersolanol derivatives for antibacterial testing. To further expand the molecular diversity of our library, in this study, we will explore the reactivity of 1,4-Naphthoquinone dienophiles with dienes, such as (2E,4E)-2,4-Hexadienyl acetate and 2,4-Hexadien-1-ol. We eventually hope to substitute Juglone (5-hydroxy-1,4-naphthalenedione) for 1,4-Naphtoquinone to explore regioselectivity of the Diels-Alder reaction. New compounds will be tested for antibacterial activity.

Keywords: organic synthesis; methods development; Diels-Alder; natural products

POSTER 8: Insertion of a Heme Binding Motif at Five Different Sites of Green Fluorescence Protein
Presenter: David Nunez Contreras, Kutztown University of Pennsylvania
Mentor: Dr. Carsten Sanders, Kutztown University of Pennsylvania
Area: Biochemistry

Abstract: Using genetic, molecular biological and microbiological methods, an 18 amino acid residues long fragment of the electron carrier protein cytochrome c (called CCCS) containing its amino-terminal region plus its conserved heme binding motif (CXXCH) has been inserted at five different positions of green fluorescent protein (GFP). This cytochrome c fragment has been demonstrated to be sufficient for recognition and covalent heme attachment by the enzyme cytochrome c hemelyase (CCHL). This project is directed towards an approach to engineer CCCS-GFP fusion proteins with new, combined features of fluorescence and heme attachment for future biotechnological applications. At this stage of the project, we created CCCS-GFP fusion proteins and collected data, initially characterizing their fluorescent properties as well as their ability to be covalently ligated with heme upon coproduction with CCHL in an established Escherichia coli recombinant gene expression system.

Keywords: cytochrome c; heme binding motif; green fluorescent protein; protein engineering; recombinant gene expression
POSTER 9: Applying the Kelly Criterion to College Football Betting
Presenter: Quyen Do, Millersville University of Pennsylvania
Mentor: Dr. Trent Gaugler, Lafayette College
Co-Authors: Keri D’Angelo, The College of New Jersey, Jamie Kunzmann, Stony Brook University, and Josh Radack, Lafayette College
Area: Mathematics

Abstract: The Kelly criterion is a mechanism used for properly sizing a portion of one’s capital for betting and investment purposes. In our research project, we explore a realistic application of the Kelly criterion. Our objective is to maximize a bettor’s return while simultaneously minimizing the risk of ruin in the context of betting on FBS college football games. We build a selection of logistic regression models using scraped college football data of the 2008-2016 seasons, simultaneously comparing our models to the well-known PFR model designed by pro-football-reference.com. We then apply the predicted probabilities to our expansion of Kelly criterion to more than one betting event. Simulations are then run with varying approaches-differing number of bets, game filtering methods, and fractional Kelly sizes are all considered to come up with the most profitable betting strategy for an FBS season.

Keywords: Kelly criterion; college football; betting; logistic regression; data science

POSTER 10: Validation of A Neurobehavioral Pharmacodynamic Test in Mice for 5-HT2C Blocking Activity: 5-HTP-Induced Head Twitch Responses
Presenter: Diamond Madison, Indiana University of Pennsylvania
Mentor: Dr. Daniel Widzowski, Indiana University of Pennsylvania
Area: Biology

Abstract: The atypical antidepressant mirtazapine (MIR) has shown promise for treating methamphetamine dependence. While MIR acts on many targets, blocking signaling through serotonergic 5-HT2C receptors may be a key mechanism for drug dependence. We need a pharmacological method for testing for 5-HT2C blocking activity to test new compounds. This study was to validate a neurobehavioral pharmacodynamic test, 5-hydroxytryptophan (5-HTP)-induced head twitch response (HTR), specifically to characterize the dose effect and time course for 5-HTP in both sexes of mice and to detect the effects of a serotonergic 5-HT2C receptor antagonist, SB242084. The greatest number of HTRs were observed from 15 to 30 minutes after injection of 300 mg/kg of 5-HTP. Lower doses of 5-HTP were less effective. The 5-HT2C antagonist SB242084 (3 mg/kg) partially blocked 300 mg/kg 5-HTP-induced HTR during peak head twitching. Future studies will focus on testing a 5-HT2C inverse agonist (SB206553) and novel serotonergic compounds made by collaborators.
**POSTER 11:** Synthesis of an Optoelectronic Covalent Organic Framework from Anthrone

**Presenter:** George Pearson, Millersville University of Pennsylvania  
**Mentor:** Dr. Kathryn Allen, Millersville University of Pennsylvania  
**Area:** Chemistry

**Abstract:** Covalent organic frameworks (COF) are porous 2- or 3-dimensional polymer structures designed using only organic elements (C, O, N, B) that are constructed of the same repeating covalent bonding. They are used for gas storage, catalysts, chemical gas sensing, biomolecule capture, and optoelectronics. Our goal is construction of a COF from anthrone by nitration, oxidation to the anthraquinone, reductive coupling to form the tetranitrated bianthryl derivative, and reduction of the tetranitrated compound to a tetraamino compound. This symmetric tetraamino compound will be condensed with 1,4-dibenzaldehyde to generate a new COF, constructed of imine linkages. The structure is geometrically and energetically designed to possess electron-trapping characteristics in a 3-dimensional organic framework because the anthryl units will be arrested in an orthogonal orientation. We will accomplish the bulk of our synthesis and characterization at Millersville University and will carry out advanced characterization studies in the form of Differential Scanning Calorimetry (DSC), IR Spectroscopy, and UV-Visible Spectroscopy at Millersville University. We will also carry out Powder X-Ray Diffraction (PXRD), Thermal Analysis, and Gas Adsorption Analysis with our collaborators at James Madison University.

**Keywords:** covalent organic frameworks; COF; polymer; optoelectronic; anthrone

**POSTER 12:** Psychological Correlates of Adaptive Coping Strategies in College Students

**Presenter:** Taylor Brandt, Millersville University of Pennsylvania  
**Mentor:** Dr. Debra Vredenburg, Millersville University of Pennsylvania  
**Co-Author:** Simeon Kulp, Millersville University of Pennsylvania  
**Area:** Psychology

**Abstract:** College life is a time when young adults must cope on their own for the first time in their lives. While much research attention has focused on the relationship between positive physical (body) image and adaptive coping behaviors in college students (e.g. establishing intimate successful relationships, engaging in wellness behaviors), less is known about how psychological components of self image might be related to adaptive coping. This study was an effort to explore self image correlates of positive coping strategies among college students.

Sixty undergraduates took the Multidimensional Self Esteem Inventory (O’Brien & Epstein), and then described their typical coping strategies. We found relationships between adaptive coping and several psychological components of self esteem. Specifically, perceived likability and self control were significantly correlated with proactively taking the initiative to solve problems. Moral self approval was significantly associated with a coping style in which individuals reinterpret problems in a positive light.

**Keywords:** coping; college students; self image
POSTER 13: Synthetic Studies Toward Altersolanol P and Derivatives
Presenters: Tobias C. Bentzel and Brandon L. Frey, Millersville University of Pennsylvania
Mentors: Dr. Steven Merwin Kennedy, Millersville University of Pennsylvania
Area: Chemistry

Abstract: Altersolanol P (AP), a new member of the altersolanol family of compounds, is the inspiration for multiple synthetic studies in our laboratory. Previously, we synthesized an intermediate, containing the complete carbon framework of AP, via Lewis acid-mediated Diels-Alder cycloaddition on multi-gram scale (in 80% yield and 8:1 regioselectivity). Current synthetic efforts are focused on epoxidations, anti-diol formations, and syn-dihydroxylations of Diels-Alder adducts based on the work of Krohn et al. The biological activities of derivatives can be further studied.

Keywords: natural products, organic synthesis; methods development; Diels-Alder; regioselective

POSTER 14: Hydrogen Bonding in Polylactones to Improve Intermolecular Strength
Presenters: Frances Wenrich and Liam Schroeder, Millersville University of Pennsylvania
Mentor: Dr. Kathryn Allen, Millersville University of Pennsylvania
Area: Chemistry

Abstract: Petroleum-based, non-biodegradable plastics, such as LDPE, HDPE, and PETE, are used in storage containers, chairs, water bottles, grocery bags, fuel tanks, car parts, prosthetics and many other applications. They are ideal because they are stable, chemically inert, and strong. However, petroleum-based plastics are bad for the environment because, on average, it takes between 10 to 450 years for decomposition. Due to their durable properties, they can absorb, concentrate, and transport pollutants in the environment; threatening the natural flora and fauna.

Biodegradable plastics are a growing field of interest as a means to replace these petroleum-based plastics. Polyhydroxyalkanoates (PHA) integrate oxygen into the polymer hydrocarbon backbone, which allows it to biodegrade when exposed to three notable bacteria strains; Bacillus sp. IBP-V002, Entrobacter cloacae sp. IBP-V001, and Gracilibacillus sp. IBP-V003. The problem with PHA is that they possess weak intermolecular forces, which leads to a brittle plastic. The integration of oxygen into the polymer backbone renders them vulnerable to certain enzymes. The modification of δ-valerolactone, by α-substitution with aryl rings, will produce a monomer that will impart more ordered structure to the polymer sample. This increased order will cause the mechanical properties of the polymer to increase and produce a strong biodegradable polymer that can be used in place of commonly used plastics, but which possesses a smaller environmental footprint.
POSTER 15: A New Ru(II) Complex Containing Bulky ligands: Applications in Photodynamic Therapy
Presenter: Joseph Marold, Indiana University of Pennsylvania
Mentor: Dr. Avijita Jain, Indiana University of Pennsylvania
Area: Chemistry

Abstract: Cisplatin (cis-[Pt(NH$_3$)$_2$Cl$_2$]) and its analogs are a class of widely used anti-tumor drugs. The anti-tumor properties of cisplatin originate from its covalent binding to DNA. Ru(II) polypyridyl complexes with bulky ligands have been shown to covalently bind to DNA upon irradiation with light. Herein, we report synthesis, characterization, and photoinduced ligand exchange studies of a new Ru(II) based monometallic complex, [Ru(2,9-dmp)2dpp](PF$_6$)$_2$ containing bulky ligands including, 2,3-bis-2-pyridylpyrazine (dpp) and 2,9-dimethyl-1,10-phenanthroline (2,9-dmp).

Keywords: anti-tumor; cisplatin; ruthenium

POSTER 16: Analyzing the Nanostructure of a Peacock Feather Using Spectroscopy and Microscopy
Presenter: Dylan Huska, Millersville University of Pennsylvania
Mentor: Dr. Natalia Dushkina, Millersville University of Pennsylvania
Area: Physics

Abstract: Humans have been interested in colors since the dawn of time, and that is no different now. Our understanding of color has increased from learning how to harvest colors, to understanding how pigments work, and how to create them. The next step is to move in to structural colors, colors produced by light interacting with bio-nanostructures. The blue and green iridescent colors with metallic sheen that are found in nature, are products of structural coloration. One of the most beautiful displays of color is found in the eye of the Peacock feather.

This project will analyze the eye of the peacock feather using techniques in spectroscopy and microscopy. The spectrum reflected by the eye will be tested through multiple angles and multiple lighting scenarios. The eye of the feather will also be observed under a polarizing microscope to investigate the polarizing effects. In addition, the eye will be observed under a scanning electron microscope (SEM) to determine the shape and nature of the nanostructures that generate the magnificent color of the feather.

Keywords: nanostructure; structural colors; spectroscopy; microscopy; scanning electron microscope
**POSTER 17: Imine Library Synthesis via Solvent-Free Reactions**

**Presenter:** Samantha K. Gillis and Joy E. Thames, Millersville University of Pennsylvania  
**Mentor:** Dr. Steven Merwin Kennedy, Millersville University of Pennsylvania  
**Area:** Chemistry

**Abstract:** We have initiated studies to expand the scope of Touchette’s solvent-free imine formation reaction between ortho-vanillin and para-toluidine. These reactions are cost efficient and exhibit green chemistry properties. The primary goal of this project is to synthesize and characterize a variety of imines. We are taking two related approaches to this study: imine synthesis via para-toluidine and a library of substituted salicylaldehydes or imine synthesis via ortho-vanillin and a library of substituted anilines. Previous studies on structurally similar imine ligands—and their bidentate metal complexes—have revealed multiple biological activities for this class of molecules, including bactericidal properties. We hope to further explore the antibacterial properties of new all compounds produced from our synthetic work. Future studies also include reductive amination of the synthesized imines.

**Keywords:** imine formation; methods development; green chemistry; organic synthesis

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**POSTER 18: A Critical Analysis of Police Brutality Against African Americans Through a Social Work Perspective**

**Presenter:** Senneca Davis, California University of Pennsylvania  
**Mentor:** Dr. Azadeh Block, California University of Pennsylvania  
**Area:** Sociology

**Abstract:** The purpose of this research is to analyze the shooting of unarmed African Americans by police officers through theoretical lenses critical to the social work profession. The paper aims to suggest new ways of viewing this information in context and to identify methodologies that have been effective in addressing issues like implicit bias. To date the literature lacks a thorough review from a social work perspective. Methodology: Authors completed a thorough review of journal articles pertaining to police brutality in social work specific journals, additionally; data at the state and national levels was evaluated to underscore the presence of this social problem, at present, in the USA. The literature review revealed three relevant theoretical constructs: Contact Theory, Fundamental Attribution Error, and Critical Race Theory. Herein, authors apply these theories to better understand the “why” of police brutality and to present possibilities for prevention and treatment of this critical social problem.

**Keywords:** shootings of unarmed African Americans; fundamental attribution error; contact theory; critical race theory; strengths based practice; social work; police brutality; reconciliation
POSTER 19: Expanding the Green Scope of Pentaerythritol Acetal Formation
Presenters: John-Paul R. Marrazzo and Samantha N. Simon, Millersville University of Pennsylvania
Mentor: Dr. Steven Merwin Kennedy, Millersville University of Pennsylvania
Area: Chemistry

Abstract: Acetals are germinal diether derivatives of aldehydes formed by the reaction of an aldehyde with two alcohols. Collard et al. have shown that by utilizing temperature control, benzaldehyde and pentaerythritol, when mixed in water with catalytic acid, can selectively form monoacetal derivatives. The goal of our project is to expand the substrate scope of this monoacetal selective reaction to synthesize new monoacetals and to define their structure using 2D NMR techniques. Acetals similar to our target monoacetal products are used in a variety of synthetic applications. They have served as alcohol protecting groups in route to polymer-based adhesives and synthetic glycodendrimers for nanomedicine applications in drug delivery and vaccines. Our work should help to broaden the synthetic utility of this user-friendly and environmentally benign reaction. It is also hoped that this work will produce starting material for multistep synthesis routes optimized for use in advanced-level undergraduate teaching laboratories. Preliminary results based on studies using the NMR internal standard dimethyl sulfoxide indicate that many substituted benzaldehydes will provide a level of selective monoacetal formation.

Keywords: green chemistry; acetal formation; methods development; organic synthesis

POSTER 20: Construction of a LED Photolysis System for High Throughput Photochemistry
Presenters: Zachary Swope and Ty Stewart, Indiana University of Pennsylvania
Mentor: Dr. Avijita Jain, Indiana University of Pennsylvania
Area: Chemistry

Abstract: Ru(II) based polypyridyl complexes have shown promise in Photodynamic Therapy (PDT). These complexes covalently bind to DNA upon irradiation with light. Dr. Jain’s lab has developed and studied a series of sterically strained Ru(II) based PDT agents. However, no cell culture work has been done on these complexes due to the unavailability of a photolysis system. Herein we report, the design and construction of a LED photolysis system for high throughput photochemistry.

Keywords: photodynamic therapy
**POSTER 21: Multipotency of Trunk Neural Crest Cells in Trachemys scripta**

**Presenter:** Seth Martin, Millersville University of Pennsylvania  
**Mentor:** Dr. Judith Cebra-Thomas, Millersville University of Pennsylvania  
**Area:** Biology

**Abstract:** The bony plates of the ventral turtle shell (plastron) are formed by intramembranous ossification, which also generates some skull bones. Several anterior skull bones arise from a population of multipotent cells that migrate from the developing nervous system, known as neural crest cells (NCCs). Previous research has demonstrated that trunk NCCs, arising from the developing spinal cord instead of the brain, migrate in two distinct waves in turtle embryos. This experiment tested the hypothesis that the second wave of trunk NCCs can differentiate into bone. Differentiated T. scripta NCCs were analyzed, and the amounts of typical NCC derivatives and osteoblasts were compared. Results suggested that the late trunk NCCs are predisposed to bone formation; thus, they provide good candidates for plastron-forming cells. An improved understanding of intramembranous ossification, and analysis of an enriched population of osteogenic NCCs, could result in improved treatment options for human developmental maladies like craniosynostosis.

**Keywords:** turtle; neural crest cells; intramembranous ossification; bone; plastron; skull

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**POSTER 22: Validation of a neurobehavioral assay for testing 5-HT2A antagonist activity of novel compounds: dose-effect characterization of volinanserin**

**Presenter:** Olivia Kalimon, Indiana University of Pennsylvania  
**Mentor:** Dr. Daniel Widzowski, Indiana University of Pennsylvania  
**Area:** Biology

**Abstract:** Mirtazapine is an atypical antidepressant that blocks various neuroreceptors and has also been shown to reduce methamphetamine dependence; however, there are also negative side effects due to the drug’s lack of binding specificity. We want to develop a drug similar to Mirtazapine that will modulate the serotonin levels, specifically in receptor 5-HT2A, that will maintain the positive effects and lose the undesirable ones. Having confirmed the 5-HTP induced head twitch assay, we are now looking into the dose response of volinanserin, a 5-HT2A antagonist, to determine the most effective dose for blocking 5-HTP induced head twitch.
POSTER 23: Covalent Organic Frameworks for Optoelectronic Applications
Presenter: Natalie Sukanick, Millersville University of Pennsylvania
Mentor: Dr. Kathryn Allen, Millersville University of Pennsylvania
Area: Chemistry

Abstract: Bonding organic molecular building blocks by strong covalent bonds, such as imine linkages, to make crystals of 2- and 3-D extended structures, produces several new classes of porous materials called covalent organic frameworks (COFs). The construction of porous COFs has gained much attention due to the infinite applications for these species. COF possess low density, large surface area, and tunable pore size and structure. These features play a key role in maximizing the use of COFs for gas trapping, storing, and adsorption ability. This project proposes the synthesis of new classes of COF networks for basic research application. Primarily, we are interested in constructing regioregular, large COF and characterizing them by powder X-ray diffraction, solid-state spectroscopy, and thermogravimetric analysis.

POSTER 24: Estimating the Environmental Impacts of AMD Treatment Sites Using Near-Surface Geophysics and Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES); an Integrated Approach
Presenters: Manny Aviles, Aaron Seidel, Nicholas Santoro, Nicole Kelley, and Garrett Sharp.
Indiana University of Pennsylvania
Mentor: Dr. Gregory Mount, Indiana University of Pennsylvania
Area: Geosciences

Abstract: Acid mine drainage pollutes 27 billion gallons of water per year in the United States, effecting both the biological and geochemical balance of surrounding environments. With economic conditions placing limits on budgets, and cost effectiveness being an issue, the passive remediation technique with self-sustaining oxygenation is a process utilized for AMD sites. Our location of interest, the Tanoma Passive Remediation Site, located in Tanoma, Pennsylvania, which is an engineered wetland that treats 1500-2800 gallons of AMD per minute. The impact of AMD on the critical zone as well as atmospheric contributions to the methane budget is quantified using ICP-OES in combination with geophysical techniques. The relationship between iron concentrations and the amount of methane produced by the biologic and thermogenic decomposition of the iron can be assessed through an analysis of the individual data sets.

Our approach uses common offset ground penetrating radar (GPR) surveys to define the thickness from the wetland surface to the regolith or bedrock interface in order to create a volume model of gas-producing organic soils. Depth-profile cores are extracted to confirm soil column interfaces and determine changes in soil carbon content with depth. In addition, gas traps placed across the wetlands measure the spatial and temporal variability of methane gas released. Electrical resistivity tomography (ERT) will be used to provide a rapid and minimally invasive method to identify and monitor contaminant pathways from AMD remediation systems in the subsurface of the Critical Zone. Inductively coupled plasma optical emission spectroscopy (ICP-OES) and drone based aerial photography will also be utilized to research the presence and concentration of heavy metals with the treatment wetland and other surface water sources. Through this data we will be able to identify potential effect they have on the productivity and effectiveness of the remediation site through time.
POSTER 25: Determining the Roles of Inhibitor of Apoptosis (IAP) Domains for Inhibiting Caspases

Presenters: Mackenzie Storm, Kutztown University of Pennsylvania
Mentor: Dr. Matthew Junker, Kutztown University of Pennsylvania
Area: Biochemistry

Abstract: Apoptosis (programmed cell death) is a regulated process for destroying cells. Apoptosis is essential to normal growth and development. Apoptosis also protects against cancer and the spread of viral infection. Caspase enzymes promote apoptosis and enable a cell to die. Inhibitor of apoptosis proteins (IAPs) prevent apoptosis by binding and inhibiting caspases, allowing a cell to remain alive. Binding of certain apoptosis-promoting proteins to IAPs relieves the caspase inhibition to enable apoptosis to occur. IAPs typically contain 2-3 BIR (baculovirus IAP repeat) domains with intervening Linkers. For some IAPs, residues in the linker bind and block the caspase active sites but the BIR domains also influence caspase inhibition. To understand the functional role of the BIR domains in caspase inhibition, we are comparing the ability of different fragments of the Drosophila IAP DIAP1 to inhibit the Drosophila caspase DCP-1 using purified recombinant proteins and an in vitro caspase assay. DIAP1 contains 2 BIR domains (BIR1 and BIR2) and one intervening Linker. We find that both BIR domains enhance DIAP1 inhibition of DCP-1. A novel competition experiment indicates that the BIR1 likely functions by helping anchor the linker to DCP-1. The basis for BIR2 enhancement is being further investigated.
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Thank you for attending the 4th Annual PASSHE Undergraduate Research Conference in Science, Technology, Engineering, and Mathematics. I hope you enjoyed your trip to Millersville University and your conversations with colleagues across the State System.

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Congratulations again to all our presenters!

Sincerely,
Michael Jackson, Ph.D.
Dean, College of Science and Technology