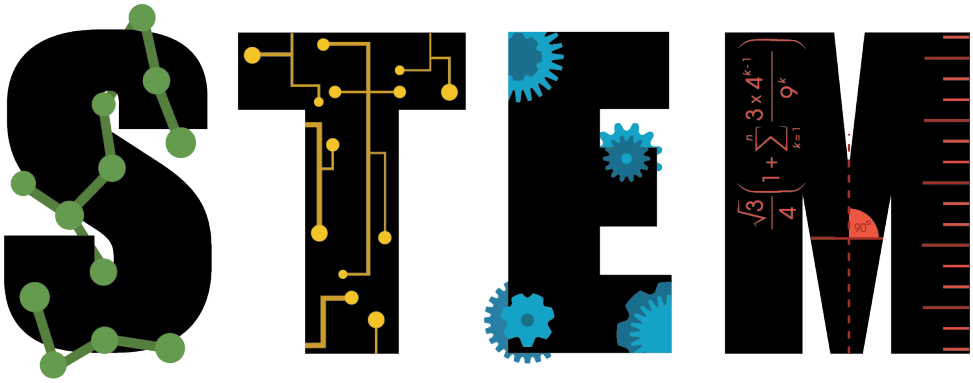
2023 PASSHE Student Research Conference in Science, Technology, Engineering and Mathematics



Pennsylvania's STATE SYSTEM of Higher Education

Hosted by

Kutztown University

Saturday, November 11, 2023

Welcome Message from the Provost

Welcome to Kutztown University and to the 2023 Annual PASSHE STEM Student Research Conference. We are so pleased to have you with us today and to host this important event that showcases the excellence of students of the Pennsylvania State System of Higher Education.

Research has repeatedly indicated that participation in STEM research is of high value for students pursuing undergraduate or graduate degrees. In addition to potentially adding to the body of knowledge about the subject matter, STEM research enhances scientific and mathematical analytic skills, problem solving, critical thinking, planning and follow-through, confidence, and often writing and presentational skills. This work can also contribute significantly to students' future careers, or ongoing educational pursuits.

Within the PASSHE system, student research is encouraged and supported by dedicated faculty who understand the value of such work in the intellectual development of our students. The collaborative spirit of these mentoring faculty members is reflected in the quality of the student work you will see in this conference.

Whether you are attending the conference as a presenter, a supportive friend or family member, a faculty mentor, or as a member of the PASSHE community who values STEM research, I wish you a productive and enlightening conference experience.

Lorin Basden Arnold, Ph.D.
Provost and Vice President for Academic Affairs
Kutztown University

Keynote Speaker: Caelan Brooks

Bio: Caelan Brooks is currently a third year PhD student in Physics at Harvard University. Her graduate school research has explored various fields such as theoretical biophysics, experimental immunology, and theoretical chemistry. She graduated summa cum laude from Kutztown University in 2021 with a B.S. in Physics and minors in Mathematics and Spanish. At KU, she worked with Prof. Kunal K. Das investigating ultra-cold atoms trapped in topologically unique lattices. Additionally, she completed a research project focusing on phenotypic patterns arising in B. subtilis biofilms through an REU program at Boston University. During her three years as an undergraduate, she was an honors program student, a member of the nationally ranked KU women's soccer team and served on the executive board of the local SPS chapter. Caelan is the recipient of the American Physical Society (APS) Leroy Apker award, given to just two students in the country for their undergraduate research contributions. As a graduate student, she has been awarded the National Science Foundation (NSF) Graduate Research Fellowship.

Title: Navigating Complex Systems as a Complex Researcher

Abstract: Upon coming to graduate school, amidst students derived from very different undergraduate institutions, I struggled to understand how Kutztown University fit into the academic landscape I was thrust into, and how I should, therefore, form my scientific identity. I found myself clinging to a few true touchstones: (1) Just like myself, many students arrive at KU without any knowledge of what scientific research is, let alone see themselves attending graduate school to do research; (2) I am certain that one of the major reasons I am in academia today is that I was introduced to the vivid world of physics by mentors who saw potential in me that I could not see in myself; (3) When the path to your goals is not clear it doesn't mean you don't belong on the path, just that you must find your own way. Holding these with me, I have begun to learn how to navigate the complex systems I find myself entangled in as I venture into spaces that I didn't know existed growing up. Along with descriptions of pivotal points in my academic journey, I will also take you on a tour through research I have done investigating various complex systems: from Bose-Einstein condensates trapped in optical lattices, to pattern forming bacterial biofilms, to excitons in light harvesting systems, to the process of evolution itself. I hope to demonstrate that although our paths to our goals may be complex, they also provide us with a unique perspective that make us equipped to accomplish them.

2023 PASSHE STEM Student Research Conference Program

November 11, 2023, McFarland Student Union (MSU)

8:50 – 9:20 am: **Registration and Continental Breakfast** (MSU 218)

9:20 – 9:30 am: **Opening Remarks** (MSU 218)

9:30 – 11:00 am: **First Poster Session** (MSU 223)

- ***Astronomy*** (AST 1-2)
- ***Computer & Information Sciences/Technology*** *(CIS 1-5)*
- ***Engineering & Engineering Technology*** *(EGR 1)*
- ***Geosciences*** *(GEL 1-8)*
- ***Marine Sciences (****MAR 1)*
- ***Psychology*** *(PSY 1)*

9:30 – 10:30 am: **Oral Presentation Session in Biology or Chemistry** (MSU 250)

- **Increasing the Potency of an Apoptosis Inhibitor Through a New Protein Self-Association Method,** Ethan Kucharski
- **Effects of T Cell Presence on Tumor Size, Microenvironment, and Responsiveness to Liposomal Curcumin Therapy,** Grace Long
- **Comparison of the Effects of Ibuprofen and the Natural Pain Reliever Turmeric on the Embryonic Development of the Common Chicken, Gallus Gallus Domesticus,** Monica Badea

11:00 – 11:30 am: **Lunch** (MSU 218)

11:30 am – 1:00 pm: **Second Poster Session** (MSU 223)

- ***Biology*** *(BIO 1-9)*
- ***Chemistry*** *(CHM 1-2)*
- **Computer & Information Sciences/Technology** *(CIS 6-8)*
- ***Geography*** *(GEG 1-2)*
- ***Math*** *(MAT 1)*

11:30 am – 12:50 pm: **Oral Presentation Session in Astronomy, Physics, or Environmental Sciences** (MSU 250)

- **Hunting for Exoplanets with the C. R. Chamblis Astronomical Observatory at Kutztown University,** Lauren Murphy
- **Interference Effects in Quantum Nonlinear Scattering,** Kathryn Gabriel
- **Utilizing the Structural Phases of MoS2 to Create More Secure Transistors and Hardware,** Christopher Barns
- **Temperature Change Over Time in Pennsylvania, 2000-2019,** Abby Wheeler

1:05 – 2:05 pm **Keynote Speech** (MSU 218)

- **Navigating Complex Systems as a Complex Researcher,** Caelan Brooks

2:05 – 2:15 pm **Awards Session** (MSU 218)

Oral Presentation Session in Biology or Chemistry

(9:30 – 10:30 am: MSU 250)

Session Chair: Dr. Matthew Junker

PRESENTATION 1: Increasing the Potency of an Apoptosis Inhibitor Through a New Protein Self-Association Method

Presenter: **Ethan Kucharski**, Kutztown University
Mentor: **Dr. Matthew Junker**, Kutztown University
Area: Chemistry

Abstract: Apoptosis has several regulatory pathways, one of them being the protein-protein interaction between inhibitor of apoptosis proteins (IAP's) and caspases, the executioner enzymes that trigger intracellular cascades to initiate apoptosis. IAP's bind to the two active sites of caspases to inhibit their ability to cleave other proteins and start the cascade. This project utilizes a new method of controlling protein self-association to dimerize IAP's to increase their efficiency for inhibiting the two active sites of each caspase. Heme activator protein 1 (HAP1) dimerizes when two monomers bind to its DNA binding-site. HAP1 was tethered to Drosophila DIAP1 as a fusion protein. Adding the HAP1 DNA binding-site to this fusion enhanced its inhibition of a Drosophila caspase by ten-fold, with 60% inhibition shifting from 50 nM fusion in the absence of DNA to 5 nM in the presence. Such dimerization could improve the potency of other caspase active site inhibitors.

Keywords: *apoptosis; IAP; caspase*

PRESENTATION 2: Effects of T Cell Presence on Tumor Size, Microenvironment, and Responsiveness to Liposomal Curcumin Therapy

Presenter: **Grace Long**, Commonwealth University of Pennsylvania
Mentor: **Dr. Kristen Long**, Commonwealth University of Pennsylvania
Area: Biology

Abstract: Pancreatic cancer possesses remarkable aggressiveness, and there is a growing need to develop new therapeutic approaches. Preclinical drug-development screenings often use T cell-deficient xenograft mouse models, and this immune cell difference could potentially contribute to the differences in responsiveness to therapy. Our lab aims to understand both challenges: development of a novel treatment and understanding what contributes to the differences in responsiveness between xenograft models and human patients. Here, we evaluated specific T cell populations in mice by depleting CD8+ or CD4+ T cells, or both in combination. Next, we implanted tumor cells and tested the anti-cancer effects of a novel therapy, Liposomal Curcumin. Identifying the major T cell population contributing to the changes in tumor phenotype may help us better understand the success of treatments in athymic mice models, as well as increasing the understanding of the potential effectiveness of Liposomal Curcumin therapy.

Keywords: *T-Cell; Tumor; Therapy; Liposomal Curcumin*

PRESENTATION 3: Comparison of the Effects of Ibuprofen and the Natural Pain Reliever Turmeric on the Embryonic Development of the Common Chicken, Gallus Gallus Domesticus

Presenter: **Monica Badea**, Kutztown University
Mentor: **Dr. Cristen Rosch**, Kutztown University
Area: Biology

Abstract: Non-Steroidal Anti-inflammatory drugs (NSAIDS) are the main pain relievers that are used when it comes to a common cold, headache, body sores, or anytime someone is in pain. Natural remedies are becoming an increasingly popular alternative for pregnant women to the use of over-the-counter pain relievers. Turmeric, a natural pain reliever, has been used for thousands of years to help with the relief of inflammation. Turmeric is believed to be safe to ingest during pregnancy in small amounts but no studies have been done to examine the effects on embryonic development. In this study, we will compare the effects of an over-the-counter NSAID to turmeric on the fetal development of chickens. We propose that turmeric will be less teratogenic than the over-the-counter NSAID, ibuprofen and therefore a safer choice for pain relief during pregnancy.

Keywords: *Developmental biology; biology*

Oral Presentation Session in Astronomy, Physics, or Environmental Sciences

(11:30 am – 12:50 pm, MSU 250)

Session Chair: Dr. Phillip Reed

PRESENTATION 1: Hunting for Exoplanets with the C. R. Chamblis Astronomical Observatory at Kutztown University

Presenter: **Lauren Murphy**, Kutztown University
Mentor: **Dr. Phillip Reed**, Kutztown University
Area: Astronomy

Abstract: NASA's Transiting Exoplanet Survey Satellite (TESS) has been on the hunt for new exoplanets and relies on the TESS Follow-up Observing Program (TFOP) Working Group (WG) to support its mission. Kutztown University (KU) astronomers, using the Carlson R. Chambliss Astronomical Observatory (CRCAO) on KU's campus, are active members of TFOP WG in Sub Group SG1: Seeing-limited Photometry. TESS was designed with a wide field of view in order to survey the entire sky in its first two years, but this often causes false positives due to blending between nearby stars. CRCAO has higher resolution and is therefore able to resolve these stars individually, so it becomes our job (i.e. the job of TFOP SG1) to verify which star is producing the observed TESS signal. This presentation will describe our exoplanet discovery process and showcase candidates that have recently been confirmed as planets due, in part, to our observations and analyses.

Keywords: *Exoplanets; Astronomy; Astrophysics*

PRESENTATION 2: Interference Effects in Quantum Nonlinear Scattering

Presenter: **Kathryn Gabriel**, Kutztown University
Mentor: **Dr. Kunal Das**, Kutztown University
Area: Physics

Abstract: "Scattering of wavepackets by barrier is a ubiquitous phenomenon in quantum mechanics that describes how coherent media interact with external potentials in a wide variety of systems. When wavepackets comprise of mutually interacting particles as in ultracold atoms, the scattering process becomes nonlinear in nature. Combined with quantum interference effects, the pattern of scattering, as a function of the barrier position, morphs from a sinusoidal pattern to a sawtooth pattern. Using a newly developed method we map out the shape of the scattered wavepackets with nonlinear analytical solutions based on Jacobi elliptic functions. We seek an explanation using this method for the morphing of the pattern for both positive and negative nonlinearity, which correspond to repulsive and attractive interatomic interactions respectively.

This work is supported by NSF Grants No. PHY-2011767 and PHY-2309025 for Dr. K. Das and a KU Bears grant for K. Gabriel and M. Lafferty.

Keywords: *Quantum Scattering; Nonlinear Dynamics; Ultracold atoms*

PRESENTATION 3: Utilizing the Structural Phases of MoS2 to Create More Secure Transistors and Hardware

Presenter: **Christopher Barns**, West Chester University
Mentor: **Dr. Scott Dietrich**, West Chester University
Area: Physics

Abstract: Finding ways to protect our technology from intellectual theft has become increasingly needed in recent years. While most people think of technology security in terms of software, many neglect the need to bolster the protection of our hardware. With the US pushing towards being a lead innovator in metal-oxide semiconductor field-effect transistors (MOSFETs), our innovations need to be protected from being stolen through reverse engineering. To aid this endeavor, we propose an alternative method of making MOSFETs by utilizing the structural phases of molybdenum di-sulfide (MoS2). Using a 30kV electron beam at 500pA, we expose the MoS2 flakes mounted on a SiO2 substrate to a variety of electron beam doses to create patterns of its 1T metallic phase surrounded by the rest of its 2H semiconductor phase. Through this method, di-material logic gates are possible, which will negate traditional reverse engineering techniques and will substantially fortify device security.

Keywords: *2D Materials; vdW Materials; Structural Phases; Hardware*

PRESENTATION 4: Temperature Change Over Time in Pennsylvania, 2000-2019

Presenter: **Abby Wheeler**, Kutztown University
Mentor: **Dr. Michael Davis**, Kutztown University
Area: Environmental Science & Geography

Abstract: Pennsylvania is in the Northeast region of the United States, which has a humid continental climate with wide fluctuations in average seasonal temperatures, hot summers (77°F), and cold winters (28°F). In recent years with the increase in urban development across the state anthropogenic climate change is becoming more and more noticeable. This study collects data in two methods from NOAA, first on summer high and low and winter high and low temperatures and a similar method but from all 4 seasons instead of just two 6-month periods, from all 67 counties in Pennsylvania in the past 20 years. They will be analyzed in excel and SPSS by looking at change over time for each county over the time span through standard deviation and t-tests. In GIS, the data will be visually displayed, and the weather the average, minimum and maximum temperatures changed significantly over the course of 20 years.

Keywords: *Pennsylvania; Temperature; County; Climate Change; Season*

First Poster Session (9:30 – 11:00 am, MSU 223)

Astronomy (AST 1-2):

POSTER 1: **Theoretical New Method in Discovering Pulsating White Dwarfs Orbiting Around Dim M-type Stars**
Presenter: **Philip Jahn**, Kutztown University
Mentor: **Dr. Phillip Reed**, Kutztown University
Area: Astronomy

Abstract: White dwarfs, due to their low luminosity, are very difficult objects for astronomers to detect. For instance, if a white dwarf were in an eclipsing binary system with a Sun-like star, the white dwarf would be outshined by a factor of 100 or more. However, a new theoretical method could provide future astronomers with a way to identify new pulsating white dwarfs. Using data from NASA's Transiting Exoplanet Survey Satellite (TESS) in combination with synthetic data, we illustrate this method of binning and phase-folding the data to show a sine wave, indicating a pulsating white dwarf orbiting the brighter main sequence star.

Keywords: *Astronomy; Astrophysics; White Dwarfs; NASA; TESS*

POSTER 2: **Python Coding in Solar Science**
Presenter: **Genevieve MacFarlane**, Kutztown University
Mentor: **Dr. Phillip Reed**, Kutztown University
Area: Astronomy

Abstract: The sun goes through active and inactive cycles with a period of approximately eleven years. We are currently approaching a maxima of activity in solar cycle 25. This past summer we had a National Science Foundation (NSF) grant to do research at the University of Southern Queensland (UniSQ). During this time we used a Hydrogen-Alpha solar telescope on a German equatorial mount to track the rise in activity and collect data over the course of a month. We looked for events on the surface and edge of the sun. A code was written in Python using OpenCV to process the raw data as the images were not centered when taken and some images were rotated off the standard orientation of the others. This code could also be used to differentiate objects in images from their surroundings as the main function is finding contours based on pixel value.

Keywords: *Sun; Python*

Computer & Information Sciences/Technology (CIS1-5):

POSTER 1: **Chat Disentanglement Different Classifiers**
Presenter: **Atom Roese**, Kutztown University
Mentor: **Prof. Jici Huang**, Kutztown University
Area: Computer & Information Sciences/Technology

Abstract: We compare and improve upon different methods of identifying and tracking separate conversations occurring simultaneously in a single text. Such data is plentiful in the form of chat messaging apps and meeting transcripts, but is difficult to use effectively for other natural language processing applications without disentanglement. Two methods we compare a neural network used in a 2008 paper to a randomforest classifier added by later papers building upon it. We also improve on the efficiency and accuracy of these implementations.

Keywords: *classsifier; neural-network; randomforest; disentanglement; chat; messaging; natural-language-processing; machine-learning*

POSTER 2: **Long-Term Map Maintenance Using Mobile Robots**
Presenter: **Patrick Perrin**, Kutztown University
Mentor: **Dr. Dylan Schwesinger**, Kutztown University
Area: Computer & Information Sciences/Technology

Abstract: Navigation of changing environments with mobile robots when using traditionally static internal environment representations is a challenging problem. This approach to Simultaneous Localization and Mapping (SLAM) problems operates on the assumption of a stable environment which can quickly lead to inaccuracies in long-term autonomous navigation. A probabilistic approach to a typical environment representation has the notable advantage of adaptability. When applied to an uncertain environment, future predictions of the environment state can be made using collected sensory data. To further enhance the accuracy of these predictions, we include the additional metric of temporal stability which is the certainty of a particular landmark's state at any given time.

Keywords: *SLAM; robotics; temporal stability; statistics*

POSTER 3: Macroeconomic Factors affecting Financial Markets using Machine Learning

Presenter: **Sai Sravya Anem**, West Chester University
Mentors: **Dr. Md Amiruzzaman**, West Chester University
Dr. Ashikahmed Bhuiyan, West Chester University
Area: Computer & Information Sciences/Technology

Abstract: Macroeconomic factors profoundly influence the dynamics of financial markets, providing positive and negative correlations that create relationships between economic conditions and market performance. This study performs a comprehensive analysis of the datasets of these factors and studies their profound implications on financial markets. Positive correlated factors and negative correlated factors tend to induce fluctuations and trends based on market corrections as they challenge economic stability and influence investor sentiment. Understanding how macroeconomic factors interact with financial markets is vital for predicting market behavior and adapting to evolving economic conditions. Statistical analysis and machine learning techniques enable the detection of hidden patterns and correlations. The findings of this study will help people in the financial market to better understand the complex global finance system and to make more informed decisions and forecasts with the existing information.

Keywords: *forecast; macroeconomic; machine learning; prediction*

POSTER 4: Hawk Mountain Bird Simulation Conversion

Presenter: **R-E Miller**, Kutztown University
Mentor: **Dr. Dale Parson**, Kutztown University
Area: Computer & Information Sciences/Technology

Abstract: This is a conversion project from Processing (Java) to P5.js (JavaScript) involving the simulation of a bird simulation in a web application.

Keywords: *Java; JavaScript; computer science; IT; birds; simulation; website; web application; application*

POSTER 5: Generative AI and its Relevance to Business Education and Small Business Operations

Presenter: **Sarah Seader**, Pennsylvania Western University
Mentor: **Dr. Mark Lennon**, Pennsylvania Western University
Area: Computer & Information Sciences/Technology

Abstract: Implementation of Artificial Intelligence (AI) is a topic that has brought on new challenges, as well as solutions. New tools focusing on Generative AI, such as ChatGPT, can offer a wide array of features to improve processes, increase efficiency, and reduce cost. ChatGPT was developed in November 2022 by OpenAI to serve as a type of chatbot to be interactive with the user. Can Generative AI be integrated at PennWest University to help facilitate students, staff, and faculty to be more efficient and effective in their academic endeavors? Generative AI is a powerful tool that can be incorporated into academic programs helping with tutoring through focusing on grammar and citations, generating lesson plans, and helping to automate processes. However, AI has limitations as it is unable to fact check. This research will help determine new uses for this technology at PennWest University, through studying and analyzing several use cases.

Keywords: *Generative AI*

Engineering & Engineering Technology (EGR1):

POSTER 1: Characterization of Laser Properties for Frequency-domain Thermoreflectance Measurements

Presenter: **Sohayla Emam**, Kutztown University
Co-Presenter: **Zak Claman**, Kutztown University
Fatima Kamara, Kutztown University
Michael Lafferty, Kutztown University
Justin Tuttle, Kutztown University
Mentor: **Dr. Justin Smoyer**, Kutztown University
Area: Engineering & Engineering Technology

Abstract: "Thermal management is fundamental to scientific and technological applications ranging from electronics to energy conversion. Due to the barrier excess heat has on electronic devices, the field of thermal management has expanded into the nanoscale to better understand thermal transport processes. One widely adopted approach involves the utilization of the frequency-domain thermoreflectance (FDTR) technique, which is an optical pump-probe method using two continuous-wave lasers to heat a surface and detect the resulting temperature change to collect precise thermal property data. Precise thermal measurements rely heavily on the knowledge of laser properties.

The objective of this work is to characterize the spot size of the lasers using two distinct methods: the knife edge and the beam profiler. Our results compare, which technique yields the most precise data minimizing error. The data collected will provide a deeper knowledge of nanoscale heat transportation enabling enhanced thermal performance in a variety of electronic applications."

Keywords: *Laser; Thermoreflectance; Thermal Transport*

Geosciences (GEL 1-8):

POSTER 1: Pine Forge Mansion
Presenter: **Linda Zúñiga**, Kutztown University
Mentor: **Dr. Laura Sherrod**, Kutztown University
Area: Geosciences

Abstract: Pine Forge Mansion is a historical industrial site once owned by Thomas Rutter. At this location, a grist mill sits along the edge of the Manatawny Creek. Though damaged by fire in the early 1990s, much of the original building remains. However, little is left of the 19th-century industrial workings, and the original millstones are believed to be buried south of the grist mill in a large grassy area adjacent to the creek.
Geophysics is often used at archaeological sites to visualize subsurface characteristics in non-invasive ways. Magnetometer and ground penetrating radar surveys (GPR) were performed over an area of 135ft by 60ft in the lawn south of the grist mill to assess potential buried structures and to locate the remains of millstones. Multiple areas of interest were identified through these geophysical surveys, and future excavations will be performed by the property manager to confirm the interpretations of the results.

Keywords: *grist mill; historical; geophysics*

POSTER 2: Taphonomy of a Multi-ootaxa Eggshell Lag Deposit, the Late Cretaceous Mussentuchit Member, Cedar Mountain Formation, Utah
Presenter: **Jaylin Calistro**, Kutztown University
Co-Authors: **Dakota Pittinger**, Kutztown University
Garrett Rogers, Kutztown University
Jason Staunton, Kutztown University
Mentors: **Dr. Edward Simpson**, Kutztown University
Dr. Kurt Friehauf, Kutztown University
Area: Geosciences

Abstract: This study describes a multi-ootaxa, fragmental eggshell lag deposit in the Late Cretaceous Mussentuchit Member of the Cedar Mountain Formation, Utah and interprets the deposits with the aid of modern neotaphonomic experiments.
The Mussentuchit eggshell-bearing lag deposits consists of a series of three lenses composed of a graded pebbly sandstone passing vertically into mudstone, sheet flood deposit.
In optical microscope thin section, samples of shell exteriors display varying degrees of abrasion and corrosion from minimally-affected ornamented surfaces to complete destruction. Near complete to partial mammillary tips are preserved. Post-depositional modification included compaction-related styolites and conjugate fractures.
Sedimentary corrosion was replicated in tumbling experiments with modern eggshells. SEM analysis of these samples documented preserved fossilized bacteria community, corrosion of calcite grains, groove marks on exterior, the absence of cuticle and sediment-filled pores. Comparison with modern taphonomical experiments, we conclude Mussentuchit eggshells were modified both by sedimentary transport and post-burial processes.

Keywords: *Paleontology; Taphonomy; Eggshells; Cedar Mountain Formation*

POSTER 3: **A Field Emission Scanning Electron Microscopic Examination of Eoplis Ekdalei Ichnofossil Late Jurassic Morrison Formation, Additional Evidence for A Termite Genesis**

Presenter: **Alayna Rea**, Kutztown University
Mentor: **Dr. Edward Simpson**, Kutztown University
Area: Geosciences

Abstract: Rock samples collected from the Morrison Formation in Utah were analyzed to observe fossil and structural evidence to termite life. We found that there is evidence to support that social insects such as termites left remnants that can be observed in rock cuttings and supports evidence of fungal harvesting. Fungal evidence found in these samples is important to social insect research and is the first seen preserved at such an old age. Termite ichnofossils play an important role in understanding how termites have changed through time.

Keywords: *Ichnofossils; Paleontology; Entomology; Morrison Formation*

POSTER 4: **A Neotaphonomic Analysis of Galloanserae Eggs**

Presenter: **Joshua Scherer**, Kutztown University
Co-Authors: **Jamie Cook**, Kutztown University
Dakota Pittinger, Kutztown University
Mentors: **Dr. Edward Simpson**, Kutztown University
Dr. Kurt Friehauf, Kutztown University
Area: Geosciences

Abstract: This neotaphonomic study documents biogenic and geogenic mechanisms driving destruction in eggs and compares egg degradation during burial and microbiome development of over six months of chicken eggs as analogs for dinosaur eggs.
Twelve eggs were buried in two types of substrates: Rodale Institute organic-rich topsoil and commercial potting soil. FESEM analysis of eggshells sampled periodically over six months revealed a progressive increase in microbially-induced corrosion of eggshell cuticle and membrane. Microbial communities population and biodiversity developed more rapidly in organic soil compared to commercial potting soil. Eggshell exterior cuticle developed a biofilm of Bacillus sp., Streptobacillus sp., coccus bacteria and fungi. Biofilm patches dominated by diverse suite of fungi proliferated by month 5. Fungal spores and hyphae, plant debris, putative fowl mites, and nematodes were also found. Observations made of fossilized fragmented dinosaur eggs show similar microbiome and degradational deformation.

Keywords: *Paleontology; Biology*

POSTER 5: The Suspected Dryville Cabin Grounds Cemetery
Presenter: **Kadisha Vallejo**, Kutztown University
Mentor: **Dr. Laura Sherrod**, Kutztown University
Area: Geosciences

Abstract: Geophysics, the study of inner Earth processes and phenomena, is crucial to near-surface investigations because most geophysical methods are non-intrusive, accurate representations of the subsurface. Ground penetrating radar (GPR) is one type of geophysical method that is used to image the subsurface via the reflection of electromagnetic pulses sent into the ground. The strength and return time of these signals allow the identification of subsurface structures, such as burials. Berks County is home to a myriad of historic cemeteries, some of which contain unmarked graves or burials lost to time due to lack of proper maintenance. GPR was utilized at the Dryville cabin grounds for the purpose of confirming the possible existence of an unmarked graveyard mentioned in property records. All GPR profiles were analyzed for hyperbolic reflections which could be indicative of burials, resulting in the identification of a few potential burial zones within the geophysical survey grid.

Keywords: *burial geophysics; Dryville; cemetery project; GPR*

POSTER 6: Paleohydrological Changes In Surface Water And Groundwater Over Time in Cleveland- Lloyd Dinosaur Quarry, Utah
Presenter: **Mirna Torres Ayala**, Indiana University
Mentors: **Dr. Jonathan Warnock**, Indiana University
Dr. Kenneth Coles, Indiana University
Area: Geosciences

Abstract: The Cleveland-Lloyd Dinosaur Quarry in Utah forms part of the Morrison Formation, well known for its ability to preserve dinosaur bones. Studying ground and surface water changes through time will help to understand the preservation conditions. Stratigraphic columns near the quarry reveal the variation in lithologies and sedimentary structures. This variation enables reconstruction of the depositional environment at these locations and how water flow changes through time. The main lithologies present are first, mudstone forming from very fine silt and clay particles that settle in still water, and second, sandstone which consists of sand grains that were transported by water flow and finally compacted. The transition in lithologies indicates that part of the Morrison Formation experienced a change from a swampy environment to one dominated by streams allowing dinosaur bones to be preserved in these sedimentary rocks.

Keywords: *Paleohydrological; Cleveland-Lloyd; sedimentary rocks; lithologies; preservation; depositional environments*

POSTER 7: Utilization of PA North Central 2019 LiDAR for Ground Truthing Historic Mine Maps of Fallbrook, PA

Presenter: **Samuel Rozanski**, Commonwealth University
Mentors: **Dr. Linda Kennedy**, Commonwealth University
Dr. Lee Stocks, Commonwealth University
Area: Geosciences

Abstract: This research utilizes Pennsylvania's new North Central QLS LiDAR dataset, produced by the US Geological Survey, to analyze and validate the accuracy of historical mine maps at Fallbrook, Pennsylvania. The usage of the LiDAR dataset allowed researchers to observe ground features that were previously unknown and uncover new features related to this historic mining town. Accuracy of the PA North Central LiDAR dataset has proven invaluable for ground truthing historical maps of the area to verify their accuracy and potentially discover new features on the landscape. Location of these unmapped features and determination of their purpose is important for analyzing potential geomorphological and environmental impacts of historic human activity on the present day landscape. The value of this dataset is that following the ground-truthing of historic maps, pollution tracing through water sources, such as Acid Mine Drainage (AMD), and volumetric analysis of fossiliferous shale spoil can be performed.

Keywords: *LiDAR; Fallbrook; Ground-truthing; Mapping; Mining; AMD*

POSTER 8: Geology Fieldwork in an Interactive Gaming Environment

Presenter: **Dane Fegely**, Kutztown University
Mentor: **Dr. Sarah Tindall**, Kutztown University
Area: Geosciences

Abstract: In order to evaluate whether research-quality structural geology measurements can be gathered in a video game environment using in-game tools, we created an interactive 3D model of a real geological field site using Unity game generator. We used approximately 200 photographs of a folded rock outcrop near Kutztown, PA to create a 3D model using Agisoft Metashape. We imported the model into Unity and added the Structural Geology Query Toolkit, specialized geology tools developed by Needle et al., 2022. The result is an interactive 3D game interface where the user can measure and analyze geologic features. We compared measurements taken in the game environment to field data gathered at the same outcrop, achieving consistent results. Our project demonstrates that the 3D gaming environment can provide an efficient and accurate method for obtaining research-quality geologic data. This method will be particularly useful for dangerous or inaccessible field sites.

Keywords: *Geology; Interactive virtual environment; Photogrammetry; Field data collection; Gaming*

Marine Sciences (MAR 1):

POSTER 1: Investigating 20,000 Years of Environmental Changes in Custis Pond, Savage Neck Dunes Natural Area Preserve (SNDP), Eastern Shore, Virginia

Presenter: **Gabriella DeMarco**, Kutztown University
Co-Presenter: **Hannah Sellers**, Kutztown University
Co-Author: **Dr. Sean Cornell**, Shippensburg University
Mentor: **Dr. Adrienne Oakley**, Kutztown University
Area: Marine Sciences

Abstract: Recent studies put local sea level rise (SLR) along the coasts of the Delmarva Peninsula at 3-4 times the global average, making this region highly vulnerable. At SNDP, located on the Chesapeake Bay, the rapidly eroding shoreline exposes layers of ancient soils (paleosols) overlain by large sand dunes and threatens a diverse maritime forest and freshwater bogs and ponds. Custis Pond, located just east of the shoreline, contains a sedimentary record of environmental change likely resulting from sea level changes since the last glacial maximum, ~20K years ago. This study aims to determine the depositional environments represented by sediments obtained from 5, 1-3.5 m-long vibracores extracted from the pond in 2021-2022, tie the sediment cores to historical records and aerial photography, determine how core sediments correlate with the paleosol at the shoreline, and add to the broader understanding of climate change and SLR in this region.

Keywords: *Marine Geology; environmental change; paleosol; sediment cores; stratigraphy*

Psychology (PSY 1):

POSTER 1: An Inquiry-Based Learning Activity to Reduce Mental Health Stigma Among College Students

Presenter: **Megan Tewksbury**, Kutztown University
Co-Author: **Dr. Meghan Owenz**, Jacksonville University
Mentor: **Dr. Meghan Owenz**, Jacksonville University
Area: Psychology

Abstract: Mental health stigma negatively affects the self-perceptions of those with diagnoses, including lowered self-esteem and self-efficacy and unwillingness to seek treatment (Downs, & Eisenberg, 2012). Some research suggests that mental health stigma may be only minimally affected by taking undergraduate psychology courses and researchers suggest there should be more emphasis on stigma reduction efforts in psychology curriculum (Jamieson et al., 2022). There has been a recent push within the field of abnormal psychology to rename the field. As such, the popular flagship journal, Journal of Abnormal Psychology, has recently been changed to the Journal of Psychopathology and Clinical Science to address this issue in 2022 (Patalay & MacDonald, 2022). Additionally, the course name “Abnormal Psychology” is both inaccurate, as up to 83% of people will be diagnosed with a mental health disorder in their lifetime (Angst et al., 2016; Schaefer et al., 2017; Copeland et al., 2011; Farmer et al., 2013) and potentially stigmatizing in and of itself. This poster presents a mixed-methods analysis of a group inquiry-based learning activity to rename abnormal psychology courses. Pre- and post-analyses suggest the activity reduced stigmatized attitudes towards mental health conditions. Qualitative analysis of student responses suggests students found the activity engaging and it resulted in increased course ownership.

Keywords: *inquiry-based learning; mental health stigma; undergraduate education; scholarship of teaching and learning*

Biology (BIO 1-9):

POSTER 1: Investigating the Effects of Resveratrol on EMT Using a Zebrafish Model System

Presenter: **Alexis Hill**, Commonwealth University
Mentors: **Dr. Jennifer Venditti**, Commonwealth University
Dr. Abby Hare, Commonwealth University
Dr. Kristen Brubaker, Commonwealth University
Area: Biology

Abstract: Cancer has been a topic of research for many years and there have been several scientific triumphs in treatment development. Many current non-surgical treatments, like chemotherapy and radiation, can have negative consequences for patients. While these treatments are intended to target cancer cells, they often affect healthy cells. A compound that has shown promise in several studies as a potential cancer treatment with limited side effects is resveratrol. While resveratrol has been studied extensively for its impacts on various pathways, the complete mechanism is not completely understood. The overall aim of this study is to evaluate the effects of resveratrol on epithelial mesenchymal transition (EMT) using a zebrafish model system. Possible target proteins to be evaluated include FNDC3B, E-cadherin, and Vimentin. Bioinformatics and dot blotting techniques will be utilized.

Keywords: *cancer; polyphenol compound; treatment; EMT; wnt; FNDC3B; xenograft; zebrafish; metastasis; carcinoma*

POSTER 2: Ctb9 Yeast Two-Hybrid Screen

Presenter: **Therese Coleman**, Kutztown University
Mentor: **Dr. Cristina Cummings**, Kutztown University
Area: Biology

Abstract: Cell division is regulated through checkpoints and regulatory proteins. Specific cell cycle proteins are targeted for degradation by adding ubiquitin, which marks the protein for breakdown. Cullin-RING multi-protein complexes, such as Cul3, are used to identify specific proteins to be targeted for destruction. Cul3 targets proteins that control cell division, interacting with various adaptor proteins to allow the targeting of an array of proteins. Ctb9 (Cul3-binding-9), a BTB protein, is one such adaptor protein that interacts with Cul3. BTB proteins often have other cellular functions. We performed a yeast two-hybrid screen to identify proteins that interact with Ctb9 to begin to learn more about its functions. Through our screen, we found 33 positive interactions with Ctb9 from the prey library. PCR and gel electrophoresis on yeast colonies showing positive interactions was followed by sequencing to determine the identify of proteins found to interact with Ctb9.

Keywords: *Ctb9; Yeast Two-Hybrid; Protein Interactions*

POSTER 3: Sleep Deprivation and Caffeine Effect on Skeletal Muscular Endurance in Mice

Presenter: **Faith Cameron**, Commonwealth University
Mentor: **Dr. Kristen Long**, Commonwealth University
Area: Biology

Abstract: Our research evaluated the effect of caffeine consumption on muscle endurance during a state of sleep deprivation. Here, three groups of mice were established: one control 12:12 light-cycle group with access to a constant water supply, and two 24-hour light exposure groups to induce sleep deprivation. One 24-hour group had constant water, and the other experimental 24-hour group had a caffeinated water supply. Wire hang time and grip strength were measured to evaluate muscle endurance. Body mass and blood-glucose levels were used as measurements of body homeostasis to confirm a sleep deprived state in the 24-hour light exposure groups. Hematocrit levels were recorded to evaluate potential dehydration in the caffeinated water group. Our results indicate that use of caffeine in a state of sleep deprivation does not significantly impact muscle endurance, and therefore, does not give a related benefit to individuals using caffeine as a substitute for regulated sleep.

Keywords: *Sleep Deprivation; Caffeine; Muscle Endurance*

POSTER 4: Identifying Fungi With Antibacterial Activity From Soil

Presenter: **Ashley Follett**, Kutztown University
Mentor: **Dr. Kaoutar El Mounadi**, Kutztown University
Area: Biology

Abstract: Fungi secrete a broad spectrum of secondary metabolites that have potential antimicrobial activity. This project aims at isolating fungi that exhibit antibacterial activity from the soil of a potato field at the German Heritage Center in Kutztown Pennsylvania. Twelve fungal strains were isolated and characterized microscopically and molecularly. The isolates were then tested for their antibacterial activity against the soilborne plant pathogen Agrobacterium tumefaciens; the human pathogen Escherichia coli; and the bacterium Bacillus megaterium. Out of the twelve fungal isolates tested, two exhibited antibacterial activity against A. tumefaciens. None of the fungal strains had any effect on the growth of E. coli and B. megaterium. These preliminary data are significant as A. tumefaciens is a pathogen of plants and there are few management strategies to control it on agricultural crops. Thus, the fungal isolates with antibacterial activity identified in this project could be developed into biological control agents against A.tumefaciens.

Keywords: *Fungi; Antibacterial; Antimicrobial*

POSTER 5: Effects of Dietary Curcumin on Gut Microbiota
Presenter: **Kristen Fulford**, Commonwealth University
Mentor: **Dr. Kristen Long**, Commonwealth University
Area: Biology

Abstract: There is a growing interest in understanding how the gut microbiota can influence disease development and progression, leading us to question whether the make-up of the gut microbiota can influence how pancreatic cancer develops, progresses, and resists therapies. To address this question and augment the gut microbiota/its induced inflammatory state, curcumin was added as a daily supplement to an experimental group of mice. Curcumin contains anti-cancer properties, has a generally low toxicity, and inhibits inflammatory pathways. When experimental and control mice were challenged with an intraperitoneal injection of tumor cells, we found that the experimental curcumin group had significantly less spread/metastasis of the tumor cells compared to control mice. Here, we investigate and identify the differences in gut bacterial populations between groups and pre- and post-implantation of tumor cells. Understanding how the gut microbiota can influence inflammatory states will allow researchers and doctors to manipulate microbiota as a therapeutic approach.

Keywords: *curcumin; gut microbiota*

POSTER 6: Evaluation of the Anti-Tumor Effects of Capsaicin
Presenter: **Kade Showers**, Commonwealth University
Mentor: **Dr. Kristen Long**, Commonwealth University
Area: Biology

Abstract: Cancer treatment effectiveness is often constrained by factors like microenvironmental resistance, location, and the lack of early detection capabilities. Aggressive cancers, such as pancreatic cancer, pose a challenge due to their resistance to common therapies like radiation and chemotherapy. To address the limited treatment options, exploring alternative, affordable, and accessible treatments is vital. Some studies have examined using herbal compounds, like capsaicin found in hot peppers, to combat cancer growth by triggering cell death. In this study, capsaicin will be tested on three different murine cancer cell lines, derived from genetically modified mice, as well as nonmalignant murine fibroblasts. Researchers will expose these cells to capsaicin in varying doses and durations to assess its cytotoxic effects, measuring viability with a Presto Blue assay. Investigating capsaicin's impact on pancreatic cancer cells can advance cancer research, potentially offering new treatment options for patients.

Keywords: *Capsaicin; Pancreatic Cancer*

POSTER 7: Induced Cytotoxicity of Essential Oils

Presenter: **Eilie Holland**, Commonwealth University
Co-Author: **Dr. Kristen Long**, Commonwealth University
Mentor: **Dr. Kristen Long**, Commonwealth University
Area: Biology

Abstract: Antibiotic resistance is an ever-growing problem, as resistant pathogens can grow and spread at an uncontrollable rate. Adding to this problem, funding to support the development of new antibiotics has significantly decreased. Interest has now shifted to essential oils, which are known to have antimicrobial properties. Here, we evaluated the antimicrobial properties of two essential oils, ginger and rosemary, and their application as a potential therapy. Their antimicrobial properties were tested using a disc diffusion assay and by determining the minimum inhibitory concentration (MIC) of each oil, as tested against various types of bacteria. MIC of each oil was then applied to fibroblasts to determine potential safety issues and/or limitations to use, by evaluating potential cytotoxicity using the presto blue assay. Essential oils that exhibit antimicrobial properties and contain a MIC that does not induce cytotoxicity in fibroblasts can be looked at as possible treatments against bacterial pathogens.

Keywords: *Antibiotic resistance; antimicrobial properties; Essential Oil; Cytotoxicity*

POSTER 8: Function of Sleep in Response to Genotoxic Stress

Presenter: **Savannah Conrad**, Commonwealth University
Co-Author: **Dr. Hilary Debardeleben**, Commonwealth University
Mentor: **Dr. Hilary Debardeleben**, Commonwealth University
Area: Biology

Abstract: We tested the role of stress-induced sleep pathways following UV exposure in the activation of the DAF-16 mediated stress response. We used a DAF-16:: GFP fusion strain to visualize the localization of DAF-16 which translocases into the nucleus following UV radiation in non-sleeping worms compared to worms who do sleep. Additionally, we quantitatively assessed the role of sleep in DNA repair using embryonic lethality assays. We found that sleep led to an increase in embryonic lethality after UV exposure compared to non-sleeping worms. This led us to hypothesize that apoptosis is not being induced in the germline of worms who cannot sleep. This hypothesis led to us using acridine orange staining and cell corpses to visualize activation of the apoptosis pathways following UV radiation.

Keywords: *Sleep; Genotoxic stress; Microbiology; C. elegans*

POSTER 9: An Investigation of Microbial Communities Residing on the Plastisphere in Local Freshwater Communities.

Presenter: **Hailey Snyder**, Pennsylvania Western University
Co-Presenter: **Zara Medhi**, Pennsylvania Western University
Elizabeth Brucker, Pennsylvania Western University
Sky Byrem, Pennsylvania Western University
Mentor: **Dr. Bryan Crable**, Pennsylvania Western University
Area: Biology

Abstract: Since World War 2, plastics have become ubiquitous in aquatic habitats. Microplastics – particles < 5 mm – are especially concerning. Microbial communities inhabiting the plastisphere in marine environments are well-studied. However, because freshwater environments are more variable, these communities remain underexplored. Through a National Science Foundation grant, we investigate the physiological diversity of microorganisms in the freshwater plastisphere. We isolated 9 organisms from plastic surfaces in contact with the water column of Lake Edinboro: 4 Gram-negative and 5 Gram-positive. Sequencing their genomes using the MinION platform will offer insights into their adaptation and role in the plastisphere. This genomic data will enhance our understanding of plastisphere life, revealing potential ecological impacts and microbial interactions.

Keywords: *microplastics; microorganisms; freshwater ecosystems; plastisphere; genome sequencing*

Chemistry (CHM 1-2):

POSTER 1: Searching for Enzymes in Wood-Rot Fungi to Use in Biofuel Production
Presenter: **Jacob Terdik**, Kutztown University
Mentor: **Dr. Matthew Junker**, Kutztown University
Area: Chemistry

Abstract: This project is developing methods to identify fungi with enzymes that break down lignocellulose. These enzymes could be useful for turning waste wood into glucose for biofuel production. To determine if break down of lignocellulose was happening, initial studies were done on fungi found outside on deadfall. These fungi were then tested in a dinitrosalicylic acid assay to detect the production of reducing sugars from the breakdown of cellulose. Incubation of fungus with purified cellulose produced an 18-fold increase in moles of glucose present in the solution compared with cellulose alone demonstrating strong cellulase activity. Incubation with wood showed an 11-fold increase in glucose compared with wood alone showing that this fungus also had the enzymes for breaking down lignin in order to access the cellulose. This fungus thus contains enzymes that could be harnessed for biofuel production. Tests are continuing with defined strains of fungus.

Keywords: *Enzymes; Fungi; Biofuel*

POSTER 2: Thermodynamic Effects on the Fabrication of Gold Nanoparticles
Presenter: **Robert Lucchi**, Commonwealth University
Co-Author: **Stephan Budkin**, Commonwealth University
Mentor: **Dr. Daniel McCurry**, Commonwealth University
Area: Chemistry

Abstract: Cyclic Voltammetry (CV), under potential displacement (UPD) of a sacrificial lead ion layer, and X-Ray diffraction (XRD) were used to analyze the effects of temperature on the surface morphology of gold nanoparticles deposited on a gold or glassy carbon electrode in a solution of 3.033 mM lead chlorate and 0.930 mM sodium tetrachloroaurate after surface limited redox replacement (SLRR) was used. SLRR was used to deposit lead ions onto a gold monolayer and galvanically displaced by gold ions and analyzed via CV and XRD to help determine the lattice and crystal structure of the formed gold nanoparticles. The number of cycles of SLRR that were performed and the temperature at which it occurred were compared using CV and XRD to determine the thermodynamic impact on the structure. There were significant differences in the intensity and overall charge density of the peaks in the 60 °C and 5 °C trials.

Keywords: *Electrochemistry; Gold Nanoparticles; Cyclic Voltammetry; Under Potential Deposition; Surface Limited Redox Replacement*

Computer & Information Sciences/Technology (CIS 6-8):

POSTER 6: Optimization of Energy Consumption in Real-time Systems Using IoT Devices

Presenter: **Sreeja Bethi**, West Chester University
Mentors: **Dr. Ashikahmed Bhuiyan**, West Chester University
Dr. Md Amiruzzaman, West Chester University
Area: Computer & Information Sciences/Technology

Abstract: The increasing demand for electricity necessitates innovative solutions to optimize energy consumption. This research delves into the realm of Real-Time Operating Systems deployed in Internet of Things (IoT) devices, aiming to develop energy-efficient algorithms. The focus is on balancing the multifaceted needs of IoT applications, including low latency, energy efficiency, and optimal resource utilization. The objective is to enhance IoT systems' overall performance and responsiveness while minimizing power consumption. This study introduces an energy-efficient scheduling framework that combines data-driven methods, machine learning, and real-time scheduling. Machine learning identifies consumption patterns. Energy-efficient scheduling algorithms, like DVFS and predictive scheduling, are explored to reduce energy use while meeting real-time demands. The findings of this research would help develop smart cities, offering a practical framework for optimizing energy consumption in IoT devices.

Keywords: *energy consumption; IoT; optimization; real-time*

POSTER 7: Survey of Deep Learning Techniques in American Sign Language Translation

Presenter: **Daejour Jones**, West Chester University
Mentors: **Dr. Stefanie Amiruzzaman**, West Chester University
Dr. Md Amiruzzaman, West Chester University
Area: Computer & Information Sciences/Technology

Abstract: Informed by a wide range of papers, this research is an investigation into the world of American Sign Language (ASL) that makes use of the capabilities of deep learning and machine learning techniques. Our main goal is to have a greater grasp of the ASL applications and technologies that serve as the project's framework. We browse a comprehensive selection of articles on topics including ASL animation creation, real-time ASL interpretation, and ASL alphabet recognition, all of which provide insightful perspectives on how technology and culture interact. Our approach is based on a thorough analysis of these articles that focuses on their main conclusions, research methods, and difficulties. We seek to determine the future direction of ASL technology by critically evaluating the misconceptions and technological challenges addressed by these works. Our research reveals the complex connection between deep learning and ASL, illuminating the field's transformational potential.

Keywords: *ASL; deep learning; survey*

POSTER 8: ASL-to-English, English-to-ASL: An Exploratory Approach to Translating Manual Language and Spoken Words

Presenter: **James May**, West Chester University
Mentors: **Dr. Stefanie Amiruzzaman**, West Chester University
Dr. Md Amiruzzaman, West Chester University
Area: Computer & Information Sciences/Technology

Abstract: This presentation will exemplify a proof of concept for a two-way American Sign Language (ASL) and English translation program. Our approach demonstrates the capability of taking an audio file as an input and then creating a video translation consisting of letters and numbers in ASL as images in sequence to the words spoken in the audio file. In addition, our approach also demonstrates the ability to predict signs that are shown in video and output the matching English text. The results of our approach indicate a strong first start to begin expanding the scope of the program with future work.

Keywords: *ASL; deep learning; translation*

Geography (GEG 1-2):

POSTER 1: Warehousing and E-Commerce in Berks County, PA
Presenter: **Anthony DeFusco**, Kutztown University
Mentor: **Dr. Moira Conway**, Kutztown University
Area: Geography

Abstract: Warehousing and distribution centers are increasing in numbers, especially in Berks County, Pennsylvania due to e-commerce growth. The growth has spread from neighboring county, Lehigh County one of the largest regions of manufacturing in the world. Furthermore, the open and available land near major roadways makes it more enticing for developers who are interested in building large warehouses to accommodate freight loads. The rise in warehousing and distribution centers in Berks County has come with many side effects. This study examines the amount of truck traffic on major roads in Berks County, as well as changes in multiple land use aspects such as land value. The use of Geographic Information Systems shows where these phenomena occur and reveals patterns in the geographic distribution on warehouses in Berks County.

Keywords: *warehousing; e-commerce; land use*

POSTER 2: Plastic Waste Management in Krakow, Poland
Presenter: **Isabella Webb**, Commonwealth University
Co-Author: **Dr. John Bodenman**, Commonwealth University
Mentor: **Dr. John Bodenman**, Commonwealth University
Area: Geography

Abstract: This project examines the opportunities and challenges of plastics waste management, focusing specifically on KMPO and the facility in Krakow, Poland which has made significant gains in plastic materials recovery since Poland's accession into the European Union (EU) in May 2004. EU extended producer responsibility (EPR) regulations, combined with German technology (SUTCO), relatively inexpensive polish labor, and a policy commitment in Poland to increase rates of recycling, has led to rapid increases in rates of materials recovery, particularly for plastics. This study utilizes a field work and case study approach to highlight the processes and successes of KMPO in Krakow, addressing specifically the processes that manage the "end life" of plastic, including practices that could be adopted in the United States and elsewhere to improve materials recovery. Potential plastics waste prevention approaches are also highlighted, with suggestions for creating an eco-friendly plastics management environment.

Keywords: *Plastic; Krakow; Recycling; European Union (EU); Extended producer responsibility (EPR)*

Mathematics (MAT 1):

POSTER 1: **Modeling Host-Parasitoid Population Dynamics**
Presenter: **Jared Guhl**, Kutztown University
Mentor: **Dr. Brooks Emerick**, Kutztown University
Area: Mathematics

Abstract: Early mathematical models of the host-parasitoid interaction include the discrete-time Nicholson-Bailey model, which is known to be unstable, i.e. coexistence is impossible. In this research, we explore the stability of the system using both numerical and analytical methods to investigate the response of the host larvae to multiple parasitoid populations. The model under consideration involves three types of parasitoids: two specialist species and one generalist species. The generalist can oviposit in any type of host, while the specialists can only infect on their respective host. Such selective competition among parasitoid species is common in natural systems. We demonstrate how stability in the system is achieved through selective competition with various forms of parasitic attack.

Keywords: *Parasitoids; Nicholson-Bailey; Modeling; Python*

Acknowledgements

Thank you for attending the 2023 PASSHE Student Research Conference in Science, Technology, Engineering, and Mathematics. We hope you enjoyed your visit to Kutztown University and your conversations with colleagues across the State System.

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Congratulations again to all our presenters! We hope to see you at the next Annual PASSHE Student Research Conference in Science, Technology, Engineering, and Mathematics.

Sincerely,

Conference Organization Committee

Brooks Emerick, Associate Professor, Mathematics
Eric Laub, Instructor, Physics
Yun Lu, Professor, Mathematics (chair)