

Abstracts: Oral Presentations

All oral presentations will take place in the Devon Room

History

(1:30 p.m.)

Investigating the Origins of Chinatown

Author: Schlupp, Frank

Advisor: Dr. Joseph Ryan

In Philadelphia at 913 Race Street, a historical marker stands in front of a building where a Chinese migrant named Lee Fong opened a laundromat in 1870. It reads simply, “Philadelphia, Chinatown, Founded in the 1870s by Chinese immigrants, it is the only ‘Chinatown’ in Pennsylvania. This unique neighborhood includes businesses and residences owned by, and serving, Chinese Americans. Here, Asian cultural traditions are preserved, and ethnic identity perpetuated.” Yet the marker, and often conventional history, leaves out significant details regarding Philadelphia’s early contact with China which dates to the period before American independence from Britain. Early trade with China included opium which destabilized that country and led to the migration of thousands to the western hemisphere. As for the founder of Chinatown, Lee Fong, surprisingly little is known. The purpose of this research is to tell the story, as best as possible, of Lee Fong and the struggles of other Chinese immigrants who came to the United States in the latter half of the 19th century using books, scholarly and newspaper articles, and the City of Philadelphia archives. This research implicates white supremacist ideology in the persecution of Chinese immigrants. White supremacist attitudes towards Chinese people were clearly expressed in legislation which institutionalized anti-Asian racism in the laws which governed immigration, naturalization, the right to vote, and the right to serve on juries. In answering the related question of the origins of Chinatown, this research centers the accomplishments of Lee Fong and his fellow immigrants who successfully resisted efforts to exclude and expel them to establish an ethnic enclave that survives today.

Humanities

(1:45 p.m.)

The Invisible Self: A Transformation of Acedia for Contemporary Culture

Author: Reen, Ashleigh

Advisor: Dr. Paul Camacho

In *Lost in the Cosmos: The Last Self-Help Book*, Walker Percy poses the following question: “Why is the [modern] self so afraid of being found out?” In his answer, Percy proposes that the modern self is a ghost, an “abyss of nothingness”, a sheer invisibility such that to be a “self” in the modern sense is in fact to be nothing at all. In this project, I link the increasing desire for invisibility to the surge of acedia in contemporary culture. Traditionally, acedia has been understood as sorrow over the good; and, because the question of the good is a question of ultimacy, the thinking about acedia has tended to be theological. Therefore, acedia is sorrow over the divine good: if God is Goodness itself, and if God created man in His image, then the acedic person hates the very nature of what she is. This hatred is not an impassioned wrath but a numbness, which, in its apathy, desires for the self to wholly disappear. I first combine ancient accounts of acedia from the early desert fathers with modern philosophical descriptions to provide a contemporary interpretation of an ancient phenomenon. This interpretation is the backbone of my research as I draw on Dante’s *Divine Comedy* and Soren Kierkegaard’s *The Sickness Unto Death* for literary examples of sloth, despair, neutrality, and invisibility as desiring to be forgotten by God. I detail the transformation of acedia in the modern context into the desire for the self to become wholly invisible, wanting to disappear entirely because the innate goodness of the self and the world can no longer be seen.

Mechanical Engineering

(2:00 p.m.)

Nanostructural and Nanomechanical Mapping of Sea Urchin Tooth

Authors: McCarry, Riley; Stark, Alyssa; Feng, Gang

Advisor: Dr. Gang Feng

Sea urchin tooth (SUT) is composed of calcite crystals and organic molecules as unique hierarchical nanocomposite, which keeps sharpening during use. To understand the self-sharpening behavior, a comprehensive understanding is needed. In this study, the SUT’s longitudinal section have been characterized for the first time using confocal Raman microscopy for nanostructural mappings (Ca and Mg) and nanoindentation for nanomechanical mappings (modulus E and hardness H). The E and H correlate well with the Mg concentration in calcite, and the stone region contains much higher Mg concentration and is ~30% stiffer and ~30% harder than the surrounding regions. Moreover, E, H, Mg and Ca distributions show two hierarchical levels of periodicity: (1) a large one (~10 micron), matching that of plates, and (2) a small one (~ 1 micron). Indentation-induced cracking is also studied to find the intrinsic preferential cracking path. This provides important insights on SUT’s self-sharpening mechanism.

Philosophy

(2:15 p.m.)

Political Anthropology and New England Wisdom: How the Puritan Political Tradition Can Enrich America's Natural Rights Doctrine

Author: Keepman, Peter

Advisor: Dr. Mark Shiffman (St. Patrick's Seminary & University)

America is a nation founded on a doctrine of natural rights. This doctrine is illuminated in the Declaration of Independence, Constitution, and Bill of Rights, and is the cornerstone of American national and individual identity. Curiously, in recent years, Americans have begun to identify themselves as possessing rights beyond those explicitly stated in America's founding documents. For example, the increasing presence of "safe spaces" at universities and workplaces points to the actualization in public life of a new individual right to be free from offense. Given the more expansive use of the term "right" in public discourse, questions arise as to whether the meaning of the term "right" as intended in America's founding documents reflects a sufficiently capacious view of anthropology and whether America's natural rights doctrine is sufficient enough to aid a person in the navigation of authentic political life. To address these questions, my research explores the history of natural rights in Classical Antiquity, Medieval Scholasticism, and the Enlightenment, and America's relationship to this history. Drawing on the work of modern thinkers, I reflect on what anthropological vision America's founding documents hold, and what that anthropology can learn from the understanding of rights laid out in Classical Antiquity and the Catholic Intellectual Tradition. I conclude by arguing that America's present tradition of natural rights could be greatly enriched by the Puritan political tradition, a tradition that has the advantage of a Socratic and Medieval Scholastic heritage, while at the same time being familiar to American soil.

Political Science

(2:30 p.m.)

Serving All Who Serve: Synergizing and Redefining Efforts in Military Transition

Author: Wade, Sean

Advisor: Dr. John Harles

The Veterans Administration's (VA) is responsible for providing care and access to programs for veterans and their families. That access and care, however, is dependent on the characterization of one's service and awareness of support services available to departing servicemembers. Inadequate transition programs provided by service components have left many veterans without care and purpose in post-military life. Furthermore, nonjudicial punishment (NJP) imposed without the due process afforded during other proceedings can leave veterans without vital services needed for a successful military transition. Since the integration of African American and female Americans into combat roles within the U.S. Department of Defense (DOD), the VA has struggled to keep pace with the changing demographics of the military and veteran populations. Furthermore, the increased

survivability of combat wounds and complexity of modern war has instigated the need for more intensive life long care and treatment for veterans serviced by the VA. The uniqueness of the modern American servicemember demands a military that is committed to honoring the service of each individual. This commitment is fulfilled by not only proper training and equipment for each occupation, but by also ensuring there is a proper Transition Assistance Program to prepare service members for civilian life. By synchronizing efforts with the DOD, the VA can usher veterans to a fulfilling and healthy life fit to the uniqueness of each veteran.

Abstracts: Posters

All poster presentations will take place in the Villanova Room

Astrophysics and Planetary Science

A-01: Antares on the Verge: Period Analyses of One of the Closest Red Supergiant Core Collapse Supernova Progenitors

Authors: Marici, Ed; Guinan, Edward

Advisor: Dr. Edward Guinan

Antares A is a ~ 0.6 - 1.4 -mag irregular variable M1.5 Iab star. Antares and Betelgeuse (M2.5 Iab) are the two nearest red supergiants (RSG) and core collapse supernovae progenitors. Unlike Betelgeuse, Antares has a companion (B4V:Antares B) and is near its birthplace in the Upper Sco OB Association. We analyzed 70 years of photometric data from the American Variable Star Observers (AAVSO) database and the Hipparcos mission. Due to its -26.25° declination, the star is difficult to observe from the Northern Hemisphere where airmasses often exceeded $z > 2.5$. As a result, it has received far less attention than its more northern counterpart, Betelgeuse. Due to the infrequency of observation, we split the analysis into segments with the 1988-2023 holding the most substantial and reliable data. In the Peranso suite, a CLEANest power spectrum and WWZ-wavelet were used. Three dominant periods were uncovered. One of 348 ± 25 days and longer periods of 850 ± 65 d and 3080 ± 320 d. An additional period of $8,000 \pm$ days was also discovered when analysis of the full 70 years of photometric data was conducted. Antares is a neglected but important supernova progenitor. High precision timeseries photometry, preferably from the Southern Hemisphere is sorely needed. This research is supported by Villanova Undergraduate Research Fellowship (VURF). We thank the many AAVSO observers who carried out visual and photoelectric observations. We also thank Don Corona for carrying out CCD photometry.

A-02: Increasing the Precision of Red Giant Eclipsing Binary Parameters

Authors: Callahan, Laura; Prsa, Kelly

Advisor: Dr. Kelly Prsa

The aim of this research is to determine the masses and radii of a red giant and its main sequence companion within an eclipsing binary star system. The red giant star selected is KIC 9970396, chosen for its evenly distributed radial velocity data and well-defined eclipses. We first downloaded the light curve for the binary system from the Kepler Eclipsing Binaries Catalog; the light curve was then detrended in python. Next, the PHOEBE (PHysics Of Eclipsing BinariEs) modeling code was applied to the detrended data. We applied estimators to get an initial model fit to the data; the physical parameters were based on geometric considerations. The Nelder-Mead optimizer was then applied. During optimization, parameters were adjusted until the model most closely matched the depth and width of the eclipses in the light curve, as well as the shape of the radial velocity curve. The results of this research are the updated masses and radii for the red giant and the main sequence component. The next step in this research will be to apply Markov chain Monte Carlo in order to have greater confidence in our results. The purpose of this work is to improve the precision of the

masses and radii of a large sample of red giant stars in eclipsing binary systems. Our goal is to measure masses and radii to better than 1% relative precision, in order to calibrate the asteroseismic scaling relations and to subsequently increase the precision of thousands of red giant masses and radii.

A-03: Modeling Oscillating Red Giant Binary Systems Using PHOEBE

Authors: Keshri, Riya; Hambleton, Kelly

Advisor: Dr. Kelly Hambleton

Much of stellar physics relies heavily on the fundamental stellar properties determined using eclipsing binary systems. In this project, we use the newly developed PHOEBE program to model KIC 10001167, an oscillating red giant binary star observed by Kepler to determine the masses and radii of the stellar components. To do this, we first download the light curves for the given binary system. We then detrend the data and group them together to create a single light curve. Using the literature values as estimates, we apply the Nelder Mead optimizer to model the detrended binary star light and radial velocity curves. These steps result in new values for the masses and radii of the stars in the binary system, which we then compare to the literature values that we initially used as estimates. The next step is to use the Markov-Chain Monte Carlo sampler, also known as MCMC, to obtain posteriors for the fundamental parameters, which will additionally give us robust parameter uncertainties. The goal of this project is to measure the masses and radii to better than 1% precision in order to improve on the currently accepted literature values and ultimately calibrate the asteroseismic scaling relations for red giants.

A-04: Refining Masses and Radii in Eclipsing Binary Systems for the Purpose of Calibrating the Asteroseismic Scaling Relations

Authors: Maldonado, Jennelle; Hambleton, Kelly

Advisor: Dr. Kelly Hambleton

Binary systems, consisting of two stars orbiting each other, play a significant role in astronomical research by offering insights into stellar properties and behaviors. Eclipsing binary systems, where one star passes another leading to periodic changes in brightness, are particularly intriguing because they provide the opportunity to determine precise masses and radii. Eclipsing binary systems featuring a red giant are of particular importance as they allow us to investigate the asteroseismic scaling relations. In this research, we focus on the red giant binary system: KIC 7037405. Inspired by a previous study, we reanalyze the system and increase the precision of kinematically determined masses and radii. We begin by analyzing the binary system's light and radial velocity curves, where we apply detrending techniques that remove excess noise and systematic effects. Using the PHOEBE (PHysics Of Eclipsing BinariEs) software, we use estimators to derive critical parameters that provide insights into the physical characteristics and interactions between the stars within the binary system. We then optimize the light curves and radial velocities using the Nelder-Mead method to minimize residuals. Our future endeavors involve the application of the MCMC (Markov Chain Monte Carlo) technique to increase our confidence in the masses and radii and their uncertainties. Through this research, we aim to achieve red giant mass and radius measurements to better than 1% relative precision, which then enables independent calibrations of the scaling relations.

A-05: Super-Habitable Earth-Like Exoplanet KOI-4878.01: Age and X-UV Irradiances hosted by a Solar Twin

Authors: Chawda, Aryan; Guinan, Edward; Engle, Scott

Advisor: Dr. Edward Guinan

KOI-4878.01 is an Earth-size exoplanet candidate that orbits within the habitable zone (HZ) of its ~ 12 -mag G4V host star (Frasca *et. al.* 2016). KOI-4878 is 1075 light years away and has properties similar to Earth: $R \sim 1.05 R_{\oplus}$; $T_{eq} 257K$ ($T_{eq\oplus} \sim 255K$); orbital period ~ 449 days. From the analysis of the transit eclipse data from Kepler, the radius of the planet is consistent with a rocky (terrestrial) planet. The bolometric irradiance is $S_{eff}/S_{\oplus} \sim 0.92$ (=instellation: analogous to the insolation for the Sun-Earth), yielding temperatures like Earth. If confirmed, KOI-4878.01 would be one of the most Earth-like planets found so far. The age of the star is poorly known and finding a reliable age is important in discerning the chances for complex life to develop. Utilizing Age-Rotation relations for G-type stars from the Villanova “Sun in Time” program (Guinan and Engle (2009 AIPC #1135), we determine an age of $\sim 6.1 \text{ Gyr} \pm 2.5 \text{ Gyr}$. This older age is in accord with the star’s sub-solar metallicity of $[Fe/H] \sim -0.29$, its solar-like space motions, and low photometric inactivity. The XUV irradiances are found to be less than currently received by the Earth. This is primarily due to its greater distance ($a=1.125 \text{ au}$) from its G4V host star. If confirmed, KOI-4878.01 could possibly be a more suitable planet for hosting complex life than Earth. Despite its distance KOI-4878.01 is an appealing SETI target. Transmission spectra secured with JWST during its long (12.6 hr) transits may be able to reveal spectroscopic evidence of an atmosphere and water.

A-06: Synthesizing the Milky Way Using Stellar Multiplicity

Authors: Hensler, John; Prsa, Andrej

Advisor: Dr. Andrej Prsa

Preexisting computational models of the Milky Way function by creating a synthetic stellar catalogue effectively made up of just single star systems. We convert a percentage of these catalogues to systems of higher multiplicity by pairing coeval single stars from an existing model’s catalogue within a distance range. These systems are then assigned functional periods, eccentricities, and inclinations by a defined set of parameter density functions. The results are then compared iteratively to data from the TESS and Kepler telescopes to judge accuracy of the parameter distributions to the Milky Way, creating a functioning IMF catalogue of both single and multiple systems.

Biochemistry

A-07: Investigating the toxicity of Redox Cycling of Tert-butyl hydroquinone and Manganese Porphyrins in Leukemic Cancer Cells (Jurkats)

Authors: Jung, Hannah; Pinero, Gabriel

Advisor: Dr. Aimee Egger

Modern day treatments against cancer like chemotherapy and radiation are widely known to be extremely toxic to both cancerous and normal cells causing adverse effects. This project explores a new way to selectively kill cancer cells by exploiting their higher levels of oxidative stress while preserving healthy cells. Past undergraduate researchers have discovered that the combination of

manganese porphyrins (MnP) and tert-butylhydroquinones (tBHQ) would be highly toxic to leukemic T cells (Jurkats). The lab has proposed that the MnPs catalyze the tBHQ to ultimately produce an oxidized product of tBHQ, tert-butyl quinone (tBQ), and hydrogen peroxide. We hypothesized that the hydrogen peroxide produced therefore induces apoptosis in cancer cells while normal cells are capable of withstanding the attack. During the summer, we worked to refine the LC50 of tBHQ, and tBQ in combination with Mn (III) meso-tetrakis(N-n-butoxyethyl-pyridinium-2yl) porphyrin, MnTnBuOE-2-PyP5+ (MnBuOE). To prove the proposed redox cycling mechanism, an LC50 curve of tBQ was performed. We reported an LC50 value of 31.6 +/- 5.489 μ M while Joey Lamorte reported it to be 29.5 +/- 2.7 μ M from his thesis. This experiment not only proved the proposed redox cycling mechanism, but it also proves that tBQ is not the inducing factor for apoptosis in Jurkats. To show the toxicity of the combination of tBHQ and MnBuOE, a double titration with the presence and absence of the MnBuOE at different tBHQ ranges were performed. The LC50 value was found to be 0.4107 +/- 0.0358 μ M with the MnBuOE while the LC50 value was 4.858 +/- 0.2639 μ M without the MnBuOE.

A-08: K63-linked polyubiquitinated substrates induce phase separation of ubiquitin shuttle proteins

Author: Llivicota-Guaman, Jennifer

Advisor: Dr. Daniel Kraut

Ubiquitin shuttle proteins can facilitate protein degradation by delivering ubiquitinated substrates to proteasomes. They may also protect substrates from degradation under certain cellular conditions. Shuttle proteins simultaneously bind ubiquitinated substrates via C-terminal ubiquitin associated domains and proteasomal ubiquitin receptors via N-terminal ubiquitin-like domains. STI1-like domains in central intrinsically disordered regions allow for self-interaction of some shuttle proteins like human ubiquilin 2 (UBQLN2). Conditions promoting UBQLN2 oligomerization have been characterized, whereby the presence of K63-linked polyubiquitin chains promotes liquid-liquid phase separation in vitro. However, less is known about the way in which shuttle proteins interact with ubiquitinated substrates. Using sedimentation assays, we examined how ubiquitinated substrates impact the phase separation behavior of UBQLN2 and human Rad23B as well as their yeast homologs Dsk2 and Rad23. In all cases, K63-linked polyubiquitinated substrates promoted phase separation of shuttle proteins in a concentration-dependent manner. UBQLN2 phase separated more readily than the other shuttle proteins, and the 26S proteasome also could co-sediment with UBQLN2 and K63-linked substrates. In contrast, K48-linked substrates did not significantly induce phase separation for any of these shuttle proteins. Interestingly, K63-linked substrates did not always phase separate with the shuttle proteins. Under phase separation conditions, K63-linked substrates robustly co-sedimented with UBQLN2 but not Rad23B, Dsk2, or Rad23. These findings suggest that although K63-linked ubiquitin controls phase separation of multiple shuttle proteins, different phase separation mechanisms are at play.

Biology

A-09: Analysis of the ARID-1 chromatin-associated complex during aging in *C. elegans*

Author: Burns, Emma

Advisor: Dr. Matthew Youngman

Cell identity and function is determined through gene regulatory programs, including epigenetics regulation by chromatin restructuring, in part through histone modification. This regulation is disrupted during aging, resulting in loss of cell identity. The ARID protein family regulates histone modification by recruiting histone deacetylases (HDACs) that promote gene silencing. ARID4A, a known mammalian tumor suppressor, has an unknown role during aging. Using the roundworm *Caenorhabditis elegans* as a human surrogate, our lab has shown that without the ARID4A ortholog, ARID-1, lifespan is shorter and sensitivity to stressors is increased. Interestingly, ARID-1 is expressed predominantly within head neurons of *C. elegans*. To understand ARID-1 function in aging, I have used co-immunoprecipitation and RNAi-mediated knockdown to identify ARID-1 binding partners. Initial attempts to immunoprecipitate an epitope-tagged version of ARID-1 from worm lysates yielded low amounts of a protein of the correct molecular weight as detected by western blotting. To improve the yield of ARID-1, a nuclear fraction was prepared from lysates, resulting in an enrichment of a subset of proteins. In a separate approach, I used RNAi to functionally characterize candidate ARID-1 interactors. I targeted *spr-3* and *spr-4*, *C. elegans* orthologs of mammalian REST complex subunits, which functions within neurons and contributes to longevity. In adult animals *spr-4* knockdown phenocopies RNAi targeting *arid-1*, resulting in increased susceptibility to the bacterial pathogen *Pseudomonas aeruginosa*. My results indicate that, like ARID-1, SPR-4 contributes to innate immunity raising the possibility of a physical association between the two proteins. Identifying components of the ARID-1 complex is important to understand the role of ARID-1 in preserving health later in life.

A-10: Changes in call structure patterns of Carolina chickadees in the summers of 2022 and 2023

Authors: Edmark, Caoimhe; Curry, Robert; Coppinger, Brittany

Advisor: Dr. Robert Curry

In highly social animals, communication plays a key role in group dynamics. Carolina Chickadees calls are important for social cohesion and their call can be influenced by a variety of factors including mate, food, and environmental changes. It is unknown how repeatable individual chickadees behavior and call structure is year to year as well as how the population changes as a whole. We used a standardized threat to elicit alarm calls from parents at our study site nests, we recorded their calls and have scored and analyzed the sonograms of these calls to determine the extent to which call structure changes from the Summer of 2022 to 2023. A preliminary look at the data indicates little difference between the populations, however as more data is analyzed a larger trend may be uncovered. These results can help us understand the extent to which environmental factors influence communication in social animals.

A-11: Determining the age-dependent site of action and substrate specificity of DAF-18, a PTEN-like phosphatase in *C. elegans*

Author: Berisha, Elizabeta

Advisor: Dr. Matthew Youngman

An organism's ability to withstand stress and repair cellular damage is correlated with its longevity. FOXO proteins are evolutionarily conserved transcription factors that regulate expression of genes important for stress resistance and lifespan determination. Studies of the roundworm *Caenorhabditis elegans* as a human surrogate in our lab revealed that although the FOXO ortholog DAF-16 is usually only triggered by stress early in life, the transcriptional activity of DAF-16 increases with age even in the absence of environmental insults. Dynamic activity of DAF-16 during aging requires DAF-18, an ortholog of the mammalian lipid/protein phosphatase PTEN, in what appear to be chemosensory neurons. The goal of this project is to identify the neuron in which DAF-18 is expressed and to decipher DAF-18's catalytic activity during aging as either a lipid or protein phosphatase. To locate the neuron, genetic crosses between DAF-18::GFP males and hermaphrodites with red fluorescent marker proteins expressed in selected chemosensory neurons were performed. Fluorescence microscopy of F1 progeny have ruled out at least three chemosensory neurons as possible sites of DAF-18 expression. To determine DAF-18's enzymatic activity, the pathogen sensitivity of *daf-18* strains bearing mutations that disrupt either of the phosphatase functionalities was compared to the complete loss-of-function mutant. Preliminary results suggest that the mutants lacking DAF-18 lipid phosphatase activity die at a similar rate from infection as total loss of function mutants, suggesting that DAF-18 may function as a lipid phosphatase during aging. Characterizing the function of DAF-18 in adult *C. elegans* will have implications for the role of PTEN during aging in humans

A-12: Exploring the role of dynamin-1-like protein in *Trypanosoma brucei*

Authors: Donio, Frank; Pereira, Alexa; Madeline, Malfara

Advisor: Dr. Megan Povelones

Trypanosoma brucei undergoes structural alterations to adapt to different host environments including reconfiguration of the mitochondrial network from a highly branched structure to a single tube. In yeast and mammals, membrane remodeling events often involve dynamin-related proteins (DRPs). In contrast, *T. brucei* relies on a sole multifunctional dynamin-like protein (TbDLP) for vesicle scission during endocytosis and organelle division. No interacting proteins have yet been identified for TbDLP and understanding its precise molecular mechanisms is complicated due to its involvement in multiple cellular pathways. We conducted tandem affinity purification of DLP and interacting partners in the related kinetoplastid *Crithidia fasciculata* and successfully identified 30 potential DLP interactors. To test the role of two of these proteins we have generated constructs for RNAi mediated knockdown of these hypothetical proteins, Tb927.6.3980 and Tb927.4.2990. Preliminary results from RNAi experiments in procyclic form parasites, which usually reside in the fly midgut, indicate that the depletion of these proteins does not significantly impact cell growth. However, we are currently in the process of confirming the extent of the knockdown through qPCR. We have also examined knockdown cells for effects on organelles such as glycosomes (using immunofluorescence with a rabbit α -aldolase antibodies), mitochondria (using a MitoTracker dye), and the nucleus/mitochondrial DNA (stained with DAPI). So far there are no discernible differences in phenotype when comparing Tb927.4.2990 RNAi cells to control cells. We are in the process of tagging and knocking down Tb927.4.2990 in bloodstream form parasites since

endocytosis is more active in this life cycle stage. We can use an endocytosis assay to track endocytic rates during knockdown of putative TbDLP-interacting proteins and compare those to endocytosis during knockdown or overexpression of TbDLP itself.

A-13: Growing Pains: How Invasive Species Impact Yeast Phenotypes

Authors: Welsh, Grace; Opulente, Dana

Advisor: Dr. Dana Opulente

Microbes play a vital role in plant environments that vary with the conditions of the environment. Previous research has found yeast species diversity is negatively impacted by the presence of invasive plant species. The difference in diversity could be the result of invasive plant species directly or indirectly altering the soil environment or chemistry. However, little is known about how altered soil conditions impact the growth of yeast species found in the soil of invasive plants. I propose to measure the effects of invasive plant species on yeast growth in the environment by simulating three variable conditions: carbon source availability, nitrogen availability, and antifungal exposure. I will compare the growth rates of yeast species isolated from invasive and native plant soils in each of these conditions. The observed differences in growth between these yeasts will allow us to draw conclusions about the impact of invasive species on the phenotypes of yeasts found within the environment. Understanding this variation could help us understand the functional role of yeasts in the larger microbial community in the environment. This research will also provide additional insights into our understanding of the yeast ecological niche.

A-14: Investigating the role of genes dissatisfaction and doublesex in sex-specific survival of a dimorphic neuron population in *Drosophila melanogaster*

Author: Miller, Kara

Advisor: Dr. Troy Shirangi

In *Drosophila melanogaster*, formation of sexual identity is achieved during metamorphosis, which includes construction of the neural circuits responsible for adult-specific behaviors. The doublesex (*dsx*) and dissatisfaction (*dsf*) co-expressing abdominal ganglion (DDAG) neurons are a sexually dimorphic population of neurons present in larvae and remodeled during metamorphosis; 11 neurons per side persist in females, whereas all but ~3 neurons per side undergo cell death in males. Here, we investigated the roles of *dsx* and *dsf* in dimorphic cell survival by utilizing RNAi to observe the phenotypic effects of *dsx* and *dsf* knockdown in a subset of the DDAG neurons only present in females and which directly contribute to the female-specific courtship behavior ovipositor extrusion. We have found that, for this subpopulation, *dsf* knockdown in females results in loss of cells, while *dsx* knockdown in males resurrects female-like neurons. Further, during optogenetic activation of the DDAG subset after *dsf*- or *dsx*- RNAi knockdown, *dsf*-depleted females no longer perform ovipositor extrusion, while *dsx*-depleted males perform an abdominal behavior analogous to that of female ovipositor extrusion. Overall, our results not only support that both *dsx* and *dsf* are crucial in forming the sex-specific identity of DDAG neurons but also suggest possible interplay between *dsf* and *dsx* in regulating apoptosis during metamorphosis.

A-15: Mangrove Roulette: Expanding the Coastal Wetland Equilibrium Model Through Comparative Analysis of Red and Black Mangroves

Authors: Woodin, Gavin; Tess, Adgie; Chapman, Samantha

Advisor: Dr. Samantha Chapman

Globally, mangroves are encroaching into saltmarshes in subtropical ecotones, but the extent and implications of their encroachment on belowground processes is not fully known. The Coastal Wetland Equilibrium Model (CWEM) is used to simulate soil accretion and vegetation survival in response to sea level rise and has to date been parameterized for the black mangrove, *Avicennia germinans*. This model indicates that *A. germinans* accretes soil at a rate four times that of the saltmarsh grass *Spartina alterniflora*. However, this model does not include data for red mangroves, *Rhizophora mangle*, which are also encroaching into salt marshes. We compared root growth of *A. germinans* and *R. mangle* root growth to improve parameterization of the CWEM model. Specifically, we placed 30cm root ingrowth bags in soil at each of 10 mangrove trees. The ingrowth bags remain in place for six months and have not yet been removed, but root biomass from the retrieved soil cores did not differ significantly, suggesting similar energy distribution to below ground biomass for both mangrove species. Additionally, sub cores showed that at 0-15cm, black mangroves produced more biomass than red mangroves. The opposite was true for 15-30cm, where red mangroves produced more root biomass, supporting *R. mangle's* production of deeper tap roots. This difference in belowground biomass raises the question on how *R. mangle* accretes soil in comparison to *A. germinans*, and the retrieval of ingrowth bags in January 2023 will provide the data and contribute to parameterization of CWEM, thus improving our ability to predict ecotonal coastal wetland resilience to sea level rise.

A-16: The effects of Zc3h8 expression on DNA double strand breaks, DNA repair, and cell recovery

Authors: Phuong, John; Schmidt, John

Advisor: Dr. John Schmidt

DNA damage recognition and repair is vital for cell survival. Accumulation of double strand DNA breaks (dsbreaks) can cause cell mutagenesis, which promotes abnormal cell growth and ultimately cancer. The Schmidt Lab is focused on the zinc finger protein - ZC3H8 (Fliz1) and how it affects cell growth and DNA damage repair. Fliz1 is significant in cell function because Fliz1 deletion led to cell apoptosis. To further investigate Fliz1 function, a series of co-localization experiments with tumor suppressor proteins were conducted. PML (Promyelocytic leukemia protein), a p53-regulated tumor suppressor, co-localized with Fliz1. Moreover, RAD52 and DAXX were tested for co-localization with Fliz1 because they are also components of PML Bodies. Tumor suppressor proteins like PML, RAD52, and DAXX are crucial in preventing dsbreaks within cells. Chemotherapy is one method to thwart abnormal cell growth because it induces lethal dsbreaks in repair-inhibited cancer cells. Previously, the Schmidt lab found that using Etoposide, a topoisomerase II inhibitor chemotherapeutic, resulted in less dsbreak repair within overexpressing Fliz1 cancer cells. Mitoxantrone is another topoisomerase II inhibitor being tested. Both are used to monitor the cells' ability to repair the induced DNA damage. Incubating the cells for 4 hours with .001 ug/ml of Mitoxantrone caused substantial amount of dsbreaks. The effective repair time was 72 hours. The repair amount between differentiated expression of Fliz1 with Mitoxantrone was similar to that of Etoposide. DNA damage was assessed based on the fluorescence of gamma H2AX – a histone that phosphorylates following dsbreaks and is detected with confocal microscopy.

A-17: Utilizing retro- and trans-Tango to identify the pre- and postsynaptic partners of sexually dimorphic neurons in *Drosophila melanogaster*

Authors: Murphy, Micaela; Shirangi, Troy

Advisor: Dr. Troy Shirangi

In the fruit fly *Drosophila melanogaster*, genes such as doublesex (*dsx*), fruitless (*fru*), and dissatisfaction (*dsf*) identify neurons that regulate sexually dimorphic behaviors in adults. *Dsx*- and *dsf*-expressing neurons in the abdominal ganglion, named the DDAG neurons, are a sexually dimorphic population that mediates receptivity behaviors in virgin and mated females. When optogenetically activated, the DDAG neurons initiate different behavioral responses depending on female mating status: virgin females open their vaginal plates (VPO) to demonstrate receptivity to male courtship, while mated females extrude their ovipositors (OE) to communicate rejection. Our research seeks to map the VPO/OE neuronal circuits by first identifying DDAG postsynaptic partners as interneurons or motor neurons. We utilize retro- and trans-Tango, two genetic tools for retro- and anterograde transsynaptic tracing, respectively, to identify pre- and postsynaptic partners of the DDAG neurons. Our work in progress has identified a population of interneurons with localized processes in the abdominal ganglion as putative postsynaptic partners of the DDAG neurons in females, mapping the DDAGs and their postsynaptic partners as upstream of abdominal motor neurons. Future experiments include optogenetically silencing and activating DDAG postsynaptic cell candidates to observe if VPO and OE responses are maintained in virgin and mated females. Results from these experiments will provide insight into *dsf* and *dsx* function in the developmental assembly of this sex-specific neuronal circuit.

A-18: Developing Antibodies to Block the Glyco-Immune Checkpoint Inhibitors, Siglecs

Authors: Singh, Jessica; Saini, Pratima; Abdel-Mohsen, Mohamed

Advisor: Dr. Mohamed Abdel-Mohsen (The Wistar Institute)

Current immunotherapy efforts focus on targeting proteins and are highly promising, but insufficient. We need to discover new immunological targets. Glyco-Immune Checkpoints are lectin (glycan-binding proteins) that transmit inhibitory signals to immune cells by binding to their glycan ligands on cancer cells. Siglecs are a family of inhibitory lectins expressed on immune cells, and they bind to Sialic acid on cancer cells. This binding allows cancer cells to evade immunosurveillance. We aim to develop blocking antibodies to a particular member of the Siglec family (Siglec-X). We will perform ELISA and Flow-based assays to validate the specificity of the produced antibodies to Siglec-X. We will examine the efficiency of these antibodies in enhancing immune-mediated clearance of cancer cells using *in vitro* cytotoxicity assays.

Chemical and Biological Engineering

A-19: Developing a Hydrogel Method to Model In Vivo Polymer Nanoparticle Cargo Release Behavior

Author: Kot, Alexandra

Advisor: Dr. Laura Bracaglia

Polymeric Nanoparticles (NPs) remain ideal candidates for drug delivery and other biomedical applications as they outperform other materials in stability, biocompatibility, and degree of controlled drug release. However, lack of procedures to evaluate drug release rates from polymeric NPs limits the correlation between in vitro characterization and in vivo performance. To model polymeric NP drug diffusion behavior in-vivo, we propose a continuous flow approach over immobilized NPs allowable through hydrogel scaffolding. Crossflow solution can be customized to reflect the solvents the NPs expect to experience in-vivo, such as pH, salt, and protein concentrations. We hypothesize that, by keeping NPs immobilized in a hydrogel scaffold, the measured release rate will be a result of drug diffusion and polymer degradation, as opposed to extreme external forces introduced in other drug release methods. Hydrogels were evaluated for a rapid cargo release and a limited NP release via various diffusion tests where uncrosslinked hydrogels were introduced to the analyte of interest, crosslinked via chemical, thermal or photo initiation, and introduced to flow via a plate shaker. Assays were conducted to analyze the changes in concentration of the analyte of interest in the crossflow solution over time. LMW Alginate continuously outperformed other hydrogels, providing a highly rapid release of all drug cargos and minimal release of NPs, and therefore is the ideal hydrogel candidate for further testing.

A-20: Synthesis of Composite Lithium Orthosilicate Based Materials for High Temperature CO₂ Capture

Authors: Fawcett, Connor; Barski, Charlie; Smith, Michael; Coe, Charles

Advisor: Dr. Michael Smith

Lithium orthosilicate (LOS) is a highly effective, reversible sorbent for CO₂ capture at high temperatures (600-650°C), with a theoretical working capacity of 36.7%. Suggested applications are reforming operations to produce hydrogen, water-gas shift operations, blast-furnace gas upgrading, and IGCC energy production. The material undergoes the following reaction during CO₂ sorption: $\text{Li}_4\text{SiO}_4 (\text{s}) + \text{CO}_2 (\text{g}) \leftrightarrow \text{Li}_2\text{CO}_3 (\text{s}) + \text{Li}_2\text{SiO}_3 (\text{s})$ (1). Bulk LOS phases form a shell of lithium carbonate and lithium metasilicate, which the CO₂ needs to diffuse through for further sorption with the unreacted core. In our lab, we prepared a nanostructured LOS composite material synthesized with a surfactant that shows rapid uptake kinetics and cyclic stability up to 80 cycles. We hypothesize the surfactant results in grain boundaries that facilitate diffusion of reacting species. Our goals are to reduce production costs as well as synthesis duration. Studies indicate that mesoporous silica sources such as SBA-15 and KIT-6 can be converted into LOS. This is typically done by a solid-state conversion with a lithium salt such as lithium nitrate. We hypothesize that through pyrolysis rather than calcination, the carbon-carbon bonds can be preserved in the silica sources which will lead to measurable porosity in the LOS product. This would increase the diffusivity of CO₂ in the material, as well as provide a cheaper and faster production method.

Chemical Engineering

B-21: Engineering a Recombinant Hemoglobin-Based Oxygen Carrier Made From Earthworm Erythrocrucorin

Authors: Osborne, Liah; Dowd, Sean; Elmer, Jacob

Advisor: Dr. Jacob Elmer

Red blood cells (RBCs) serve as the primary oxygen carriers in animals, thanks to the oxygen-binding protein hemoglobin. However, RBCs have a short shelf life when refrigerated, lasting only about 42 days. In contrast, earthworms (*Lumbricus terrestris*, *Lt*) have a unique oxygen transport system that doesn't involve red blood cells but relies on an extracellular protein called erythrocrucorin (Ec). Ec transports oxygen efficiently through the bloodstream and remains functional without refrigeration at 40°C for 6 months, making it an intriguing source of inspiration for improving oxygen carriers. In this study, we hypothesize that by developing *Lt*Ec-expressing Chinese Hamster Ovary (CHO) cells, we can create a hemoglobin-based oxygen carrier that is not only efficient in oxygen transport but also amenable to mass production and prolonged storage without refrigeration. To achieve this, we employed various molecular biology techniques, including PCR, Restriction Digest, Gibson Assembly, Golden Gate Assembly, plasmid cloning, and sequencing to engineer CHO cells to transiently express *Lt*Ec. Currently, we extract hemoglobin from the worms and replicate that in the lab. However, this isn't a sustainable option because there is a finite number of earthworms on the planet. Therefore, we would like to only make the protein responsible for oxygen transport and express that into CHO cells at any scale we like. Our results include the expression of *Lt*Ec plasmids with and without secretion tags, providing insight into potential improvements for producing an effective hemoglobin-based oxygen carrier. Secretion-tagged plasmids create disulfide bonds and glycosylation, but the Ec protein also remains outside of the cell membrane. Non-secretion-tagged plasmids the Ec protein is protected in the cell membrane, but it doesn't form disulfide bonds or glycans. Ongoing research is being conducted to determine which of these two options is more beneficial. This research would allow us to produce a sufficient supply for future clinical trials, thus leading to potential FDA approval.

B-22: Zinc Zeotypes for Enhancing CO₂ Capture and Air Separation

Authors: Kochman, Alex; Coe, Charles; Smith, Michael

Advisor: Dr. Charles Coe

This research addresses the pressing need to reduce energy requirements and adsorbent usage for carbon dioxide (CO₂) removal from concentrated sources and the atmosphere, alongside the demand for on-site oxygen generation. Selective adsorption is pivotal in gas separation processes, hinging on the properties of the solid adsorbent, and this ability is the key strength of zeolites for this application. Zeolites have proven successful in non-cryogenic gas separation. Recent advancements have enabled the synthesis of zinc-containing zeotypes, offering potential benefits in catalysis. This proposal seeks to synthesize and characterize zinc zeotypes with a novel approach - replacing aluminum (Al³⁺) framework atoms with zinc (Zn²⁺) to increase gas-accessible cations in the microporous structure. The objective is to examine the effect of increased electrostatic fields within zinc-containing zeotypes on the adsorption properties of permanent gases, including CO₂, CH₄, N₂, and O₂. Initial experiments will focus on chabazite (CHA) zeotypes, which provide high cation accessibility. The research methodology comprises the synthesis of zincosilicate and

zincaluminosilicate CHA samples, followed by ion exchange into different cation forms (Li, Na, Ca, and Zn) and subsequent measurement of adsorption isotherms for CO₂ and N₂ at 23°C and up to 1 atm. The results aim to provide insights into the utility of Zn zeotypes for enhanced gas adsorption, with the potential to revolutionize CO₂ capture and medical oxygen production.

Chemistry:

B-23: Characterization and electrochemistry of BIAN derivative ruthenium complexes

Authors: Coyne, Maxwell; Kassel, William; Paul, Jared; Boyko, Walter

Advisor: Dr. William Kassel

A series of ruthenium 2,2'-bipyridine complexes with derivatives of 1,2-bis(arylimino)acenaphthene ligands (Ph-BIAN, Mes-BIAN, 2,6-MePh-BIAN, and 3,5-MePh-BIAN) were prepared using microwave irradiation. The complexes were characterized by ¹H, COSY (1H-1H correlation) NMR, IR spectroscopy, and mass spectrometry. The electronic properties of varying the substituents on the pyridyl component of the BIAN ligand were studied by luminescence and UV-Visible spectroscopies, as well as electrochemistry. Initial studies on a related series of complexes with β-diketiminato ligands (Ph-BDI, Mes-BDI, and 3,5-MePh-BDI) will also be reported.

B-24: Chimeric amphiphilic disinfectants: quaternary ammonium/phosphonium hybrid structures

Author: Leatherbury, Moneya

Advisor: Dr. Kevin Minbiole

The development of novel disinfectants is crucial to counter the rise of bacterial resistance mechanisms; there is a particular value in structures distinctly different from those currently in commercial use. Accordingly, we are investigating the efficacy of mixed cationic QAC-QPC structures; we are developing a series of chimeric biscationic amphiphilic compounds, each bearing both ammonium and phosphonium residues. We have designed two-step syntheses, with straightforward and chromatography-free purifications. Initial bioactivity analyses against a panel of Gram-positive and Gram-negative bacterial strains, including two MRSA strains as well as *A. baumannii*, were encouraging, as strong antimicrobial bioactivity has been observed for multiple structures. Select amphiphiles displayed low levels of susceptibility to bacterial resistance, and favorable therapeutic indexes (up to 125) when comparing antimicrobial activity to RBC lysis²⁰ measurements

B-25: Effects of Wastewater Nitrogen Sources on Algae *Nannochloris eucaryotum* for Biofuel-Compatible Lipid Production

Authors: Clayton, Emily; Watt, T'Naysia

Advisor: Dr. Bryan Eigenbrodt

Fossil fuels are scarce and sustainable alternative energy sources are in rapidly increasing demand; one contender is biodiesel from plant matter. One of the most recent developments in biodiesels is algal biofuels, produced by converting triacylglycerols from algal intracellular lipid bodies into free

fatty acids. The research presented describes the cultivation of the algae *Nannochloris eucaryotum* and the subsequent quantification of four intracellular lipids. All *Nannochloris* colonies were cultivated with 25% of the suggested nitrogen concentration, as environmental stress promotes lipid yield. Two sources of nitrogen, nitrates and ammonia, were studied for their prominence as nitrogen sources in wastewater. This study simulates the cultivation of *Nannochloris* in wastewater conditions for biofuel production. Qualitative and quantitative methods used include fluorescence spectroscopy, confocal fluorescence microscopy, and gas chromatography-mass spectrometry. This research aids in the development of a renewable fuel source, with the additional potential to clean wastewater and prevent eutrophication.

B-26: Fub1 Inhibits Degradation of Ubiquitin-Independent Substrates by 26S Proteasome, Clipse Mechanism in 26S

Authors: McWilliams, Destiny; Kraut, Daniel

Advisor: Dr. Daniel Kraut

The proteasome is a protein complex that degrades regulatory, abnormal, and misfolded proteins. The complex consists of the core particle (20S) and the regulatory particle (19S), together making a wildtype proteasome (26S). Since the degradation of proteins occurs in the core particle, the regulatory particle is not always required for 20S to function. Protease inhibitors prevent the degradation of substrates of either 20S or 26S. Fub1 (or PI31), specifically, is known to inhibit the degradation of substrates by 20S by interacting with its active sites. The goal of the research is to determine whether Fub1 also prevents the degradation of ubiquitin independent and dependent substrates by the 26S proteasome and what mechanism it uses. Degradation assays were used to test inhibition. The assays showed that Fub1 has no effect on ubiquitinated substrates, but Fub1 does prevent the degradation of ubiquitin independent substrates. An assay with reconstituted 26S confirmed that Fub1 inhibits the degradation of ubiquitin-independent substrates by 26S, and not freestanding 20S. A native gel was used to look at the structure of reconstituted 26S and it was determined that Fub1 does not disassemble the proteasome to reach the core particle. We tested a UBL-GFP substrate that has ATP-dependent degradation and ATP-independent clipping and showed that Fub1 inhibits clipping of the substrate but not degradation. These results suggest that there is a 20S-like activity associated with the 26S that Fub1 is inhibiting, one that is a different mechanism than the inhibition of 20S alone.

B-27: Homology and ab initio modeling of bacterial cyclooxygenase-like proteins

Authors: Ford, Elisabeth; Selinsky, Barry

Advisor: Dr. Barry Selinsky

Prostaglandins are messenger compounds with many functions in mammalian biology. Cyclooxygenases are proteins that complete the first step of synthesizing prostaglandins, and also interact with and synthesize fatty acid hydroperoxides. Several bacterial proteins are hypothesized to perform cyclooxygenase-like functions, such as proteins from *Nitrosomonas europaea*, *Nostoc punctiforme*, and an unnamed *Cyanothece* species. Proteins were modeled with both a homology model, Swiss Model, and an ab initio model, AlphaFold. The model was tested by seeing if it could artificially bind (dock) a ligand in a similar way to a cyclooxygenase using AutoDock Vina. Each protein studied had at least one model that could dock heme, which suggested that they approximated the true structure of the protein. However, when fatty acids and fatty acid hydroperoxides were docked into the heme-

docked models, *N. europaea* docked the fatty acid hydroperoxide plausibly, while *N. punctiforme* and *Cyanothece* were not able to dock the fatty acids and fatty acid hydroperoxides in an expected way.

B-28: Molecular mechanism of coenzyme specificity of *Trypanosoma cruzi* D-3-hydroxybutyrate dehydrogenase

Authors: Rossy, Tatiana; Hashimoto, Hideharu; Mawn, Ian; Debler, Erik; Palenchar, Jennifer
Advisor: Dr. Jennifer Palenchar

D-3-Hydroxybutyrate dehydrogenase (HBDH) catalyzes the conversion between D-3-hydroxybutyrate and acetoacetate. Most HBDHs use the coenzyme nicotinamide adenine dinucleotide (NAD), but not its phosphorylated analog NADP, presumably because of steric clashes and/or electrostatic repulsion between the 2'-phosphate of NADP and the "NAD/NADP-specificity loop". However, trypanosomal HBDHs differ, such as *Trypanosoma brucei* HBDH, which uses both NAD and NADP with similar affinity, and *Trypanosoma cruzi* HBDH, which only uses NADP, as shown here. Using enzyme kinetics and crystallographic analysis of *T. cruzi* HBDH in complex with the reduced coenzyme NADPH and a substrate mimic, we determined the molecular mechanism of its strict NADP specificity. The structure revealed a conformational change of the longer NAD/NADP-specificity loop with respect to bacterial HBDHs, which enables accommodation of the additional 2'-phosphate. We identified the *T. cruzi*-specific residues responsible for the strict NADP specificity of *Tc*HBDH. Additionally, we found two *Tc*HBDH mutant enzymes with a 10-fold increased turnover number with respect to the wild-type enzyme. These residues specifically diverged across *Trypanosoma*, demonstrating that they are not only involved in coenzyme recognition, but also catalysis. Finally, we tested the role of an identified loop-stabilizing amino acid in both *Tc*HBDH and *Tb*HBDH. Collectively, our studies define the roles of unique residues in *Trypanosoma* HBDHs and provide a framework for future in vitro and in vivo studies on the enigmatic physiological role of trypanosomal HBDH.

B-29: Progress Towards the Syntheses of Isogemichalcone Analogs

Authors: Johnston, Josephine; Casillas, Eduard
Advisor: Dr. Eduard Casillas

Excess estrogen, especially in post-menopausal women, is associated with an increased risk of breast and ovarian cancers. Existing cancer treatments therefore target aromatase, an enzyme responsible for the biosynthesis of estradiol from testosterone and estrone from androstenedione. Additionally, the naturally occurring isogemichalcones B and C exhibit moderate inhibitory activity against aromatase. Thus, analogues of isogemichalcone may serve as new cancer therapeutics. By varying stereoelectronic properties such as size, hydrogen bonding ability, and electron-withdrawing nature, we plan to complete the synthesis and characterization of isogemichalcone analogs for structure-activity relationship (SAR) analysis. Synthesis of these analogs was accomplished through a sequence of Stille coupling, Claisen-Schmidt condensation, and Mitsunobu esterification. Synthesis of the hydrogen, methyl, and *t*-butyl analogs have been successfully carried out, while the fluoro, trifluoromethyl, and methoxy analogs are currently in progress. Current efforts focus on improving the efficiency of the overall syntheses, for instance optimizing the purification of a critical vinyl stannane intermediate and overcoming challenges posed by the Claisen-Schmidt condensation step in the fluoro analog series.

B-30: Selective and efficient synthesis of pseudoxylallemycin A using enamide scaffolding and further optimization of tetrapeptide macrolactamization

Authors: Tiffany, Aidan; Fumo, Vincent

Advisor: Dr. Matthew O'Reilly

Pseudoxylallemycin A, a cyclic tetrapeptide (CTP) natural product isolated from a *Pseudoxylaria* fungal species, has previously shown notable antibacterial activity and has thus become a potential target for antibiotic drug discovery. However, the syntheses of this molecule and its analogues are limited by the success of their critical cyclization steps. Common limitations include poor yields due to undesired stereochemical epimerization, extremely dilute conditions (0.001 M) to prevent oligomerization, and the need to optimize conditions for each stereochemical analogue. By employing enamide scaffolding into the synthesis of the linear precursor molecules, these limitations can be addressed, leading to a more efficient synthesis of pseudoxylallemycins or other CTPs. When incorporating a single enamide into the linear precursor synthesis for pseudoxylallemycin A, the cyclization was successful at a higher concentration (0.01 M) with limited oligomerization occurring. This cyclization was optimized using a high-throughput macrolactamization reagent array, allowing nine peptide coupling reagents and four bases to be screened simultaneously in multiple solvent combinations on a single milligram scale. Current work is focused on resolving ring opening issues in the cyclized product and performing the cyclization at higher concentrations (0.1M).

B-31: Strategies for the detection of serotonin in frog wash samples

Authors: Washington, Keshyne; Minbirole, Kevin

Advisor: Dr. Kevin Minbirole

Serotonin, oftentimes regarded as “the happiness molecule,” is a key neurotransmitter biosynthesized from tryptophan. Our laboratory aimed to quantify the levels of serotonin in 126 frog wash samples provided by collaborators at the University of Massachusetts in Boston; serotonin displays immunomodulatory effects in frogs. In anticipation of low levels of serotonin in these samples, a series of extraction and concentration strategies were explored to maximize efficiency and minimize detection limits. Initial extraction strategies using commercial standards, followed by either HPLC-UV-VIS or HRMS analysis, established a detection limit of ~10 ppm. Optimization methods, as well as ELISA-based immunoassays, were subsequently explored to more effectively analyze the biological samples and lower limits of detection.

B-32: Synthesis and characterization of a series of ruthenium complexes containing the 4,7-dihydroxy-1,10-phenanthroline ligand

Authors: Moss, Niya; Kassel, Scott; Paul, Jared; Olsen, Mark

Advisor: Dr. Jared Paul

Proton coupled electron transfer reactions are found throughout chemistry, including several important reactions such as water oxidation and nitrogen fixation. Developing metal complexes that can carry out these types of reactions are of significant interest. In this work, a series of new ruthenium complexes were synthesized by microwave irradiation with the 4,7-dihydroxy-1,10-phenanthroline (47dhphen) ligand. These complexes take on an octahedral geometry with two remaining bidentate coordination sites, which can be referred to as ancillary ligands. A series of four complexes were synthesized with varying the ancillary ligands (2,2'-bipyridine, 4,4'-dimethyl-2,2'-

bipyridine, 4,4'-dimethoxy-2,2'-bipyridine and 1,10-phenanthroline). The complexes were characterized by NMR spectroscopy, IR spectroscopy, and mass spectrometry. Preliminary UV-visible studies in both aqueous and nonaqueous solvents will be presented.

B-33: Synthesis and characterization of Cobalt(III) terpyridine complexes with application to water oxidation and proton reduction

Authors: Allen, Stefanie; Kassel, Scott

Advisor: Dr. Scott Kassel

Cobalt polypyridyl complexes have been shown to be effective catalysts towards water oxidation and proton reduction for potential generation of sustainable fuels. Using cobalt complexes for proton reduction is a potential for a closed, carbon neutral energy production system that uses cobalt-nitrogen complex as a catalyst. Varying electron donating groups and electron withdrawing groups on the pyridine rings affects catalytic activity and allows for systematic investigation of the factors that affect reactivity. As such, developing methods to prepare a variety of novel cobalt polypyridyl complexes is needed. This work focuses on synthesizing and characterizing cobalt terpyridine complexes with bidentate pyridine-based ligands. Complexes are synthesized from a cobalt(III) chloride 1.5 complex ($[\text{Co}(\text{trpy})\text{Cl}_3]$, where trpy = terpyridyl and select bidentate nitrogen ligands: 2,2'-bipyridine (bpy); 1,10-phenanthroline (phen); 1,0 4,4'-dimethoxy-2,2'-bipyridine (MeO-bpy), and 4,4'-dimethyl-2,2'-bipyridine (Me-bpy). Initial structures have been confirmed using ^1H NMR spectroscopy and further characterized using UV-Visible spectroscopy and electrochemistry.

B-34: Synthesis and Characterization of Cu(I) Complexes with Methyl Substituted tris(2-pyridyl)phosphine oxide (OPpy3) Ligands

Author: Snyder, Abbigail

Advisor: Dr. Scott Kassel

The synthesis and characterization of a series of Cu(I) complexes with methyl substituted OPpy3 ligands is presented. Complexes were prepared from an OPpy3 derivative and an appropriate copper(I) salt. Isolated complexes were characterized by ^1H and ^{31}P NMR. In addition, a new one-pot method for preparing tris(4,6-dimethyl-2-pyridyl)phosphine oxide (OPpy3_{4,6me}) was developed using 4,6-dimethyl-chloropyridine, red phosphorous, aqueous KOH, and DMSO. The OPpy3 ligands were further studied using $^{31}\text{P}\{^1\text{H}\}$ decoupled NMR (Phosphorous decoupled Proton Nuclear Magnetic Resonance) Spectroscopy to assist in the complete assignment of the ^1H NMR spectra.

B-35: Synthesis and Characterization of Imino-Pyridine Iron(II) Complexes

Authors: Malik, Sophie; Farry, Kimora

Advisor: Dr. Deanna Zubris

Polymers are substances that are present in many parts of everyday life, including synthetic fibers, rubber, plastics, and more. One major area of study is understanding the reaction mechanisms followed by different catalyst possibilities that may be used to synthesize polymers. For example, select amino- and imino-pyridine iron (II) complexes are versatile polymerization catalysts. When these iron (II) catalysts are used to polymerize diene monomers, ligand substitution can impact the

isomer distribution of the polymer repeat units, or building blocks. This project focuses on two new imino-pyridine ligands with differently substituted imine nitrogen atoms (one with a benzyl substituent and another with a larger benzhydryl substituent) and their respective iron (II) complexes. Efforts were directed towards optimizing reactions conditions for synthesis of all four substances while also completing full characterization of each. Studies are underway to continue synthetic optimization to maximize product purity and yield. In future work, these iron (II) complexes will be used as catalysts for diene polymerization.

B-36: Synthesis and characterization of tetrapyrido[3,2-a:2',3'-c:3'',2''-h:2''',3'''-j]phenazine-bridged polypyridyl ruthenium (II) complexes

Author: Bierling, Hailey

Advisors: Dr. Jared Paul; Dr. Scott Kassel

Bimetallic complexes where two metal centers are joined by a bridging ligand have shown promise in catalysis as their two metal sites increase the electrons available for multi-electron processes. This work reports the synthesis of the bimetallic complex $[(\text{bpy})_2\text{Ru}(\text{tpphz})\text{Ru}(\text{bpy})_2]^{4+}$ (bpy = 2,2'-bipyridine; tpphz = tetrapyrido[3,2-a:2',3'-c:3'',2''-h:2''',3'''-j]phenazine) by the reaction of two equivalents of $\text{Ru}(\text{bpy})_2\text{Cl}_2$ and one equivalent of tpphz ligand using both conventional and microwave methods. $[(\text{phen})_2\text{Ru}(\text{tpphz})\text{Ru}(\text{phen})_2]^{4+}$ (phen = 1,10-phenanthroline), $[(\text{bpy}(\text{OMe})_2)_2\text{Ru}(\text{tpphz})\text{Ru}(\text{bpy}(\text{OMe})_2)_2]^{4+}$ (bpy(OMe)₂ = 4,4'-dimethoxy-2,2'-bipyridine), and $[(\text{dmbpy})_2\text{Ru}(\text{tpphz})\text{Ru}(\text{dmbpy})_2]^{4+}$ (dmbpy = 4,4'-dimethyl-2,2'-bipyridine) were prepared similarly using a microwave reactor. The complexes were characterized via NMR, UV-Visible, and transient absorption spectroscopy, cyclic voltammetry, and mass spectrometry.

B-37: Synthesis and Solubility of CNC Pincer Ligand Triflate Salts

Authors: Acosta, Enzo; Rongo, Austin; Zubris, Deanna

Advisor: Dr. Deanna Zubris

Previous research in the Zubris group synthesized a family of three tridentate ligands with carbon-nitrogen-carbon donor atoms, referred to as CNC pincer ligands. These CNC pincer ligands were used to prepare copper(I) catalysts for Atom Transfer Radical Polymerization (ATRP). While this synthetic method is successful, it requires multiple metathesis reactions to prepare the ligand, starting from the bromide, converting to the hexafluorophosphate, and finally forming the chloride salt of the ligand. This multi-step sequence lowers the overall percent yield for ligand synthesis, leaving room for improvement. This project is focused on an alternate synthesis of the CNC ligand $1,1'$ -(pyridine-2,6-diyl)bis(3-benzyl)-1H-imidazolium], as its triflate salt. Two synthetic routes were tested, yielding two new products: a mono(3-benzyl) triflate product and bis(3-benzyl) ditriflate product. Recrystallization and trituration conditions were optimized for these two products, and these products were characterized by a range of methods. In future work, these new CNC triflate salts will be prepared on a larger scale and used to synthesize Cu(I) CNC complexes for catalytic applications.

B-38: Synthesis, Characterization, and Computational Analysis of Oxygen-Functionalized N-Heterocyclic Carbene Ligands and Associated Silver(I) Complexes

Authors: Huwar, Jessica; Zubris, Deanna

Advisor: Dr. Deanna Zubris

N-heterocyclic carbene ligands are a common and versatile structural motif for use in metal catalysts. Oxygen-functionalized N-heterocyclic carbene ligands are chelating ligands with many possibilities for structural variation, such as alcohol and phenol donor atoms. Our research group seeks metal-ligand complexes that contain these ligands for use in polymer synthesis and other catalytic applications. One phenol-functionalized NHC ligand was synthesized in prior research, yet metalation attempts with silver(I) were inconclusive. To help understand these results, a structurally related alcohol-functionalized NHC ligand and its corresponding silver(I) complex have been synthesized and fully characterized. Experimental data and computational analysis of this alcohol-functionalized complex reveal the favorability of a four-coordinate silver complex, while the two-coordinate complex is also detected. The bidentate coordination of two oxygen-functionalized NHC ligands to one silver(I) atom suggests an obstacle to the proposed future synthesis of a copper(I) complex via transmetalation from the corresponding silver(I) complex. Future work will explore other metals such as nickel(II) and palladium(II) which may accommodate a single oxygen-functionalized N-heterocyclic carbene ligand more readily than silver(I).

B-39: Synthesis of a series of Cu bis(aryl)acenaphthenequinone diimine complexes

Authors: Lopez Espinoza, Daniel; Kassel, Scott; Paul, Jared

Advisor: Dr. Scott Kassel

A method to routinely synthesize a series of new heteroleptic and homoleptic copper(I) complexes of the general formula $[\text{Cu}(\text{Ar-BIAN})_2]\text{PF}_6$ and $[\text{Cu}(\text{Ar-BIAN})(\text{L})]\text{PF}_6$, where Ar-BIAN = bis(aryl)acenaphthenequinone diimine and L = 1,10-phenanthroline or 1,10-phenanthroline-5,6-dione was investigated. The primary method of synthesis required the use of an isolated $[\text{Cu}(\text{Ar-BIAN})(\text{MeCN})_2]\text{PF}_6$ (MeCN = acetonitrile) intermediate to which an equivalent of (Ar-BIAN) or (L) was added to obtain heteroleptic and homoleptic copper(I) complexes. Structures were confirmed using ^1H NMR spectroscopy and further characterized using $\{^1\text{H}-^{15}\text{N}\}$ HMBC NMR, UV-Visible, and Infrared spectroscopies as well as mass spectrometry. Cyclic voltammetry was utilized to determine the redox properties of the copper complexes.

B-40: Synthesis of cyclic tetrapeptide Histone Deacetylase (HDAC) Inhibitors that pose as a promising antimalarial agent of the parasite, Plasmodium falciparum

Authors: O'Reilly, Matthew; Howey, Kelsey; Bernhard, Harrison

Advisor: Dr. Matthew O'Reilly

The deadliest form of Malaria, primarily caused by *Plasmodium falciparum*, poses a global health crisis, leading to hundreds of thousands of deaths each year. Conventional antimalarial drugs, like mefloquine and quinine, face resistance issues; therefore, exploring innovative treatments, such as histone deacetylase (HDAC) inhibitors, is critical. In *Plasmodium falciparum*, HDACs are essential for various stages of the parasite's life cycle, including host invasion and immune evasion. Thus, disrupting these HDACs with an HDAC inhibitor can potentially weaken the parasite, causing it to be depleted of a type of epigenetic regulation that is necessary for its life cycle. This project seeks to

elucidate the significance of stereochemistry by synthesizing all analogues of the HDAC inhibitor cyclic tetrapeptide, which contrasts with the prevailing scientific literature that primarily focuses on a singular stereoisomeric configuration of the molecule due to one stereoisomer being isolated from its naturally occurring source. During summer research, progress on the synthesis of HDAC inhibitors was made through several chemical reactions, such as peptide coupling reactions, esterification, deprotection and saponification reactions. The most notable outcome achieved during this summer's research was the successful synthesis of a linear tetrapeptide, representing the product of one of the synthesis steps. However, more work is to be done, such as completing compound characterization and optimization of the cyclization to fully synthesize the desired HDAC inhibitor, which involves reacting the linear tetrapeptide with different combinations of coupling reagents, bases, and solvents, and analyzing the products through LC-MS to deduce which conditions enable this challenging macrolactamization. The synthesis and optimization of HDACs as antimalarial agents offer an opportunity to potentially overcome the limitations of current treatment options.

C-41: Synthesis of Irregular Amino Acid found in Potential Histidine Deacetylase Inhibitor of Malaria

Author: Bernhard, Harrison

Advisor: Dr. Matthew O'Reilly

Although in recent years antimalarial measures have progressed, the mutation and adaptation of the virus continues to be a concern as it begins to affect new populations. Histidine deacetylases (HDAC) are enzymes which perform essential functions that enable organisms to perform regular processes. Inhibitors of these proteins therefore have potential to suppress HDAC activity, which may have significant growth inhibitory effects on organisms where this is occurring. A recent study isolated and tested the effects of several naturally occurring cyclic tetrapeptides (CTP) as HDAC inhibitors within malaria. While several of these products showed potential to combat the disease without significant harm to the host cells, the research group was unable to modify the CTP compounds to test the ramifications of stereochemistry on the effectiveness of these compounds. This research project attempted to synthesize these analogues to allow the effect of stereochemistry to be properly analyzed. To accomplish this, irregular amino acids of (D) and (L) configurations needed to be synthesized. This process proved to be difficult and required numerous procedure modifications to optimize. Over the course of this project, several attempts to synthesize this molecule were conducted. Ultimately, low yields of desired product by the pathways performed indicated that further experimentation with different reaction types is necessary in order to determine the most favorable path to generate this irregular amino acid before continuing on to synthesize the analogs of the desired CTP.

C-42: The Cellular Effects of Particulate Matter (PM) from Philadelphia Subway on Human Lung Cells

Authors: Hong, Caryn; Shakya, Kabindra

Advisor: Dr. Aimee Egger

Exposure to air particles containing particulate matter (PM) in subways has been linked to adverse cellular and health effects. Most studies on the effects of air pollution in subways have been conducted in European and Asian cities. Philadelphia is the 6th largest city in the U.S., with 90.3 million riders on the SEPTA in 2018. This is the first study to correlate PM composition from U.S.

subways to cellular effects in human lung cells. To develop an extraction method for filters, particles from a gas generator were collected on Teflon filters, extracted into water and/or ethanol solutions, and centrifuged under vacuum to remove ethanol from samples. Aqueous suspensions of filter extracts were tested in the 16HBE cell line for two assays. The first utilizes the fluorogenic probe dichlorodihydrofluorescein diacetate (DCFDA), an indicator for oxidative stress. Upon entering cells, the DA moiety is cleaved by cellular esterases, and the H₂-DCF is oxidized to DCF by oxidative species and fluoresces in the green channel. The CellTiter-Fluor (CTF) assay measures the relative number of viable cells using the fluorogenic protease substrate glycyphenylalanyl-aminofluorocoumarin (GF-AFC). When the substrate enters live cells, the GF moiety is cleaved by proteases, and the AFC is released to produce a fluorescent signal proportional to the number of viable cells. Dilutions of hydrogen peroxide were tested as a positive control, expected to induce oxidative stress and lower cell viability of 16HBE but not interfere with the CTF assay. We find that 1) extracting filters in 100% ethanol significantly increased the % mass extracted, 2) direct oxidation of CTF by hydrogen peroxide treatment in 16HBE is not occurring, 3) hydrogen peroxide is not inhibiting the protease from cleaving the CTF substrate, and 4) a concentration of 3.125 μM or lower of hydrogen peroxide can be used as a positive control in the DCFDA and CTF assays.

C-43: The development of bushy-tailed amphiphilic disinfectants to counter microbial resistance

Authors: Toles, Zachary; Wu, Alice; Thierer, Laura; Sanchez, Christian; Vargas, German; Wuest, William; Minbiole, Kevin
Advisor: Dr. Kevin Minbiole

Benzalkonium chloride (BAC) has long been a stalwart in disinfection practices, finding utility in various sectors, including homes, hospitals, and industry, for almost a century. However, the relentless evolution of bacteria, particularly resistant strains of *Acinetobacter baumannii* and *Pseudomonas aeruginosa*, has exposed vulnerabilities in our existing disinfection practices. Recent research has shed light on the structural-activity relationships of next-generation quaternary ammonium amphiphiles, revealing the advantages of multicationic structures, as well as chain length optimizations to minimize eukaryotic toxicity, thus maximizing the therapeutic index. We are investigating the preparation of a series of multicationic amphiphiles that bear multiple shorter alkyl chains (≤ 10 carbons in length). Our synthetic efforts and observed therapeutic indices of these “bushy-tailed” multicationic amphiphiles will be presented.

C-44: The Effects of Medium pH on the Lipid Profiles of *Nannochloris eucaryotum*

Authors: Watt, T'Naysia; Clayton, Emily
Advisor: Dr. Bryan Eigenbrodt

This research presents the findings following the cultivation of colonies of the algae *Nannochloris eucaryotum* which were analyzed under various metrics for this study. The research investigates the potential of *Nannochloris* as a source of biomass for biofuel production based on lipid content using growth media adjusted to pH values of 8 and 9. The study will look into the effects that the growth medium pH will have on the lipid accumulations and chemical profiles of this *Nannochloris eucaryotum* algal system. The quantitative methods and instrumentation used to monitor the production of five different lipids include cell counting, fluorescence spectroscopy and microscopy, gas chromatography, and mass spectrometry.

C-45: The use of Media pH as a Stress Mechanism to Stimulate Lipid Production in *Nannochloris eucaryotum* for Potential use in Biofuel Generation

Authors: Watt, TⁿNaysia; Clayton, Emily; Eigenbrodt, Bryan

Advisor: Dr. Bryan Eigenbrodt

As a source for biofuel generation, algae as shown great potential in its ability to have fast growth kinetics along with favorable lipid productions. Previous research with algal systems has also exhibited the significant increase in lipid production when these organisms are exposed to an external stress. Some examples of external stresses include nitrogen deprivation, other nutrient deficiencies, temperature changes, and etc. Specifically, this research explored the effects that artificial saltwater media pH has on the lipid production of the algal system *Nannochloris eucaryotum*. A media pH range of 7.0-9.0 was explored for these algal systems. Fluorescence spectroscopy, and Gas Chromatography coupled with mass spectrometry was used to monitor the effects that this pH stressor has on the overall lipid production. Results exhibited that as pH increased towards basic conditions, the algal system showed signs of becoming stressed, as evident by a decrease in cell density, and decrease in chlorophyll. As the cell density reached the stationary phase, lipid production continued to increase producing doubling the amount of lipids as compared to the cultures grown towards neutral conditions. Out of the main fatty acids in all of the trials, the one that showed a significant increase when stressed was oleic acid and contributed to most of the increase in lipid production.

C-46: Ubp6 Influence on Proteasome Degradation Using Single and Multi-Lysine Ubiquitinated Substrates

Author: Baul, Panchatapa

Advisor: Dr. Daniel Kraut

The proteasome is a protein complex that degrades abnormal, misfolded, and regulatory proteins. Proteins to be degraded are tagged with a chain of ubiquitin proteins on one or more substrate lysines. This research aimed to determine the impact of ubiquitin chain length and the proteasome-associated deubiquitinase Ubp6 on proteasomal unfolding ability. To examine unfolding ability, we used substrates featuring an N-terminal Neh2Dual degron followed by an easy-to-unfold barnase domain and a difficult-to-unfold DHFR domain; unfolding ability can be calculated based on the relative extent of degradation of the two domains. The experimental substrates also contained different chain attachment points - one with a single lysine within the degron (pPB2) and another with seven lysines (pERR2). A reconstituted proteasome using 19S and 20S corrected for any inconsistency that could arise from the amount of Ubp6 being co-purified with the proteasome. A degradation assay was conducted on the substrate and gel electrophoresis images were used to determine how much degradation was occurring in the proteasome. Unfolding abilities were calculated based on degradation assay results. From these experiments, it has been concluded that the number of chains is more important than chain length for efficiency of degradation of WT proteasome, Ubp6 protein inhibits degradation significantly for both single-chain and multi-chain ubiquitinated substrates, and Ubp6's binding activity but not catalytic activity is required for inhibition.

C-47: What Are Ancient Eukaryotic *Trypanosomes* Doing with Bacterial Haloacid Dehalogenases (HADs)?

Authors: Costello, Brian; Moore, Molly; Palenchar, Jennifer

Advisor: Dr. Jennifer Palenchar

Transmission of the unicellular eukaryotic parasite, *Trypanosoma brucei*, is responsible for human African trypanosomiasis (HAT, also known as sleeping sickness) commonly found in sub-Saharan Africa. Transmission of *T. cruzi* can lead to Chagas disease. Considering the need for effective and affordable therapeutics for these global health threats, one avenue to combat this challenge is to identify and characterize the activity and physiological role of proteins that are unique to the parasite and absent or different from the host. To pursue this goal, we are characterizing a repertoire of *T. brucei* haloacid dehalogenase-like (HAD) enzymes acquired by the parasites from bacteria via horizontal gene transfer (1) and now have become an integral component of normal *T. brucei* growth (2). Sequence analysis revealed two putative HADs in *T. brucei*: *TbHAD32* (32kDa) and *TbHAD35* (35kDa). The putative His-tagged HADs were expressed in bacteria and purified to approximate homogeneity. Each HAD has a phosphatase motif. Accordingly, we screened each protein for activity with a variety of potential phosphate-containing substrates and kinetically characterized those with activity. We also explored how the presence of one HAD impacts the activity of another in vitro through size exclusion chromatography and native PAGE methods. The findings of our in vitro characterization will guide our exploration of the in vivo activity of *Trypanosoma* HADs.

Computing Sciences

C-48: Machine-readable datasets for two low-resourced languages: Igbo & Nigerian Pidgin

Authors: Nwafor, Ebelechukwu; Nguyen, Minh

Advisor: Dr. Ebelechukwu Nwafor

Currently, there is a lack of machine-readable datasets for two low-resource African languages: Igbo and Nigerian Pidgin. This obstacle hinders the progress of natural language processing (NLP) technologies in these languages despite their cultural and societal significance. The primary goal of this research is to develop a machine-readable dataset for Igbo and Nigerian Pidgin. The dataset can be used to overcome the data gap and facilitate researchers and developers in building language models and other NLP tools in the future.

Economics

C-49: Analyzing Land Tenure Security in Matrilineal Regions of Mozambique

Authors: Jordan, Kathleen

Advisor: Dr. Laura Meinzen-Dick

Land tenure security can be understood, in terms of national development, as integral to the incentivization of sustainable investment in household-level means of productivity, which increases national development en masse. A relatively land-abundant nation situated within sub-Saharan Africa's Matrilineal Belt, land administration in Mozambique occurs at the intersection of formal and

customary law. Under Mozambican law, all land legally belongs to the state, which is imbued with the power to relegate land administration to local chiefs. While formally Mozambique's land policy is one that demands equality between men and women, customary land law— where most land administration occurs at the community level— maintains gendered systems of inheritance and land ownership. This research project analyzes the gendered implications of land tenure security in matrilineal regions and compares them to those experienced in patrilineal regions using econometric analyses of household and parcel-level survey data. In addition to this, it analyzes how efficiently various land formalization treatments alleviate the economic stresses of land tenure insecurity, respond to existing tensions related to Mozambique's scarcity of arable land, and ease the rift between customary and formal mechanisms of land administration and distribution— all while maintaining close observation of the potential disparate effects of these treatments on gender disaggregated populations.

Geography and the Environment

C-50: A tale of two sites: examining Hurricane Ian's overwash sediments

Authors: Nogueira, Arielle "Lu"; Hong, Isabel

Advisor: Dr. Isabel Hong

Hurricane Ian made landfall in southwest Florida on September 28th, 2022, at Category 4 intensity (maximum wind speed of 178 km/hr and maximum flood heights of 10-15 m). The damage it caused was severe and widespread, with casualties in 19 different counties in Florida. Our study aims to characterize and compare overwash deposits in two different locations to understand how hurricane deposits can differ from pre-Hurricane sediment depending on their proximity to a hurricane and its track. Six months after it passed through Florida, Hurricane Ian overwash sediment was sampled at Blackwater Bay, Ten Thousand Islands and Matlacha Pass, Charlotte Harbor, southwest Florida to compare and contrast hurricane deposits from a site directly (Matlacha Pass) and on the margin (Blackwater Bay) of a Hurricane's track. Using grain size and loss-on-ignition analyses, the results show that the two deposits differ: the Matlacha Pass deposit is more sorted, less organic, and coarser than the Blackwater Bay sediment. At Matlacha Pass, the overwash sediment is a light gray, moderately sorted (0.50Φ to 1.88Φ), less organic (2 to 15% organic content) sand (mean 4.25Φ). The overwash sediment at Blackwater Bay is a light gray, poorly sorted (1.77Φ to 1.88Φ), slightly organic (7 to 42% organic content), sandy silt to sand (mean 5.44Φ). The results of this study will aid in better understanding how to identify deposits from a high intensity, landfalling hurricane, as well as demonstrating the differences in the characteristics of a hurricane deposit in the paleorecord of two different sites.

C-51: Assessing soil lead contamination in Hispanic neighborhoods around Norristown, PA

Authors: Walicki, Sara; Brandy, Caitlin; Lugo, Diana; Esquivel-Cote, Rosalba; Goldsmith, Steven; Smith, Daniel Jackson; McDermott-Levy, Ruth; Shakya, M. Shakya

Advisor: Dr. Kabindra Shakya

Lead contamination in soil is a concern in environmental justice communities that adversely impacts the health in minority communities. The anthropogenic sources of lead in soil could be fossil fuel combustion, fertilizer/pesticide use, industrial activity and mining, disposal of municipal waste, and

urbanization. The University and local community organization collaboration was done to analyze lead contamination in soil samples in the residences of the Hispanic community in Norristown, PA. Sampling was conducted from June 5th, 2023, through July 13th. Soil samples were analyzed by XRF (X-ray fluorescence spectrometer) and ICP-MS (inductively coupled plasma mass spectrometer). A total of 28 samples were collected from 18 households. The mean lead concentration in soil was 315.89 ppm with the highest value being 1,452 ppm and the lowest 21 ppm. The EPA's standard for lead in soil is 400 ppm; 25% (7/28) of the samples have exceeded the EPA's standard. The residents time of lead in soil can last from decades to centuries, making it persistent and dangerous especially for areas that already experience legacy pollution. In minority communities such as black and Hispanic neighborhoods, EBLL levels are generally higher than those in white neighborhoods which is concerning due to the adverse health effects of lead exposure such as anemia, hypertension, and renal and cognitive impairments in adults. In children lead can impact IQ, mental development, sleep, learning and behavioral problems, hearing and speech impediments, and fine and visual motor function deficits.

C-52: Delineating the source and potential ecosystem impacts of macroplastics in suburban and urban first order streams

Authors: Anthony, Mikaela; Rodrigues, Lisa; Feldman, Hannah; Spangler, Emma; Singh, Sydney; Droege, Alice; Goldsmith, Steven; Clark, Tom; McGeehan, Maurine
Advisor: Dr. Steven Goldsmith

Aquatic plastic pollution can have many negative ecological impacts, including harming the digestive health of aquatic organisms and increasing the potential bioaccumulation of heavy metals. Despite its substantial role in delivering plastics to the ocean, few studies have investigated the distribution of macroplastics in riverine environments with even fewer studies focused on upstream areas. Understanding the sources of plastics to riverine environments could help society take meaningful measures to prevent its introduction to waterways. We collected litter, including macroplastics (>4mm in diameter), from 20 suburban and urban headwater streams in southeastern Pennsylvania. Litter was collected from both the stream channel and banks along a 50-m longitudinal transect immediately downstream of stormwater outlets where streams daylighted. A second round of sampling occurred approximately 45 days after the first sampling date. Litter was categorized in accordance with the National Oceanic and Atmospheric Administration (NOAA) marine debris shoreline survey guide. In total, 2,444 macroplastics were collected. Plastic film fragments (n=863), food wrappers (n=335), and hard fragments (n=277) were the most identified items. Macroplastic totals were compared to potential controlling parameters such as area, population density, and socioeconomic variables in the upstream area. Finally, select plastic litter items were analyzed for metal content (Al, Ba, Cd, Cr, Cu, Pb, Sb, Zn) using an Olympic Vanta series X-ray fluorescence (XRF) spectrometer in Geochem mode. Collectively, the data suggest the need for municipal plastic ordinances and litter prevention measures to protect the ecosystem health of riverine ecosystems.

C-53: Diversifying Geosciences: Exposing Underrepresented Minority Groups at Walter B. Saul High School to the World of Geoscience through The Villanova Environmental Geochemistry Summer Institute (VEGSI)

Authors: Singh, Sydney; Droege, Alice; Mander, Asata

Advisor: Dr. Steven Goldsmith

Diversity in the geosciences is crucial for understanding and representing all people, as we learn more about Earth's environment. Encouraging people of various backgrounds to participate in this field not only promotes equity but also brings unique perspectives to research. We helped facilitate a geoscience summer pathway program consisting of soil core collection, air pollution monitoring, and plastic waste collection along streams from suburban to urban environments within Philadelphia related to issues of urban contamination and discriminatory pollution exposures. The program hosted high school students (n=7) from Saul High School with around 80% of children below the poverty line and about 85% from underrepresented minority groups (URM). The three cohorts were able to map and graph using ArcGIS Pro and Excel, respectively, how their own field of study affects their own community. The effectiveness of the program was measured by evaluating the response of participating Saul high school students using a mixed methods approach. Knowledge quizzes given before and after the program, post-program focus group interviews, artifacts, student notebooks, and general observations assessed student attitude changes regarding geosciences. Overall, the results show that the students have had an increased interest in pursuing an undergraduate major or obtaining a career in the geosciences, an increased likelihood to engage with geosciences outside of the classroom, and an increased passion for environmental justice. Increased representation of URM students in geoscience undergraduate programs will lead to the development of coursework and analytical skills addressing urban environmental issues, ultimately establishing a model for secondary education.

C-54: Evaluating Potential Toxicity of Sediment Deposits in the Raritan Watershed

Author: Polakiewicz, Christine

Advisor: Dr. Nathaniel Weston

In recent years, anthropogenic actions and resulting variability in the climate system have caused the intensity and frequency of hurricanes to increase. Flooding produced from intense hurricanes mobilizes toxic materials into the environment with impacts on human health and wildlife. Hurricane Ida struck the United States East Coast as a Category 4 storm in August of 2021. Ida brought destructive storm surge, high winds, and heavy rainfall to the region and left over \$75 billion worth of damage. To assess the spread of toxic materials from Hurricane Ida's flooding, soil samples were taken from 21 sediment deposits in low-lying regions of the Raritan Watershed and verified as deposits from Hurricane Ida flooding by examining flooding from satellite imagery. Analysis of heavy metals in these soil samples occurred using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) following sample digestion using a hot nitric acid (HNO₃) (Bradshaw et al., 1989). The radiation of these deposits was also assessed. The activities of U-238 and U-235 and their daughter products were determined by placing soil samples into a gamma spectrometer (Canberra Instruments broad energy germanium detector) for 24 hours (Novikov et al., 2014). Differing traces of U-235 have been found and each site location downstream from land that used to hold an old atomic bomb sampling plant. Preliminary findings from the ICP-MS analysis are still being interpreted.

C-55: Health risk assessment of PM2.5 exposure at Philadelphia Subway Stations

Author: Tian, Runze

Advisor: Dr. Kabindra Shakya

Air pollution, particularly particulate matter (PM_{2.5}), poses significant health risks globally, with indoor environments like subway stations often harboring higher concentrations than other environments. This study focuses on Philadelphia's subway system, aiming to estimate the toxicological risk of PM_{2.5} exposure for daily commuters. PM_{2.5} were measured using dusttrak DRX aerosol monitor (Model 8533) from three subway stations in Philadelphia during the summer of 2023. The health risks of subway commuters were estimated for subway stations for different demographic groups. The 5th Station recorded the highest Cumulative Inhale Dose, especially during weekdays belowground (63.74 μg), suggesting elevated exposure levels. Risk Quotient (RQ) values, which indicates potential health risks, were higher for children across all stations, with the 5th Station presenting high RQ of 10.39. Health risk assessment estimates the vulnerability of certain demographic groups, notably children, and accentuates stations that may requires more priority for intervention. The toxicological risks from PM_{2.5} exposure warrant comprehensive strategies for mitigation and protection of subway commuters in Philadelphia.

C-56: Heavy Metals in Honeybees Along an Urban to Rural Gradient in Philadelphia Region

Authors: Ransom, Tenley; Baker, Paris; Johnson, Erin; Weston, Nathaniel

Advisor: Dr. Nathaniel Weston

Honeybees provide critical ecosystem services, such as pollination to a variety of economically important crops. There has been increasing concern about honeybee health due to incidences of 'colony collapse disorder' and declining honeybee populations. Since honeybees pollinate a variety of flowering plants near their hive, honeybee health may also be indicative of the health of the plants they pollinate and the soil those plants grow in. The goal of my research was to evaluate heavy metal content in honeybees along an urban to rural gradient in the Philadelphia region. Honeybees were collected at nine sites along this gradient, from Center City, Philadelphia to Chester Springs, PA. Three samples (consisting of 10 bees each) from each site were microwave digested and analyzed for heavy metals and several other elements (Mg, Cr, Mn, Fe, Cu, Zn, As, Cd, and Pb) by inductively coupled plasma mass spectrometry (ICP-MS). The land use for each site was analyzed with a 1.5km radius, which is the honeybee foraging radius. The foraging habitat from bees collected along the urban to rural gradient ranged from 1.68 to 84.50% impervious surface. I found that Pb, As, and Fe content in the honeybees increased with increasing impervious surface ($p < 0.05$), while Mn content decreased ($p < 0.05$). My results indicate that honeybees living in urban environments have higher Pb, As, and Fe content, indicating higher exposure to those heavy metals in urban environments. There were statistically significant differences between sites for Cu and for Mg (ANOVA $p < 0.05$), but I did not find a relationship between land use or impervious surface and Cu or Mg, suggesting other factors not investigated in this study may influence honeybee heavy metal content.

C-57: Quantifying paleotsunami intensity using sediment deposits found at Willapa Bay, WA, USA

Author: Murphy, Shealyn (Shea)

Advisor: Dr. Isabel Hong

Coastal geohazards originating along the Cascadia subduction zone of the US Pacific Northwest are not well understood due to a lack of historical or instrumental observations of previous earthquakes. Thus, the geologic record has become an essential tool to establish the occurrence of earthquakes and their resulting tsunamis along this subduction zone, but also to draw out details regarding these prehistoric events. In this study, I analyzed several sediment cores from multiple locations at the Niawiakum River, Willapa Bay, WA to determine if the geologic record had recorded past tsunamis. More specifically, a tsunami sand that corresponded with the infamous 9.0 Mw earthquake of 1700 CE was analyzed. Grain size analysis of the samples was performed using a laser particle analyzer. The tsunami sand layers were found to be composed mostly of very fine sands or silts, with a mean grain size ranging from 4-5 ϕ . With the grain size data, an inverse sediment transport model (Moore, et al. 2007) was used to determine potential flow depths and average flow speeds of the 1700 CE tsunami at the different sampling sites (upstream versus downstream). The first sampling site, the furthest downstream, had flow depths ranging from 3.7-6.5 meters and flow speeds between 7.6-12.7 m/s. The site furthest upstream had flow depths ranging 4.2-7.1 meters and flow speeds ranging 8.1-13.2 m/s. In between these sites, the third site had flow depths ranging 1.5-2.3 meters and flow speeds between 4.8-7.6 m/s. The analysis of past geohazard trends will improve our understanding of these events, as well as better inform a response in the event of a future tsunami.

C-58: Salt flats: A sink for microplastics in La Paguera, Puerto Rico

Author: Bruffey, Brenna

Advisor: Dr. Lisa Rodrigues

To properly manage microplastics in coastal environments, it is critical to understand where they accumulate. Salt flats are unique ecosystems that form on the leeward side of mangrove forests and can also be influenced by ocean- and land-based processes. Salt flats flood during high tide and suspended items, including microplastics (MP), may be deposited as ocean water recedes and evaporates. MP distribution has been investigated in mangrove ecosystems but, the vulnerability of salt flats to MP accumulation is unknown. We assessed the distribution of MP within salt flats with varying mangrove densities and proximities to anthropogenic influence, including roads. We randomly collected four sediment samples along a transect at each of four different salt flats. The sediment was dried and filtered into five size classes (from 300 μm to 25 mm), followed by density separation of MP from the sediment. We found MP at all sites, but the uninhabited island and the roadside sites had the highest abundance. The other sites had relatively higher mangrove cover and minimal human interference. The overall average abundance of MP was 147.86 ± 220.06 per kg with 57.5% of MP collected in the 0.3-1 mm size class. MP abundance was positively correlated to the distance from the mangroves at three of the four sites. In a random subset of MP, the most common plastic polymers were polyethylene (46%) and polyethylene terephthalate (14%). Together, our data suggest that mangrove forests provide some protection but are not impenetrable to MP, as they still accumulate within adjacent salt flats. The presence of MP in such high abundance implies that further mitigation methods are needed to reduce MP accumulation, particularly in areas with heavy anthropogenic presence.

C-59: The Impact of Hail Frequency and Severity on Crop Loss in the United States

Author: Giammarco, Genevieve

Advisor: Dr. Stephen Strader

Hail has threatened crops for years, especially in the Great Plain states like Texas, Nebraska, Oklahoma, and Kansas. These hail trends are concerning since the American population continues to grow, pressuring crop production to keep up while weathering obstacles like natural hazards. While previous studies have looked at how hail has affected plants, there has not been research on the impact of its frequency and severity on farming. This relationship can be illustrated with USDA data on farmers' insurance claims between 1989 and 2022, assessing the yearly average damage to crops and how it is related to the frequency and severity of hail. The average indemnity, or the payment from insurance, of hail-related incidents over this timeframe was over \$462 billion in 2022 values. The yearly average frequency of hail occurrences increased until 2000 before gradually decreasing the next two decades. The average indemnity increased, especially in the past 20 years while the average frequency slowed down. These patterns show a relationship between the damage of crops and the severity of hail events with the increasing indemnity over the last three decades. There is no clear relationship between the frequency of hail and the damage to crops. These results are significant as it shows an increasing severity of hailstorms. If the patterns from 1989 to 2022 are an indication of future weather, there will be more threats to farming that will affect crop production and accessibility of food unless there is effective protection against natural hazards.

C-60: Understanding the Degradation, Toxicity, and Environmental Impact of Macroplastics in Streams

Authors: Spangler, Emma; Anthony, Mikaela; Goldsmith, Steven; Clark, Tom; McGeehan, Maurine; Atkinson, Lorna

Advisor: Dr. Steven Goldsmith

Riverine systems have shown to be major contributors of macroplastics (>4mm in diameter) to the global ocean. Yet, few studies have evaluated the degradation and potential ecosystem impacts of macroplastics within these freshwater environments. Emerging evidence indicates that biofilms which grow on the surface of macroplastics bioaccumulate metals over time. In the mid-Atlantic United States, the cumulative application of road salt has led to increased concentrations of metals in stream water via reverse cation exchange in soils. Therefore, biofilms could theoretically bioaccumulate higher concentrations of metals in streams with higher salinity, if controlling for geology. In this study, we deployed replicates of 5 common debris types, both suspended and buried, in three southeastern Pennsylvania streams; all three streams had the same underlying geology, yet varying salinity. Upon collection, biofilm metabolism was determined through the light/dark method; assessing gross primary production and community respiration to calculate the net primary production. Total metal concentrations on the surface of debris were determined using x-ray fluorescence spectrometry. Select metal concentrations (Al, Ba, Cd, Cr, Cu, Pb, Sb, and Zn) were compared to the respective parent material to determine the relative state of weathering. In addition, the bioavailability of metals was determined using an acetic acid extraction and inductively coupled plasma mass spectrometry. The study results provide valuable insights into the degradation and potential ecosystem impacts of macroplastics in riverine systems.

D-61: Variability of Particulate Matter in Philadelphia Subway Stations

Authors: Jenkins, Brent; Tian, Runze; Karim, Anjum; Egger, Aimee; Shakya, Kabindra

Advisor: Dr. Kabindra Shakya

Particulate matter is a criteria air pollutant that causes several adverse human health effects, including the lungs and respiratory system. Combustion from gasoline and oil is a primary way particulate matter is created. PM_{2.5} is one type of PM that is 2.5 micrometers in diameter or smaller. In this project, we measured PM_{2.5} concentrations for six hours in three Philadelphia SEPTA subway stations (5th street, 15th street, and Cecil B. Moore) and their respective roadsides on both weekdays and weekends during summer 2023. The 5th street station has the highest PM_{2.5} concentrations overall while Cecil B. Moore has the largest underground to above ground PM_{2.5} ratio. The 15th street station has a higher weekend concentration while Cecil B. Moore and 5th street station have a higher weekday concentration. The air quality at the subway stations may depend on cleanliness, age, ventilation, maintenance, and the number of passengers. With proper maintenance, frequent cleaning and improved ventilation at the underground subway stations, SEPTA can ensure that EPA's primary standard for PM_{2.5} at 12.0 µg/m³ is met which helps to indicate a healthier standard of living for commuters, especially SEPTA workers and daily users.

Health Policy and Management

D-62: Assessing Risk of Bias in Studies on Opioid Stewardship Practices

Authors: Jubilee, Nicholas; Bass, Eric; Sharma, Ritu; Dy, Sydney; Waldfogel, Julie; Rosen, Michael

Advisor: Dr. Eric Bass (The Johns Hopkins University Bloomberg School of Public Health)

The opioid addiction epidemic warrants new practices to improve patient safety related to use of prescribed opioids. To determine the strength of evidence on the effectiveness of opioid stewardship practices, we evaluated the risk of bias in recent studies of opioid stewardship. We conducted a systematic search of PubMed for original studies since 2018 on opioid stewardship, defined as promoting appropriate use of prescribed and ordered opioids in clinical populations while reducing the risk of opioid use disorder, misuse, overdose, and other complications. To be eligible for review, studies had to be randomized controlled trials (RCTs) or observational studies with a comparison group, conducted in the United States. We used the Cochrane Risk of Bias Collaboration Tool to assess the risk of bias in RCTs, and the ROBINS-I tool to assess the risk of bias in observational studies. The Cochrane tool covered the domains of selection, performance, detection, attrition, reporting, and other bias. The ROBINS-I tool covered bias due to confounding, selection of participants, classification of interventions, deviations from intended interventions, missing data, outcome measurement, and selection of reported results. Assessments focused on the primary outcome in each study and were performed by a primary reviewer and then a secondary reviewer. 92.3% (n=12) of RCTs had serious risk of bias in multiple domains. We conclude that evidence on the effectiveness of opioid stewardship practices is limited by the risk of bias in multiple domains.

Management

D-63: Navigating the STEM career ecosystem: How partnerships between organizations can ameliorate underrepresentation and reduce career disparities in STEM

Authors: Quigley, Narda; Lanouette, Noah

Advisor: Dr. Narda Quigley

“Leaky pipeline” issues continue to be problematic in STEM fields. Highly qualified individuals leave the STEM workforce in search of more sustainable career paths, causing a persistent labor shortage and threatening economic growth in the U.S. (e.g., Iammartino, Bischoff, Willy, & Shapiro, 2016). These challenges are particularly acute when considering the movement of women and underrepresented groups out of STEM (i.e., individuals who identify as Black and/or Hispanic/Latinx, and American Indians/Alaskan natives; Alfred, Ray & Johnson, 2019; *National Science Foundation Digest*, 2019). We highlight the need to shift away from the pipeline and pathways metaphors and toward a multilevel, dynamic, and intersectional STEM career ecosystem metaphor. By studying ecosystems such as Chevron’s partnership with Project Lead the Way or the international network Teaching Institute for Excellence in STEM (TIES) set up, we can better understand the factors contributing to the high occupational turnover of these groups. Based on this metaphor, we discuss a future research agenda for management scholars and prescriptive leverage points for the STEM career ecosystem.

Mathematics and Statistics

D-64: Bootstrap Confidence Intervals for the Population Variance Using Ranked-Set Sampling

Author: Bui, Khang

Advisor: Dr. Jesse Frey

We applied bootstrap techniques, specifically the pivotal and percentile methods, to compute confidence intervals for the population variance based on a ranked-set sample. Using a simulation study where we drew data from five different distributions—normal, exponential, log-normal, uniform, and $t(3)$ — and also considered both perfect and imperfect rankings, we found that the pivotal method tends to outperform the percentile method in terms of providing the correct coverage probability, but that the coverage for both methods tends towards the nominal level as the sample size increases. We also studied a normal-theory parametric method, finding that it is not competitive with the bootstrap methods when the parametric assumptions fail. The bootstrap methods did not perform well with small samples, suggesting that obtaining confidence intervals for the variance is more difficult than solving the same problem for the mean.

D-65: Improved Lower Bound on the Size of Maximum General Sets in \mathbb{F}_q^t

Author: Abdullah Al Rafi, Mahmud

Advisor: Dr. Michael Tait

A set of points in \mathbb{F}_q^t is called (d, s) -**general set** if no s points are in a d -dimensional affine space. In this project, we study the maximum size of $(d, d+2)$ -general sets. The best-known lower bound is by using a greedy or probabilistic argument and is of order $(q^t)^{\frac{1}{d+1}}$. We use results from coding theory to give an improved lower bound of order $(q^t)^{\frac{m+1}{m^2+m+1}}$ for sufficiently large t .

Mechanical Engineering

D-66: Data Center Environmental Burden Reduction Through On-Site Renewable Power Generation

Authors: McMullen, Matthew; Wemhoff, Aaron

Advisor: Dr. Aaron Wemhoff

The energy demands from data centers contribute greatly to water scarcity footprint and carbon emissions. Understanding the use of on-site renewable power generation is an important step to gaining insight into making data centers more sustainable. This study examines the impact of on-site solar or wind energy on water scarcity usage effectiveness (WSUE) and carbon usage effectiveness (CUE) at a U.S. county scale for a given data center size, water consumption level, and energy efficiency. The analysis uncovers combinations of specific metrics associated with the grid-based carbon emissions and water scarcity footprint that enable predictions of the improvements anticipated when implementing on-site solar or wind energy. The implementation of on-site renewables has the most benefit in reducing carbon footprint in areas with high existing grid-based emissions such as the mountain regions and the western side of the Appalachian Mountains. The largest benefit in reducing water scarcity footprint is generally seen in counties with low water scarcity compared to adjacent areas.

D-67: Implementation of a Single-Phase Water Liquid Cooling System for NVIDIA High Power Density Servers in a Data Center Rack

Authors: Costello, James; Margaritondo, Ben

Advisor: Dr. Alfonso Ortega

The high speed computations that are ubiquitous in today's world, from credit card transactions, to on-line shopping, to web browsing, using mobile-phone apps, or running sophisticated AI software, are all performed in data centers. Data centers are buildings that house interconnected servers (i.e. the "computers") mounted in equipment racks about the size of a large refrigerator. Servers require power and generate heat. Servers running powerful high-speed applications increasingly dissipate so much heat that they must be cooled using indirect water cooling using cold plates. Cold plates are metal blocks strapped onto the heat dissipating CPUs or GPUs in the server. The coolant (water) passes through cold plates through internal channels and absorbs the heat dissipated into the cold plate. In the current project, a test reference rack was assembled in order to experimentally

characterize the performance of a liquid-cooled system mock-up. The first task was to build a 3-D CAD model of the overall system in order to develop a list of components that needed to be designed, manufactured, or purchased. Simulated servers that utilize thermal test vehicles to mimic the heat generated from high performance chips were then provided by NVIDIA and installed in the rack. Cooling loops consisting of interconnected cold plates were provided by vendors and were mounted on multiple thermal test vehicles simulating the GPUs. They were instrumented with over a hundred temperature, pressure, and flow sensors to thermal-hydraulically characterize each component of the cooling systems. Experimental data was collected under conditions of maximum power in order to assess the system performance under the most stressful conditions. The experimental data showed that the flow distribution network providing cooling water to the cold plates had design flaws that caused the flow to vary over the different cold plates. Nevertheless, the vendor-supplied flow loop satisfied the thermal design targets. Currently the team is building a second-generation thermal-hydraulic reference rack with enhanced components for more refined testing.

D-68: Investigating Properties of Nanoparticle Agglomeration on Ceramic Surfaces

Author: Patel, Aryan

Advisor: Dr. Calvin Li

In recent years, rapid development in both knowledge and usage of nanoparticles has resulted in a burst of applications throughout various industries. Specifically, iron-oxide nanoparticles have gained interest due to their great potential and extensive availability. However, despite their promising properties and applications, the presence of iron-oxide nanoparticles in the form of rust within Reactor Coolant Pumps (RCPs) poses a great threat to the efficiency and longevity of these seals. The purpose of this investigation was to discover the fundamental mechanisms by which several factors affect the agglomeration and particle-size distribution of iron-oxide nanoparticles, hence providing insight into the interactions between nanoparticles in a working fluid and the ceramic surface of pump seal. The results of this investigation revealed inherent properties by which the blockage develops. Specifically, rather than agglomerating onto the surfaces of these ceramic substrates as proposed by other researchers, the particles agglomerate to each other, creating clusters large enough to block the seal's gap. The principal factor behind this clustering turned out to be the presence of an external electric field around the seal surfaces. The electric potential that exists on the iron-oxide nanoparticles causes particles to agglomerate together, and the resulting clusters interact with the ceramic surfaces and each other, which, alongside other factors such as flow rate and circulation duration, creates blockages in Nuclear RCPs.

Nursing

D-69: Barriers to safe medication use in adult populations accessing community health centers

Author: Polito, Lauren

Advisor: Dr. Elizabeth Dowdell

Background: Research projects that 50 to 80% of individuals are nonadherent to their medication regimen. This problem is especially prevalent among those with chronic conditions and long-term

medications and causes consequences related to exacerbated health conditions, costly intervention, and a higher risk of mortality. **Purpose:** To understand the barriers that prevent adult community health center patients from taking their medications safely and to identify the ways that nurses help relieve these roadblocks. **Methods:** This project used observational data from a 9 weeks of medication reconciliation visits at a community health center in Philadelphia, PA as well as journal articles. The health center's population includes adult men and women aged 21 and above. The literature review searched *CINAHL* and *PubMed* using keywords “barriers,” “medication safety,” and “community health care.” **Results:** Challenges related to safe medication use are more common among uninsured, low income, and minority patients and those with multiple comorbidities. Low health literacy, complex and fragmented care, and prescription access influence unsafe medication habits. **Conclusion(s)/Implications:** Medication adherence makes a significant impact on a person's quality of life, especially for those with chronic conditions like diabetes, hypertension, and depression. Nurses play a critical role in facilitating medication safety by scheduling medication reconciliation appointments, providing education, maintaining continuity of care, and coordinating between providers and pharmacies. It is important to use this research to address the root causes behind poor medication adherence for patients in the community health setting. Future research should assess patient behaviors across multiple health centers and interview providers, nurses, and patients. In addition to identifying barriers, subsequent studies should also explore strategies to bridge identified gaps.

D-70: Caring Beyond Cure: Perspectives of Pediatric Oncology Nurses on Palliative and End of Life Care

Authors: Scarperi, Peter; MacKenzie Greenle, Meredith
Advisor: Dr. Meredith MacKenzie Greenle

Background: Pediatric patients with cancer should receive high-quality end of life (EOL) care when needed. Limited research exists on nurses' attitudes toward providing EOL care for pediatric oncology patients. **Purpose:** In a sample of nursing students and nurses working in pediatric oncology, this study aims to: a) Describe attitudes towards providing EOL care; b) Examine the relationship between educational preparation, work experience and attitudes towards providing EOL care; and c) Explore the experiences of providing pediatric EOL care. **Methods:** This descriptive mixed methods study included nursing students completing an externship in pediatric oncology and pediatric oncology nurses. Participants completed a demographic survey and the Frommelt Attitude Toward Care of the Dying, a five-point scale that measures attitudes toward providing EOL care, modified for the pediatric population. Following the questionnaire, 10 participants completed qualitative interviews. Descriptive statistics and multiple regression were used to complete the second aim, while qualitative data analysis and the integration of quantitative and qualitative themes were used for aims 1 and 3. **Results:** Participants (N=38) were primarily female (87%) and white (89%). Participants on average held positive attitudes towards providing EOL care, with staff nurses holding slightly more positive attitudes than student nurses. All participants had experience in providing EOL care, yet only 2 (5.41%) believed their education thus far prepared them. Age, education level, years of experience and burnout were associated with nurse's attitudes towards providing EOL care. Qualitative themes included challenges of preparedness and training, the nurse's role and parent-team barriers.

D-71: Factors that Affect Sleep in Undergraduate Nursing Students

Author: Matella, Madison

Advisor: Dr. Elizabeth Dowdell

Background: Prelicensure baccalaureate undergraduate nursing students are at a particularly critical point of development, not only academically, but personally, as they learn how to best mediate stress and maintain healthy habits. Sleep is an essential part of healthy living, and yet 89.1% of nursing students identify themselves as poor sleepers. Nursing students are at increased risk for sleep deprivation due to their varied obligations to school, clinical, and extracurriculars, and this can have negative health consequences for students as well as safety risks for patients. **Purpose:** This literature review describes the major contributing factors that reduced sleep outcomes in prelicensure undergraduate nursing students in the United States. **Methods:** Following the Preferred Reporting Items (PRISMA) guidelines, this descriptive study searched the CINAHL electronic database using key words: “nursing students,” “sleep deprivation,” “sleep hygiene,” “sleep behavior,” and “reduced sleep” with limits to the last 5 years and the English language. Of the 114 records, eight articles met inclusion criteria. **Findings:** Results were organized into four themes of contributing factors that influence sleep in undergraduate nursing students: 1) Stress and Mental Health, 2) Technology Use, 3) Health Behaviors, and 4) Obligations to Work and School. **Conclusion(s)/Implications:** Sleep is increasingly recognized as important to health across the lifespan and findings support evidence-based results indicating that coping strategies, digital addiction, lifestyle behaviors, and burnout as major areas for improvement among prelicensure undergraduate nursing students. These findings are extremely relevant for academic advisors, faculty, administrators, staff, and institutions seeking evidence-based strategies to improve sleep, success, and safety for their students and their patients. It is essential to explore these contributing factors as part of a larger effort to discover the most effective strategies for improving nursing students’ health and well-being as they prepare for the demanding field of nursing.

D-72: The Effectiveness of Dietary Therapy in Women with Polycystic Ovary Syndrome: A Systematic Review

Authors: Stinson, Mya; Oliver, Tracy

Advisor: Dr. Tracy Oliver

Background: Polycystic ovary syndrome (PCOS) is an endocrine disorder affecting women aged 18–44. PCOS leads to a range of symptoms like infertility, metrorrhagia, hirsutism, and weight gain. PCOS increases the risk of developing obesity and insulin resistance, which can lead to other complications such as type 2 diabetes, hypertension, and endometrial cancer. Dietary changes may help manage PCOS symptoms and lower the risk of developing other related diseases. **Purpose:** This systematic review examines existing literature on various diets to identify any significant health improvements in women with PCOS. **Methods:** This review analyzed articles between the years 2013 and 2023 using search terms: PCOS or Polycystic Ovary Syndrome, nutrition, diet, and insulin resistance. Data was sourced from PubMed and CINAHL. Eligible articles were written in English and included populations of women aged 18 and up. PRISMA guidelines were followed, and study quality was assessed using the Mixed Methods Appraisal Tool (MMAT). **Results:** The analysis of seven articles identified three themes: (1) low-glycemic load diet and satiety, (2) time-restricted feeding and hormonal balance, (3) ketogenic diet and endocrine improvement. **Conclusion & Implications:** This review suggests dietary interventions, time-restricted feeding, low-glycemic load, and ketogenic diets may improve symptoms of PCOS. More research is needed to fully understand

the long-term effects of these diets on the overall health improvement of this population. Healthcare providers should consider these dietary interventions in their care plans due to their potential health benefits.

D-73: The Role of LGBTQ+ Senior Groups in Chronic Disease Management

Author: Dsouza, Aidan

Advisor: Dr. Elizabeth Dowdell

LGBTQ+ seniors are at an increased risk of social isolation, experiencing chronic conditions, and food and housing insecurities. Today's LGBTQ+ seniors grew up in a generation in which their peers tend to be less accepting of varying social and gender identities, leading to more social isolation and marginalization from their peers. The primary purpose of this project was to explore how LGBTQ+ senior groups support older adults in effectively managing their chronic disease. This project utilizes an interview-based qualitative approach among 8 participants who are members of the LGBTQ+ senior group at the Vintage Center for Active Adults in Pittsburgh, PA. Participants were interviewed one-on-one during their regularly scheduled meeting and asked a total of 8 questions. A total of eight ($n = 8$) participants ages 55 to 82 (mean = 72 years old) were interviewed. Three themes emerged from the interviews. (1) All participants described living with some sort of chronic condition including, but not limited to hypertension, arthritis, hearing deficits, etc. (2) The majority of participants indicated that the support group did not directly impact their physical health but rather kept them motivated in managing their chronic illnesses. (3) Five ($n=5$) of the 8 participants indicated that the group was useful in sharing information about LGBTQ+-friendly health services. Although this LGBTQ+ senior group did not directly impact older adults' physical health, the group catered to the social and emotional components of chronic disease management.

Physics

D-74: BurstStatVeto: An Application of Statistical Vetoes to the Development of Data Quality Vetoes in the Search for Burst Gravitational Waves

Authors: Vandra, Khushi; Stuver, Amber

Advisor: Dr. Amber Stuver

BurstStatVeto is a tool to study the effect of data quality from LIGO (Laser Interferometer Gravitational-Wave Observatory) in the search for unmodelled “burst” gravitational waves. The performance of statistically generated vetoes from Hierarchical Veto (Hveto) and Used Percentage Veto (UPV) are measured by determining their potential performance on burst search results. While these statistical vetoes are not currently used directly in the burst search, the auxiliary channel measurements that performed the best may be used as the basis of vetoes that are applied by the search. BurstStatVeto collects daily results of Hveto and UPV and applies those candidate vetoes to the burst analysis algorithm known as Coherent WaveBurst (cWB). The statistical vetoes are generated by correlating data collected by auxiliary monitors at various parts of the detector to the gravitational wave data and are generated based on different statistical significance. Ranking these correlations produces a set of candidate vetoes from various parts of the detector. This tool has never been used in actual data quality investigations. The research applies BurstStatVeto to times of

known data contamination in the LIGO-Virgo-KAGRA fourth observing run (O4) to determine its ability to identify contamination and its source to existing vetoes. When functioning as designed, this tool may prove effective at identifying poor data quality, reducing the labor needed to perform investigations like this manually. This material is based upon work supported by the Villanova Center for Research & Fellowships and NSF Grant PHY-2110157.

D-75: Development of a Burst Gravitational Wave Detectable Range Visualization

Authors: DePergola, Nicole; Stuver, Amber

Advisor: Dr. Amber Stuver

Laser Interferometer Gravitational-Wave Observatory (LIGO) measures gravitational waves of astrophysical origin. While all the detected gravitational waves to date have been of standard binary neutron star mergers, it is expected that the next class of detected gravitational waves will be from unmodelled or unanticipated sources, also known as “bursts.” This research focuses on applying a measure of the detectable distance for a burst gravitational wave that is sensitive to the near real-time data quality of the detector and the impact this data quality has on the search for bursts. We are using software developed using data from the third LIGO-Virgo-KAGRA observing run that collects results from Coherent WaveBurst, a burst search algorithm, to determine what signal-to-noise ratio (SNR) is needed to achieve a threshold false-alarm rate. This SNR is combined with the power spectral density of the noise to calculate the detectable distance for a standard burst source. The result can be visualized as a time-frequency representation or an average distance over the sensitive frequency range. We also compare the average ranges for similar times of the year from O3 and O4 to determine if the improved O4 data quality results in better ranges. The statistical significance of ranges improvements are also studied by removing known glitches and then comparing that range to the distribution of ranges found by randomizing the “glitch” times. Ultimately, this work may provide near real-time feedback on how instrument changes or complications are affecting the search for burst gravitational waves. This material is based upon work supported by the Villanova Center for Research & Fellowships and NSF Grant PHY-2110157.

D-76: Fourier-domain Tools for Analysis of Galactic Center Far-infrared Polarimetry Data

Authors: Bolinsky, Tristan; Chuss, David; Inara Iuliano, Jeff; Karpovich, Kaitlin

Advisor: Dr. David Chuss

FIREPLACE (Far-Infrared Polarimetric Large Are CMZ Emission Legacy Survey) is a survey taken using the 214- μm HAWC+ (High-resolution Airborne Wideband Camera-Plus) instrument in the SOFIA (Stratospheric Observatory For Infrared Astronomy) telescope of dust polarization in a $\sim 1.5^\circ$ region of the CMZ (Central Molecular Zone) within the Galactic Center (Butterfield et al.). As part of the data validation as well as for scientific analysis, we developed tools to compare the FIREPLACE data from the second data release (DR2; Paré et al. 2023, in prep) to other data sets. As part of this effort, we use polarization map data from the Atacama Cosmology Telescope (ACTPol). This data set has a coarser ($1'$) resolution, but more sensitivity to larger scales than FIREPLACE. This motivated comparisons in both map and Fourier domains. We create FITS files of both the ACTPol and FIREPLACE data on a common grid. We use Astropy’s convolution function with a Gaussian 2D kernel to reduce the FIREPLACE data’s angular resolution to that of the ACTPol data. With both FITS files at a common resolution and pixelization, we make use of the

Cross-Correlation Theorem of Fourier Transforms to create correlation plots in both the space domain and the Fourier domain. The use of the cross-correlation theorem significantly increases the speed of the algorithm as compared to direct integration.

D-77: HAWC+/SOFIA FIREPLACE Legacy Survey: Systematic Checks and Analysis

Authors: Karpovich, Kaitlyn; Chuss, David; Paré, Dylan; Butterfield, Natalie

Advisor: Dr. David Chuss

The Far Infrared Polarimetric Large Area CMZ Exploration Legacy Survey (FIREPLACE) is a SOFIA Legacy Program using the High-resolution Airborne Wideband Camera Plus (HAWC+) instrument. This survey covers approximately 150 pc across the Galactic center at a resolution of $\sim 20''$ and is aimed at the measurement of the magnetic field in the cool dust in the Central Molecular Zone (CMZ). Producing a polarimetric map for such a large region is a challenge and requires “scan mode” polarimetry, where the instrument is scanned over strips of the Galactic center, modeling the correlated noise contributions for each case. The resulting map is produced by merging these fields together. Because of the novel nature of this approach, multiple levels of validation are required. One of our methods used is the comparison with several discrete fields obtained with the more standard chop-nod-match observing mode. We describe the FIREPLACE observing method and show comparisons between the data reduction and data obtained from these test fields. As part of this analysis, we measure correlations between the reduced Stokes parameters of each data set as a function of the total intensity and find good agreement. One of these test fields is the massive star forming region, Sgr B2, where the superposition of physical environs makes the interpretation of far-infrared polarization data challenging. We combine the HAWC+ data with additional polarimetric data to test models of the magnetic field structure.

D-78: Investigating iDQ as a Binary Veto for Burst Gravitational Wave Searches

Authors: Granda Argianas, Lili Mei; Stuver, Amber

Advisor: Dr. Amber Stuver

When massive astrophysical collisions occur, they send “ripples” throughout space-time called gravitational waves. In 2015, LIGO (Laser Interferometer Gravitational-Wave Observatory) detected their first gravitational wave signal, which was caused by the collision of two black-holes. All gravitational waves detected since then have been the collision of binary system like this. LIGO continues to search for these gravitational waves and is also looking for signals from poorly modelled sources called bursts. The search for bursts is extremely sensitive to glitches in the data since we cannot make assumptions about the waveform. Glitches can be removed from the data through vetoes and this research aims to conclude the effectiveness of a machine learning algorithm called iDQ construct vetoes for the burst search.

D-79: The Feasibility Non-Binary Vetoes in the Search for Burst Gravitational Waves

Authors: Bevins, Nathaniel; Stuver, Amber

Advisor: Dr. Amber Stuver

The Laser Interferometer Gravitational-Wave Observatory (LIGO) measures gravitational waves from astrophysical sources with amplitudes on the order of a thousandth the diameter of a proton. The high precision of this detector makes particularly susceptible to environmental disturbances, which can cause "glitches" in the data. These glitches can be confused with candidate detections of unmodelled gravitational waves, called burst gravitational waves. Typically, these glitches are manually removed, or vetoed, via data quality studies that compile a list of times that are known to contain glitches and exclude those times from analysis. However, these glitch times could overlap with actual gravitational-wave detections, meaning that those data would be removed as well. This research investigates the feasibility of applying a machine learning algorithm (iDQ), which measures the likelihood that a glitch is present, to proportionately reduce the significance of contaminated times, rather than completely removing them as with traditional vetoes. We examine the iDQ likelihood distributions at known accidental burst gravitational-wave events and at randomly selected times to measure the efficiency with which the iDQ likelihood can be used to identify glitches.

D-80: Topographical Characterization of Ferritin Heteropolymers by AFM

Authors: Weidel, Mackenzie; Vizzoni, Marissa

Advisor: Dr. Georgia Papaefthymiou-Davis

Ferritin is the iron storage protein that plays a central role in critical cellular processes to maintain iron homeostasis in living organisms. It consists of an iron biomineral core of ferrihydrite surrounded by a spherical hetero-polymeric shell composed of 24 amino acid subunits of two types, H and L. There are H-rich ferritins and L-rich ferritins, meaning that the respective amino acids are more abundant depending on the organ tissue. Due to the nanoscale size of the ferritin molecule, ca. 12-nm outer shell diameter, it is challenging to analyze its topographical properties. Atomic Force Microscopy (AFM) utilizes a cantilever and tip to create an image of the surface of a substrate on the nanometer scale. Using AFM, we were able to obtain topographical data by acquiring height profiles of four different ferritin samples: L-rich apoferritin, H-rich apoferritin, L-rich holoferritin, and H-rich holoferritin. Using the pinpoint mode of a Parks' System AFM, we were also able to get a measure of the stiffness of the heteropolymers by acquiring Deformation and Young's Modulus data for each sample.

E-81: X-ray Spectral Analysis of Accretion Disk Winds in the Obscured State of GRS1915+105 with Chandra and NuSTAR

Authors: Karavangelas, Georgia; Neilsen, Joey

Advisor: Dr. Joey Neilsen

After a bright, 26-year-long outburst, the black hole binary GRS1915+105 dimmed considerably in 2018 and dropped sharply in flux in 2019. The system has remained in this new, faint "obscured state" ever since, exhibiting activity characterized by occasional X-ray flares. We utilize observations of GRS1915+105 from Chandra and NuSTAR, all performed in July of 2021, to conduct X-ray spectral analysis and photoionization modeling of the obscuring medium. The smooth continuum is consistent with disk emission and Compton scattering from an optically thick hybrid plasma, along

with a smeared absorption edge. We find dozens of absorption lines in our Chandra grating spectra, and our measured Doppler shifts show evidence for a significant outflow. To study these absorption lines further, we perform photoionization modeling using the XSTAR analytic model warmabs; our best fit model requires two partially-covered warmabs components that differ in column density and ionization parameter. Our photoionization analysis suggests the presence of a warm absorption region at radius $R = 7.12 \times 10^{10}$ cm and a cold absorption region at $R = 1.94 \times 10^{11}$ cm. We discuss the implications of this model for the structure of the obscuring medium.

Psychological & Brain Sciences

E-82: Evaluating brain-behavior relationships in mice to gain insight into psychiatric disorders and their treatment.

Authors: Borelli, Hannah; Quatela, Isabella; Warner, Allison; Iskander, Lauren; Allen, Kristen; Sachs, Benjamin

Advisor: Dr. Benjamin Sachs

Depression and anxiety inhibit the day-to-day life of millions worldwide as the most prevalent mental disorders. As there are currently no known causes, significant research is conducted to discover their etiologies to inform the best treatment. Similarly, animal models have helped determine the mechanisms through which treatments for these conditions exert their effects. One neurobiological mechanism that has been argued to play a critical role in antidepressant-like effects is increasing hippocampal neurogenesis. Studies using such models have produced information on how genetics and other factors play a role in the manifestation of anxious and depressive tendencies. Our summer project expanded on previous research to provide more insight into the genetic factors that govern sensitivity to the neuronal benefits of exercise. Prior work from the lab had shown that mice with low levels of brain serotonin were less sensitive than typical, wild-type mice to the behavioral effects of aerobic exercise in several behavioral tests considered relevant for depression and anxiety-like behavior. However, the mechanisms underlying this failure of exercise to induce positive behavioral changes had not been established. We used immunohistochemistry and fluorescence microscopy for doublecortin and bromodeoxyuridine to quantify the number of immature neurons in the hippocampi of wild-type and serotonin-deficient mice that were provided with running wheels to enable voluntary exercise (and controls that were not). Our results showed that the lack of brain serotonin did not prevent exercise-induced increases in hippocampal neurogenesis, suggesting that other mechanisms must explain the failure of serotonin-deficient mice to exhibit antidepressant-like effects.

E-83: Influence of Repeated Amphetamine Exposure on Stress Susceptibility in Male and Female Mice

Author: Eby, Anne

Advisor: Dr. Benjamin Sachs

About 25% of adults world-wide will suffer from a diagnosable mental health disorder in their lifetime. Many individuals who experience anxiety disorders or mental disorders, such as generalized anxiety, post-traumatic stress disorder, and major depressive disorder, also develop substance use disorders (and vice versa). Due to the high rates of comorbidity between substance use disorders,

anxiety, and depression, the relationship between an individual's susceptibility to stress following drug use is worthy of exploration. In this study, we focus on the effect of amphetamine pre-exposure on behavioral outcomes in response to a three-day stress paradigm in male and female mice. Mice were injected with either saline or 3 mg/kg of an amphetamine solution. Half of the subjects were exposed to the stress paradigm, and all were subjected to panel of behavioral tests to quantify their depressive and anxiety-like behavior. The results of this study show that repeated amphetamine exposure led to decreased anxiety-like behavior in the Light Dark Emergence and Elevated Plus Maze tests for both males and females. In the Forced Swim Test, a sex by stress by drug interaction ($p=.033$) reveals sex-differences in the distance stressed and amphetamine-exposed mice traveled. In this parameter, females exposed to amphetamine were significantly more susceptible to stress than amphetamine-exposed males, suggesting heightened depressive-like behavior in females only. Future work will delve into gene expression to examine the molecular mechanisms that may contribute to these behavioral phenotypes.

E-84: Learning from Anthropomorphic Stories: Teaching Preschoolers Acquired vs Inheritable Traits by Varying Character Realism

Authors: Van Dusen, Kathryn; Weisberg, Deena

Advisor: Dr. Deena Weisberg

Nearly all children's education media contains at least one fictional aspect. When trying to teach a scientific lesson, the fictional element could blur the lines between what is real and what is fantastical. To test the influence of fantasy on the ability to learn a scientific lesson, we read to children ages 4-6 years old with stories that varied by having human or kangaroo main characters and realistic or anthropomorphized target animals. The text for each story was consistent, with the main characters teaching about the difference between inheritable and acquired traits between parent-child target animal pairs. The goal is to determine if there is an ideal amount of fantasy to include in a story to capture the child's attention while not interfering with the educational information. We are still running subjects but expect to find that moderate inclusion of fantasy elements would have the most positive effect on learning about traits.

E-85: Non-familial Support Structures and Parental Wellbeing in Homeless Experiences

Authors: Guillette, Liberty; Herbers, Janette

Advisor: Dr. Janette Herbers

In relation to homeless shelters, families that have younger children may come from a richly diverse number of backgrounds and experiences. How these families are made up, their different support systems and their differing housing accommodations, vary drastically. Existing studies tend to concentrate on the family's internal situation and the impact that may have on their mental wellbeing, overlooking the importance of a family's support systems, both familial and non-familial, such as friends, coworkers, social workers and mentors. A family's support network plays a very important role in determining duration of homeless situations and a family's wellbeing during these situations. This proposed study seeks to explore the differing dynamics of family structures within the context of homelessness and how their differing familial and non-familial support compare in association with parent's well-being. Participants filled out an ecomap that detailed their support networks and the types of relationships they had with them. These were then coded and compared

with a 14 item questionnaire from the Symptom Checklist-25. This study was done in parallel with adult-sibling relationships and their association with parents' well-being.

E-86: Non-Spanish-Speaking Adults Can Detect Meaning Through Prosody in Spanish-Speaking Mothers' Toy-Play Utterances

Authors: Koo, Grace; Cetrulo, Jillian; Gartland, Casey; Lucolino, Francesca, McMahon, Jennifer; Molina, Maria Gabriela; Brand, Rebecca

Advisor: Dr. Rebecca Brand

In parent-infant interactions, the coordination of mothers' speech and action, called acoustic packaging, may provide support to infants' learning. Acoustic packaging seems well-suited to support infants' learning about actions, especially if utterances have recognizable "messages" based on prosody, as has been found in the emotional realm. Meyer et al. found that adults were able to differentiate and correctly identify mothers' utterances type – either attention getting, action description, or celebration/completion, based on prosody alone. For acoustic packaging to be of use to pre-linguistic infants, it would likely function similarly across languages. In the current study, we replicate and extend previous work, using English and Spanish utterances, and engaging raters who are either proficient in Spanish or naïve to Spanish (no proficiency), with a third sample falling in between. Utterances from English-speaking and Spanish-speaking mother-infant pairs were low-pass-filtered, obfuscating word meaning but retaining prosody. Forty-five Villanova students (M age = 18.9 years) listened to 36 filtered utterances (6 of each type in each language) and attempted to categorize them correctly. All utterance types were categorized at above-chance levels by all Spanish-proficiency categories. That is, both Spanish and English infant-directed interactions contain common utterance categories that are detectable by prosody alone, even to listeners who are unfamiliar with the language in which they were spoken. This suggests a possible cross-linguistic or pre-linguistic availability of meaning in the prosody of infant-directed utterances.

E-87: Parental Mental Health and Infant Negative Emotionality in Homeless Shelters

Authors: Helstrom, Sarah

Advisor: Dr. Janette Herbers

Parents in families experiencing homelessness show high rates of mental health problems, especially depression. Their infants also face risk for developing anxiety and depression in adolescence due to their experiences of poverty and instability in their families and environments. Parental depression can impact the quality of the parent-infant relationship, which plays a critical role in children's social-emotional development. Early signs of risk for developing social-emotional problems include temperamental negative affect in infants. For my project, I utilized a sample of parent-infant dyads recruited from emergency housing to explore associations among parent mental health and infant negative affectivity. I examined parent-reported depression symptoms and parent perception of infant temperament in relation to observational assessments of infant sadness and anger based on three behavioral tasks. I expected to find positive correlations between parent depression and indicators of infant negative emotionality based on both parent report and observation.

E-88: Perceived Control During Childbirth Predicts Maternal Postpartum Wellbeing: A Basic Psychological Needs Approach

Authors: Gartland, Casey; Hicks, Jordan; Koo, Grace; McMahon, Jennifer; Al-Khayyat, Ranya; Brand, Rebecca

Advisor: Dr. Rebecca Brand

Postpartum mental health problems are distressing and dangerous for both mother and child. One relatively understudied factor in women's postpartum well-being is the experience of childbirth itself. Studies indicate that women's satisfaction with their childbirth experience predicts psychological health, including postpartum depressive symptoms as well as maternal self-efficacy. Despite dozens of studies, there is no consensus regarding what makes for a satisfying childbirth experience. We argue that Basic Psychological Needs Theory (BPNT; Deci & Ryan, 2008) provides an ideal framework for understanding what makes this transformational experience satisfying and empowering versus dehumanizing and traumatic. One completed study and one underway test this claim. In Study 1 ($n = 80$), we found that mothers' postpartum maternal self-efficacy (MSE) was predicted by their perceived control in childbirth (Stevens *et. al.*, 2012), over and above prenatal MSE, number of birth interventions, and pre- and postnatal depression. In Study 2 (ongoing), we are investigating whether support from maternity care providers for autonomy, competence, and relatedness during labor and delivery predict postnatal MSE and depression, controlling for prenatal MSE and depression. We predict that support for basic psychological needs – particularly during childbirth itself – is influential in maternal postnatal well-being.

E-89: Ready for Bed? The Association Among Sleep Myths, Sleep Hygiene, & Sleep Quality in College Students

Author: Lima, Isabel

Advisor: Dr. Irene Kan

Decades of sleep research has demonstrated the crucial role of sleep in physical, mental, and cognitive health. While sleep patterns in younger adolescents have been extensively researched, relatively fewer studies have examined the sleep profiles of college students, who likely experience a time of minimal adult supervision, erratic schedules, and academic stress. Recent studies found that false beliefs about sleep, often referred to as sleep myths, are associated with sleep hygiene behaviors. In the current study, we assessed the degree to which sleep myths are endorsed in a sample of 568 Villanova University students (62.3% female; Mean age=21.04) and its associations with sleep hygiene behaviors and sleep quality. In addition to evaluating endorsement of sleep myths (e.g., Watching TV in bed is a good way to relax before sleep), participants also reported their sleep quality (using the Pittsburg Sleep Quality Index), sleep hygiene behaviors, and demographics. Across all participants, we found that stronger beliefs in sleep myths are associated with behaviors that are incompatible with sleep hygiene recommendations (e.g., higher inconsistency in bedtime, more in-bed activities, and engaging in more ineffective fall-asleep strategies). Furthermore, shorter sleep duration, higher bedtime inconsistency, and more in-bed activities are associated with lower sleep quality. No significant relationship was observed between sleep quality and sleep myth endorsement. These results suggest that sleep myths that go unaddressed may result in maladaptive sleep hygiene patterns. Exploring effective sleep interventions for college populations may inform future efforts in promoting sleep hygiene behavior and quality.

E-90: Sex Differences in Stress-Induced Alterations of DNA Methylation

Author: Domanico, Matthew

Advisor: Dr. Benjamin Sachs

Stress has been shown to influence the brain and is believed to contribute to the development of mental disorders. One mechanism underlying how stress impacts brain function involves epigenetics and gene methylation. Previous studies conducted by the Sachs Lab have revealed that stress can enhance the expression of an epigenetic enzyme responsible for DNA methylation in the nucleus accumbens (NAc) of female, but not male, mice. Consequently, this project set out to determine how stress affects gene-specific methylation in the mouse NAc and whether any sex differences exist. Two cohorts of c57BL/6 mice were either exposed to a 5-day stress regimen or served as control subjects. After the 5th day, the mice were sacrificed either two hours or one week later. Bilateral brain tissue samples were collected from the NAc, and DNA was subsequently extracted and left either undigested or digested with restriction enzymes sensitive or non-sensitive to methylation. Finally, real-time PCR was conducted to quantitatively assess methylation levels. The results indicate that the previously reported increase in the epigenetic enzyme in stressed females does not result in a genome-wide increase in DNA methylation. While stress did elevate methylation of the IKKB gene in females, consistent with the hypothesis, it did not lead to a similar pattern of methylation alterations in other genes. Altogether, the results are consistent with prior studies suggesting that both stress and sex influence DNA methylation, but the findings documenting site-specific effects of these factors highlight the complexity of epigenetic regulation.

E-91: *The Knowledge of Early Development in Services (KEDS) Workshop Series and Flip-Book Production Within and For Local Philadelphia Homeless Shelters*

Authors: Cosme, Michael; Knight, Abigail; Al-Khayyat, Ranya; Nuzzo-Dozier, Eli; Guillette, Liberty

Advisor: Dr. Janette Herbers

Family homeless shelters provide crucial support for families in crisis, offering temporary housing and access to resources. This comes with the issue of also accommodating young children in a critical stage of early development. The *Knowledge of Early Development in Services (KEDS)* workshop series was created to offer shelter staff, regardless of their background or specialized training in early childhood development, a framework to understand and aid the needs of young children in shelters. *KEDS* consists of six core modules, each covering an essential aspect of early childhood development: relationships, resilience, brain development, cognitive/motor development, emotions/self-regulation, and language/reading. These workshops have three primary objectives: (1) conveying vital information in a clear and accessible manner, (2) reinforcing learning through hands-on activities, and (3) encouraging open discussions among participants about applying this within their shelter settings. Each workshop lasts approximately 30-40 minutes and can be delivered in either as three weekly 2-hour sessions, or as a full-day seminar with breaks. The first set of data showed that parents and staff do not understand certain aspects of child development heavily such as resilience and trauma within early child development, like when to comfort a child when they are crying. The *KEDS* workshop series is a valuable resource for shelters, recognizing the crucial role that all staff members play in supporting healthy early childhood development, *KEDS* aims to provide them with practical application and knowledge for these situations. Continuing from the workshops, the *KEDS* Flip-Book project was developed to provide homeless shelter staff with a readily accessible resource for families seeking developmental information and advice. Based on data from the workshops, the Flip-Book is organized into sections corresponding to the modules,

featuring graphics created by students on one side and additional information on the other. Being provided to local Philadelphia shelters once production and copyright are finalized.

Sociology and Criminology

E-92: Gaps & New Research in School Discipline & Safety in the Context of the School-to-Prison Pipeline

Authors: Faria, Deborah; De La Cruz, Zenaida; Scerba, Alivia

Advisor: Dr. Kelly Welch, Dr. Allison Payne

School Discipline and Safety in the Context of the School-to-Prison Pipeline suggests that harsh school discipline and safety policies push students into the criminal justice system. The School-to-Prison Pipeline raises the question of how/why these harsh policies are enacted and their consequences on students. Previous research was done by Dr. Kelly Welch and Dr. Allison Payne that analyzed racial threat theory for African Americans and Latinx students, punitive school discipline, restorative school discipline practices, racial threat on expulsion, suspension, and zero tolerance policies, and the school impact on the development of criminal and antisocial behavior. Our research strives to find any gaps or unanswered questions found in Dr. Welch and Dr. Payne's research to provide new ideas for further research on the topic. We used data from both Dr. Welch and Dr. Payne's research articles, along with looking at various data sets such as TIMMS, SSOCS (School Survey on Crime and Safety), SCS (School Crime Supplement), ADD Health, and the Violence Project Mass Shooter Database to provide relevant questionnaires/data for our possible new research topics. Our method involved conducting literature reviews, participating in focus groups, critical thinking, note-taking with file organization, analysis of data, and working on a team to get results. We found possible further research topics such as a Multilevel Modeling Examination on the "nested communities" of schools, the Asian Threat and Model Minority in schools, Latinx/Hispanic Identities in schools, School shootings that deal with zero-tolerance policies and stricter security measures, and finally, the Native American Threat in schools. Our findings suggest there is much more research needed to be conducted to better understand the School-to-Prison Pipeline and all the contextual factors of school discipline and safety policies that push students into the criminal justice system.

Spanish

E-93: Does Perception Match Performance? Neurophysiological Correlates of Cognitive Control

Author: Caselli, Jake

Advisor: Dr. Grant Berr

Conflict resolution depends on the ability to detect conflict and the engagement of cognitive mechanisms (cognitive control). Individuals rely on a combination of both top-down (proactive) and bottom-up (reactive) mechanisms to accomplish this but often develop a preference for one strategy over the other (Braver *et al.*, 2007; Gonthier *et al.*, 2016). To date, the relative strength of these mechanisms has been measured primarily by behavioral tasks, but behavioral measures only capture

the end result of cognitive processing. The current study compares behavioral performance on two widely used behavioral tasks of conflict resolution with neurophysiological responses using electroencephalography (EEG), a tool with high temporal resolution. Specifically, we evaluate whether early measures of auditory conflict detection (mismatch negativity, or MMN) correlate to late measures of task performance derived from accuracy and reaction times (indices from the AX-CPT and n-back task with lures). Though data are limited ($n=8$), we do not currently find strong evidence for a relationship between early measures of change detection and performance on conflict resolution tasks. We interpret these results as meaning that change detection may be independent from task performance.