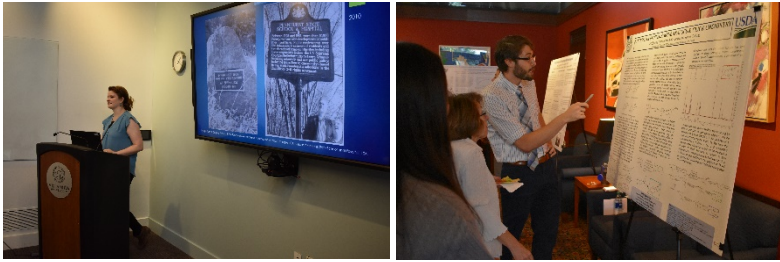


College of Liberal Arts and Sciences

Graduate Student Research Symposium



November 12, 2021

1-4 p.m.

Connelly Cinema and St. David's Room

Connelly Center



GRADUATE LIBERAL ARTS & SCIENCES

Schedule of Presenters

Oral presentations - Connelly Cinema, 1-2:30 p.m.

- 1:05 p.m. Shane McFoy, Biology
 Gabrielle Coker, Math
 David McCauley, History
 Hannah Kessler, Chemistry
 Nathaniel Grimes, Theology
- 1:35 p.m. Samuel Sinemus, Psychology
 Zoe Darazsdi, Counseling
 Christopher Quintana, Philosophy
 Marissa Rossi, Environmental Science
- 2:00 p.m. Nick Langan, Software Engineering
 Yakendra Bajgain, Biology
 Christopher DelSanto, History
 Alison Warner, Psychology
 Joshua Zalewski, Biology

Poster presentations - St. David's Room, 2:30-4 p.m.

- | | |
|---------------------------------------|---|
| Margaret Boyle, Biology | Em Friedman, English |
| Kelly Hodges, Biology | Panagiotis Christoforos
Sassarlis, English |
| Marissa Bradley, Chemistry | Daniel Cunningham,
Philosophy |
| Rachel Grady, Chemistry | Alexa Gonzalez, Psychology |
| Amy Troutman, Chemistry | Ailie Posillico, Theology |
| Bikal Lamichhane, Computer
Science | |

Research is an essential element to the experience of graduate students in the College of Liberal Arts and Sciences at Villanova. Each year, the Office of Graduate Studies puts out a call for proposals for the Graduate Summer Research Fellowship. This abstract book represents the research projects of the recipients of the 2021 award. These projects completed in the face of the additional challenges posed by the pandemic, reflect the wide variety of fascinating research being conducted by graduate students in CLAS at Villanova, ranging from Biology and Chemistry to History and Philosophy. Students were invited to present their research either with a poster or a Three Minute Thesis-style brief oral presentation.

We would like to thank the faculty members who joined Dr. Emory Woodard (Chair) on the 2021 Summer Research Fellowship committee: Drs. Anil Bamezai (Biology); Sarah-Vaughn Brakman (Philosophy); Lynne Hartnett (History); Daniel Kraut (Chemistry); Thomas Ksiazek (Communication); Edward Sobel (Theatre); Peter Spitaler (Theology and Religious Studies); Joseph Toscano (Psychological and Brain Sciences). Sincere appreciation goes to the faculty sponsors for each of these exciting research projects. Faculty mentorship at Villanova is what makes the graduate student experience so unique. Finally, thank you to the Dean of the College of Liberal Arts and Sciences, Dr. Adele Lindenmeyr, for her continuing support of graduate student research.

Office of Graduate Studies, CLAS

Biology

Understanding the transcription of *Candida glabrata* thiamine starvation-regulated promoters by characterizing the binding of transcription factor CgPDC2

Author: Yakendra Bajgain

Sponsor: Dr. Dennis Wykoff

“The thiamine signal transduction (THI) pathway of *Candida glabrata* contains two different regulatory factors (Thi3, Pdc2) that downregulate the expression of genes involved in the biosynthesis of thiamine when it is available from extracellular sources. Pdc2p contains an internal transactivation domain and a Thi3p-interacting domain along its C-terminal. It also contains a DNA-binding domain in its N-terminal, allowing it to regulate genes involved in the synthesis of thiamine pyrophosphate (TPP), an essential cofactor required for amino acid and carbohydrate metabolism. Despite multiple studies, the exact transcription factor binding sites in THI promoters have not been uncovered yet. Recent studies have shown that transcription factors contain polar or charged amino acid-rich polypeptide segments called intrinsically disordered regions (IDRs) that play a significant role in transcription by either accelerating binding-site search, or by aiding in binding site selection. Studies on the influence of the IDR-rich C-terminal of CgPdc2 on directing the transcription of THI genes have not been done. My research aims to characterize the binding properties of CgPdc2 and assess the importance of IDRs in guiding the transcription factor to its binding sites in THI promoters. Preliminary data shows that only full-length CgPdc2 is capable of binding to Thi3 and regulating THI genes,

suggesting the DNA-binding domain or IDR-rich activation domain only are not enough to confer such regulation. Moreover, truncation analysis has shown that serially removing 40 amino acids from the C-terminal end of CgPdc2 gradually decreases the promoter-binding ability of CgPdc2. Future experiments conducted using Chromatin Endogenous Cleavage (ChEC) coupled with high throughput sequencing will shed light on the exact CgPdc2 binding sites in TH1 promoters.”

**oral presentation*

Does social dominance of tufted titmouse asymmetrically impact black-capped versus Carolina chickadees?

Author: Margaret Boyle

Sponsor: Dr. Robert Curry

“Interspecific interactions—such as predation, parasitism, and competition—can shape a species’ behavior. Social network analysis (SNA) is a powerful approach for investigating associations among interacting individuals. We used SNA to examine relationships among and between tufted titmice (*Baeolophus bicolor*) and black-capped chickadee (*Poecile atricapillus*), two songbirds that interact within mixed-species winter flocks in the northeastern USA. Despite the extensive geographical overlap between tufted titmice and black-capped chickadees, social networks involving these two species remain understudied. We hypothesized that the smaller chickadees would avoid the larger, aggressive, and socially dominant titmice at the bird feeder. Accordingly, we predicted that chickadees would be more peripheral than titmice in social networks. To carry out SNA, we constructed site-specific networks using visits to upstate New York feeders monitored with Radio

Frequency Identification (RFID) methods, with association (“edges”) based on spatiotemporal co-occurrence of uniquely tagged individuals (“nodes”) of both species. We then measured network positions for individual birds as degree centrality (the number of adjacent edges); eigenvector centrality (high for nodes connected to many other well-connected nodes); strength (a function of the number of edges and the frequency of each association), betweenness (the number of the shortest paths that pass through a node), and closeness (the number of steps required to access every other node from a given node). We also analyzed assortativity of networks to determine if the species. Overall, titmice and chickadees did not differ in any node metrics; additionally, individuals did not assort themselves by species. Chickadees and titmice were therefore equally distributed across social networks. These results fail to support our hypothesis that chickadees aggregate within networks to avoid the more aggressive titmice, and they suggest that heterospecific interactions are more frequent than they could be. Chickadees therefore may face some unavoidable costs from participation in mixed flocks, despite other benefits of membership. The number of novel species assemblages has increased with climate change; for example, both the Carolina chickadee and tufted titmouse have expanded their ranges northward into black-capped chickadee territory. By assessing novel species interactions resulting from these shifts, we can begin to predict if and how native species will be affected by the changing climate.”

**poster*

Determining the Role of Adenylate Cyclases in *Crithidia fasciculata*

Author: Kelly Hodges

Sponsor: Dr. Megan Povelones

“Kinetoplastids are a group of single-celled eukaryotic parasites. These species are transmitted by insect vectors in which the parasite must undergo specific developmental transformations, including a stage in which parasites adhere to insect tissue. Using *Crithidia fasciculata* as a model kinetoplastid I have begun to investigate this tissue adherence and the signals required for the adherent structure to form. Preliminary data suggests that cyclic AMP (cAMP)-mediated signaling is important and may play a role in the transition from a swimming to an adherent parasite. To investigate cAMP signaling during differentiation in *C. fasciculata* I am studying a family of receptor adenylate cyclases (ACs) which, in other organisms, are known to catalyze the creation of cAMP. The expression, localization, and regulation of ACs in *C. fasciculata* are currently unknown. I have tagged one of these ACs, which I call RAC6500, with a C-terminal GFP (green fluorescent protein) tag, and determined that it localizes to the flagellum in swimming cells. I am now interested in how the expression and localization of this protein changes as the parasite switches from swimming to adherent. I am also planning to address the function of this AC through genetic knock-out studies which will explore how cAMP levels affect the parasite’s ability to adhere.”

**poster*

Social networks of mixed species chickadee flocks change with food accessibility

Author: Shane McFoy

Sponsor: Dr. Robert Curry

“Social groups are collections of individuals that interact with one another regularly that exhibit a consistent relationship pattern. Certain social interactions among wild animals demonstrate an advantage to survival. Black-capped chickadees (BCCH), Carolina chickadees (CACH), and hybrid chickadees (HYCH) coexist in mixed species flocks at Hawk Mountain in Kempton, Pennsylvania in the chickadee hybrid zone. The disadvantages of mixed species flocks such as resource competition, decreased feeding efficiency, and increased disease transfer are outweighed by the benefits which includes heightened predator vigilance and avoidance, enhanced information transfer, improved decision-making, increased foraging success and social learning. Social networks can be quantified and defined along specific behavioral criteria using a social network analysis tool. A social network graph comprises ‘nodes,’ representing an individual, and ‘edges,’ representing the relationship between two or more individuals. With this kind of data, we can measure node-level metrics like ‘degree’ (the number of connections a given node has) and ‘strength’ (the total number interactions, given quantitative data). As part of the larger cognitive study I am performing for my thesis, I have collected social interaction data from an array of eight ‘smart feeders’ of black-capped, Carolina and hybrid chickadees at hawk mountain. I looked at how the social networks of the birds changed based on access to food. In the first stage, the feeders were open, and any bird in the area had access to the food in any of the eight feeders regardless of species. In the second stage the door to the feeders only opened for any tagged chickadee. In the third

stage all tagged birds were assigned to one of eight feeders and only had access to that feeder's food if their name was on the list. Between the three modes food became harder to access and the birds needed to learn whether or not they had access to a particular feeder. My study showed two distinct social groups formed based on the food availability and accessibility. The two groups and social networks of the chickadees in my study changed with food accessibility. Seeing how social groups form from these data is important to my future cognitive study to understand how plastic problem solving is in avian species. These data and how I am investigating social relationships can illuminate how social networks and interactions with other individuals affect a bird's ability to find food thus impacting its survival and fitness.”

**oral presentation*

Environmental factors as predictors for peatland bryophyte assemblages of the Glaciated Pocono Plateau of Pennsylvania

Author: Joshua Zalewski

Sponsor: Dr. R. Kelman Wieder

“Plant communities of peatland ecosystems in Pennsylvania are poorly understood, despite their critical role in peatland development and their relative vulnerability to habitat loss and climate change. My thesis project aims to describe the distribution and composition of these communities, and to correlate their occurrence with relevant environmental factors, such as water chemistry, peat depth, and shade. The results are potentially valuable at a local scale, informing management and conservation of peatlands, and at a global scale, filling gaps in knowledge about peatland community ecology in temperate climates.”

**oral presentation*

Chemistry

Modifying a Solid Oxide Fuel Cell Anode, $\text{Sr}_2\text{Fe}_{1.5}\text{Mo}_{0.5}\text{O}_{6-\delta}$ (SFMO), to Improve Redox Stability for Fuel Cell Applications Using Biofuels

Author: Marissa Bradley

Sponsor: Dr. Bryan Eigenbrodt

“Today, 84.3% of global energy comes from fossil fuels, including coal, oil, and natural gas. These are non-renewable, limited resources that our society uses inefficiently in combustion systems causing a dwindling supply of fuels, alongside increasing demand. Solid oxide fuel cells are a promising renewable energy source that doesn’t require the use of fossil fuels and instead converts fuels directly to electrical energy, making them far more efficient systems. One solid oxide fuel cell anode material, $\text{Sr}_2\text{Fe}_{1.5}\text{Mo}_{0.5}\text{O}_{6-\delta}$ (SFMO), gained attention because of its ability to be used with renewable hydrocarbon fuels. However, studies conducted at Argonne National Laboratory revealed that the anode material is not stable under reducing conditions, as previously suggested. These environments are important for solid oxide fuel cells because of the environments the anodes must endure as working cells. Modifying the iron and molybdenum ratios in the SFMO crystal structure allowed for the synthesis of a redox stable anode material, even in high temperature reducing environments. Analysis using x-ray diffraction of the material in alternating oxidizing and reducing environments confirmed the potential of the groundbreakingly stable variant SFMO anode..”

**poster*

Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS) Method for the Quantitation of Sulforaphane (SFN) in Human Plasma and Insights into Decomposition Pathways

Author: Rachel Grady

Sponsor: Dr. Anthony Lagalante

“The transcription factor Nrf2 is the master regulator of antioxidant defenses and cytoprotective genes, many of which provide detoxification, repair, and oxidative stress responses. Activation of the Nrf2-ARE pathway is a major therapeutic target for chronic disease. Sulforaphane (SFN), a phytochemical derived from cruciferous vegetables, is a potent inducer of the Nrf2-ARE pathway and phase II cytoprotective enzymes and is currently under evaluation in clinical trials. A liquid chromatography-tandem mass spectrometry (LC-MS/MS) method was developed to quantify sulforaphane in human plasma with an emphasis on SFN stability and decomposition. Previous reports have demonstrated SFN’s instability at temperatures above 40°C and in protic solvents that are commonly used in SFN analysis, such as methanol, ethanol, and water. Short-term (24 h) decomposition studies of SFN in these protic solvents and the aprotic solvent acetonitrile at 40°C, 25°C, and 60°C were conducted to identify SFN decomposition products. SFN remained stable at room temperature over 24 hours in all solvents but decomposed the slowest in acetonitrile at 60°C. SFN decomposition products due to nucleophilic attack by methanol and ethanol were identified in protic organic solvents relevant to LC-MS/MS analysis. Acetonitrile was used for SFN analysis based on this decomposition data. Unexpectedly, we observed that SFN metabolite standards (SFN-GSH, SFN-Cys, SFN-NAC) dissociated under HPLC conditions, and thus we chose to only measure free SFN. The method was applied to an

acute SFN supplementation trial consisting of 12 participants. SFN concentrations peaked 1-hour post-consumption with a mean concentration of 15.00 ± 0.05 nM. SFN was detected and quantified at levels as low as 1.30 nM, demonstrating the high sensitivity of this LC-MS/MS method for SFN quantitation in human plasma. SFN concentrations correlated with Nrf2-ARE binding data where a maximum Nrf2-ARE response was observed 2 hours post-SFN consumption.”

**poster*

Synthesis of Functionalized Dihydropyrimidines for the Exploration of their Potential Antibiotic Activity

Author: Hannah Kessler

Sponsor: Dr. Matthew O'Reilly

“The Centers for Disease Control (CDC) reported that 2.8 million antibiotic resistance infections occurred in the United States in 2019, and more than 35,000 people died as a result. The discovery of novel antibiotics working through unique mechanisms is an important goal toward mitigating the threat antibiotic-resistant bacteria present. Dihydrofolate reductase (DHFR) inhibition is an underexploited antibiotic target, with only one approved antibiotic working through this mechanism. A lead compound called emmacin was reported to exert antibacterial activity through uncompetitive inhibition of DHFR, and we are exploring this compound class using a combination of medicinal chemistry, bacteriology, and biochemistry approaches. We also plan to synthesize analogs of emmacin by changing the ethyl group to a phenyl or methyl group and by dehalogenation of the chlorine and bromine groups to

evaluate the structure-activity relationships (SAR) of the compound class. Finally, we plan to perform enzyme kinetics assays with bacterial and mammalian dihydrofolate reductase inhibitor (DHFR) to evaluate the mechanism of action of bioactive compounds.”

**oral presentation*

Analysis and Characterization of Dissolved Organic Matter in Arctic Surface and Subsurface Waters

Author: Amy Troutman

Sponsor: Dr. Vanessa Boschi

“Due to global climate change, the Arctic Ocean has been experiencing a significant amount of decreasing sea ice concentration. Due to ice melting in the Arctic Ocean, an increased amount of dissolved organic matter (DOM) is being introduced into oceanic waters. Dissolved organic matter is a group of complex compounds mostly comprised of carbon, oxygen, and hydrogen and consists of molecules like lipids, lignin, carbohydrates, protein, and tannins. The increase in DOM affects the amount of sunlight absorbed, which affects the biology, and thus the chemistry of the molecules. The molecules in oceanic water can also affect the atmosphere due to bubble bursting mechanisms which causes the molecules to become primary marine aerosol, which affect the formation and lifetime of Arctic clouds. The dissolved organic matter and microbiology communities present in the ocean’s surface affects aerosol chemistry. Thus, the Arctic Ocean is influenced by sea ice density which influences surface water chemistry and consequently influences atmospheric chemistry. To better understand the molecules which are present in the Arctic Ocean waters, samples were taken from the surface microlayer as well as the bulk water. Water samples were

placed in a marine aerosol reference tank (MART) to generate aerosols. Pre-MART samples, which represent the initial water chemistry, were compared with post-MART water samples which represent water chemistry being affected by aerosolization. By using ESI-FTICR-MS, the DOM present in the samples can be characterized and given a molecular formula type. Upon characterization, the most interesting relationship is between lipid and lignin within the surface microlayer and bulk water samples. Lignin is more abundant in the surface microlayer than bulk water and lipids are more abundant in the bulk water than the surface microlayer. The predominate formula type for lignin molecules is CHO while the predominate formula type for lipid molecules is CHOS. Despite the surface microlayer having a lower concentration of lipids, there is a higher percentage of CHOS found in this water fraction. This suggests that there is a significant loss of sulfur in this compound group which can be highly volatile at the ocean's surface."

**poster*

Computing Sciences

DiHD: Efficient classification of viral diseases from DNA Sequences using Hyperdimensional Computing

Author: Bikal Lamichhane

Sponsor: Dr. Xun Jiao

"DNA sequence classification is a crucial area of research in computational biology. It enables researchers to diagnose possible illnesses and conduct genomic analysis. In this work, we present DiHD for multi-class classification of viral conditions including Sars-Cov-2 (COVID-19) and other

infectious diseases such as Influenza, Human Immunodeficiency Virus(HIV), and Hepatitis C. Based on the principles of hyperdimensional computing, DiHD utilizes high-dimensional vectors called hypervectors (HS) to represent the number of amino acids present in a given DNA sequence. The frequency of different amino acids or codons in a DNA sample aid in the effective classification of viral conditions. Experimental results on the dataset obtained from National Center for Biotechnology Information (NCBI) show that DiHD is able to achieve similar or outperform baseline machine learning classifiers, but with significantly less storage requirements. Moreover, a design space exploration of DiHD is conducted by tuning its hyperparameters such as the dimension of HVs, number of epochs, and alpha parameter(α) to evaluate the impact of such parameters on the accuracy and memory requirements.”

**poster*

Mobile app development: Evaluating FM radio signal propagation

Author: Nick Langan

Advisor: Kristin Obermyer, M.S.

“There are insufficient mobile options to find which North American FM radio stations a listener can hear over-the-air at a given location. Factors that impact FM signal propagation include transmitting power and antenna height of the FM station, the distance the receiver is from the transmitter, and the land terrain in between the transmitter and the receiver. Using Agile software engineering practices, a mobile app, called RadioLand, was designed to generate accurate FM radio station listings from a given set of coordinates. The predicted signal strengths are calculated

using GIS data and the Longley-Rice propagation model, through software offered by the FCC known as TVStudy. The early results in tests conducted show listings that are reflective of what can and cannot be heard over-the-air, particularly in environments in and around hills and mountains (e.g. the eastern Appalachians). The RadioLand app will be released for iOS and Android during the Winter 2021-22.”

**oral presentation*

Counseling

Examining the Relationship Between Autistic People’s Self-Esteem and Perceived Bias in their Alliance with their Mental Health Practitioners

Author: Zoe Darazsdi

Sponsor: Dr. Christa Bialka

“Bias towards the autistic community has permeated our society, especially the mental health field. Studies show that the alliance between the client and their mental health practitioner has the potential to improve client self-esteem, and perceived bias can rupture that bond. This study utilizes qualitative measures to identify whether a sample of autistic adults perceive bias in their alliance with their mental health practitioners and if they feel that bias influenced their self-esteem. These findings will address a gap in existing research by exploring a largely ignored but substantial issue in mental health care and indicating potential solutions.”

**oral presentation*

English

Feminist Abolitionism Across Time

Author: Em Friedman

Sponsor: Dr. Travis Foster

“The Philadelphia Female Anti-Slavery Society (PFASS) was an interracial abolitionist group active in Philadelphia from 1833-1870. While historiographical accounts of PFASS exist, there is little work that explicitly surveys the ideological content of this organization, particularly its practices of interracial abolitionist feminist solidarity. This project proposes to fill this gap through a comparative reading of PFASS’s archive alongside contemporary feminist abolitionist discourse. Utilizing PFASS’s archive at the Historical Society of Pennsylvania, I read the group’s rhetoric alongside with contemporary feminist abolitionism, specifically writing by two Black feminist abolitionists, adrienne maree brown and Alexis Pauline Gumbs. Read together, these archives show the adept way that feminist abolitionist knowledge and rhetoric invokes and re-purposes categories and frameworks such as woman and Christian, and in our contemporary moment, the natural world and scientific classifications, in order to do the cultural work of movement building.”

**poster*

Locating the Byzantine in Medieval English Literature: The Auchinleck Manuscript

Author: Panagiotis Christoforos Sarris

Sponsor: Dr. Eliza Gettel

“The reception of the Byzantine Empire and its culture in Britain remains understudied. This line of inquiry is overshadowed by studies of Byzantium’s more frequent and visible interactions with the societies of Continental Europe and the Near East, explored in works such as Donald M. Nicol’s classic *Byzantium and Venice: A Study in Diplomatic and Cultural Relations*, as well as more recent studies. After all, as Michel Balard’s recent article (“Colonisation and Population Movements in the Mediterranean in the Middle Ages”) reminds us, most Westerners who settled on Byzantine lands were Venetian and Genoese. The study of British reception of Byzantium is also overshadowed by explorations of British writers’ reception of Classical Greece and Rome, Byzantium’s cultural and political antecedents. As a result, the topics of Britain and Byzantium are not jointly addressed in a substantial way in either of the two most recent notable studies of perceptions and interactions between Byzantium and the West—*Cross-Cultural Interaction Between Byzantium and the West* and *Byzantium and the West: Perception and Reality*. This is surprising because the histories of Britain and Byzantium have always been intertwined. For instance, it was in York, England, that Constantine the Great came to power before founding the Byzantine capital of Constantinople in the Greek polis of Byzantium. Later, English troops comprised most of the Varangian guard, the Byzantine Emperor’s personal bodyguards. And, during the Christmas of 1400, King Henry IV welcomed Emperor Manuel II Paleologos to the English court. Byzantium played a significant role in the

English imagination during the Renaissance as well; for example, Paradise Lost poet John Milton expressed a widespread belief of his time when he mistakenly wrote that Constantine the Great was English in his unfinished *History of Britain and elsewhere* (this belief has its origins in medieval British texts, such as Geoffrey of Monmouth's *Historia Regum Britanniae*). The significant role of Byzantine reception in British culture is evident as late as the eighteenth and nineteenth centuries. As Peter Sarris reminds us in his primer on Byzantine history, Edward Gibbon's critical view of Byzantine politics in *The Decline and Fall of the Roman Empire* influenced generations of British thinkers. In the following century, English architect Sidney H. Barnsley studied Byzantine churches around Greece and later implemented Byzantine aesthetics in his design of the Chapel of St. Andrew in Westminster Abbey, located only a stone's throw away from the historical nucleus of British culture and politics. While the important role of Byzantium is evident in several stages of British history, the most logical place to begin a study of this topic is the medieval period, because that was when Britain and Byzantium directly interacted with each other. Terminology becomes a problem when trying to track down relevant primary texts in the Middle English language. Although Byzantines usually identified as Roman, Western Europeans associated the term "Rome" with the "old" Rome and the Papacy. We cannot rely on the anachronistic term "Byzantine" either, as it emerged long after the Fall of Constantinople in 1453. To locate the Byzantine in British literature, we must instead examine references to Greeks, the many variants of this word in the flexible vocabulary of Middle English, slang terms like "Gryffon," and references to geography and religion. The Auchinleck manuscript, a 14th-century collection of texts, is especially helpful here. In the manuscript, a romance called *The King of Tars* presents an Eastern Christian kingdom named Tars, possibly

meaning Thrace, which was once part of Byzantium. A text about St. Katherine reframes the Roman Emperor Maxentius as a medieval king of Greece, thus collapsing Greek and Roman into a single category that reflects Byzantine identity. In the romance of Sir Isumbras, the English protagonist joins a group of Byzantine metalworkers, a highly developed trade in Byzantium, which produced a variety of items out of gold, many of which found their way to Western Europe (especially after the Fourth Crusade). In another romance, the English Guy of Warwick protects Constantinople in battle and, unlike the Western armies that sacked the city in 1204, refuses to seize the Byzantine throne. This text also resists the medieval stereotype of the “treacherous Greek” (i.e., Byzantine Greek), which is quite prevalent in Continental texts of the same period. Constantinople briefly resurfaces in this romance’s sequel, mainly as a place that represents religious conviction. Richard Coeur de Lyon depicts the Third Crusade, when King Richard the Lionheart clashed with Byzantines in Cyprus and Messina, largely because he needed funding and supplies. These and other examples not only reflect the military nature of most Anglo-Byzantine interactions, but also reveal a keen awareness of Byzantine religion, geography, commerce, and cultural identity in 14th-century Britain. These texts thus demonstrate that Byzantine reception is a significant aspect of English-language literature, and it should be studied alongside the more visible reception of Classical Greece and Rome.”

**poster*

Environmental Science

Impacts of impervious surface cover and road salt application on sodium and chloride concentrations in southeastern Pennsylvania streams

Author: Marissa Rossi

Sponsor: Dr. Steven T. Goldsmith

“Understanding drivers of freshwater contamination is essential for maintaining proper ecosystem functioning and for preserving municipal water supply. Yet, few studies evaluate long-term stressors to water quality, such as land use land cover (LULC) practices and roadway deicing agents, in multiple watersheds in the same geographic area. Here we use long-term (2004-2020), utility-sourced streamwater quality data combined with daily streamflow for six watersheds in southeastern Pennsylvania to examine the relationship between sodium and chloride concentrations and controlling factors such as impervious surface cover (ISC). Annual flow-normalized sodium and chloride concentrations were calculated using the weighted regressions on time, discharge, and season (WRTDS) model. Flow-normalized chloride concentrations were compared to ISC within the entire watershed. An increase in ISC in all six watersheds (0.65-1.96%) was observed from 2004 until 2019. Flow-normalized chloride and sodium concentrations also increased over the study period, and the watersheds with the greatest increases in ISC also experienced the greatest increases in flow-normalized chloride concentrations. Although flow-normalized chloride concentrations are below the U.S. Environmental

Protection Agency's (USEPA's) chronic threshold value for impacts to aquatic organisms, year-round exceedances will likely occur by the end of this century in all six watersheds. Additionally, in 2019, the annual flow-normalized sodium concentration in all six watersheds exceeded the USEPA's recommended drinking water threshold for individuals on a low sodium diet. The study results suggest that road salt application can have demonstrable impacts on watersheds with limited ISC (i.e., ISC ranges from 6.77-14.0%).”

**oral presentation*

History

Conspiracy Theories and Party Politics in the Antebellum North

Author: Christopher DeSanto

Sponsor: Dr. Whitney Martinko

“Conspiracy theories played a significant role in shaping the partisan politics of Northerners in the United States in the decades before the American Civil War. Newspaper editors, functioning as partisan political operatives, utilized conspiracy theories of Freemason and Southern slaveowners’ designs for political control of the United States to shape Northern public opinion and mobilize individuals to political action. This strategic use of conspiracy theories constituted an innovative use of partisan rhetoric that was a significant development in the “political technology” of the age. But this new political technology had insidious consequences as it supported white male prerogatives to power.”

**oral presentation*

David Burpee and the Marigold Makeover

Author: David McCauley

Sponsor: Dr. Craig Bailey

“This microhistory interrogates how human systems, such as culture, science and economics, impact the biological development of plants. David Burpee, president of W. Atlee Burpee and Co. from 1915 to 1970, used his control over one of the oldest, largest, and most respected seed companies to reconfigure the marigold, both in physical form and cultural identity. Burpee used twentieth century advancements in chemistry and atomic science to alter the genetic makeup of marigolds for the American market. By commercializing scientific advancements, Burpee sought to identify his new varieties of marigold with technological progress. At the same time, Burpee embarked on a personal crusade to construct an American identity for the marigold, a plant with no actual American provenance. To this end, Burpee attempted to exploit American diplomacy for his commercial benefit, attempting to transform the marigold into what he called “friendship flowers” and “American marigolds.” Despite becoming a regular topic of Congressional debate, Burpee’s crusade to designate the marigold as the official national flower of the United States failed, demonstrating the limits of his hegemonic power over the seed and flower industry.”

**oral presentation*

Mathematics

Mathematical Modeling of Crime and its Deterrents: an Investigation of Prison, Policing and Collective Efficacy

Author: Gabrielle Coker

Sponsor: Dr. Kaitlyn Muller

“The scientific community has a vested interest and responsibility to engage in study of the criminal justice system, and to challenge its methodology. Recently, much investigation has gone into prison as a deterrent to crime, often suggesting that imprisonment is not the most effective deterrent. We seek to determine which deterrence efforts have greater impact. The mathematical model discussed herein is a deterministic transmission dynamic compartmental model, in the style of the commonly used SEIR epidemic model. We select this approach based upon Sutherland’s differential association theory of crime, which proposes that crime is a learned behavior which spreads by interaction with those who commit crimes – much like a virus spreads to susceptible individuals from infected individuals. Within the model, individuals transition between the following states: noncriminal, exposed, criminal and incarcerated. Transition between these states is dictated by parameter values which represent risk factors associated with crime, as well as interaction, and deterrents. We consider three deterrents to crime: prison, policing and collective efficacy. We analyze our model to determine crime free and high crime equilibria, and perform a sensitivity analysis to determine which parameters have the greatest impact on the size of the simulated criminal

population. We find that three parameters play the largest role in determining the tendency of the population toward high or low crime: number of contacts, infection rate, and collective efficacy. The most efficient way to reduce the number of criminals in our theoretical population is to keep contact and infection rates low, with high levels of collective efficacy, while neither policing nor incarceration play a significant role in reducing the criminal population. We conclude that, in the framework of our theoretical model, collective efficacy is the strongest deterrent to crime.”

**oral presentation*

Philosophy

The Modern Revolution in Political Affect

Author: Daniel Cunningham

Sponsor: Dr. Gabriel Rockhill

“My dissertation argues that the modern European political revolutions, which replaced state absolutism with liberalism from the 17th to the 19th centuries, followed and depended upon a centuries-long revolution in mass political affect, or in the available categories of mass feeling about politics. I identify two broad historical conditions of this revolution—a transformation in the experience of time and a secularization of politics—and analyze the most salient events contributing to those developments. Developing this historical perspective involves elaborating a theory of political affect, in critical discussion with other current theories, amenable to explaining medium- and long-term historical change. Such a theory requires considering political affect in close connection with ideology, and accordingly I also develop a comparison between the forms

of ideology operative in modern and in pre-modern politics.”

**poster*

Aristotelianism and Technological Development

Author: Christopher Quintana

Sponsor: Dr. Sally J. Scholz

“This dissertation, with its blend of ancient western philosophy, contemporary ethics, and contemporary technologies, promises to contribute a new of understanding of virtue for our current techno-social landscape. This aim is achieved through a critical evaluation of the current stock of Aristotelian options for critically evaluating the use and design of information communication technologies (ICTs) in contradistinction to Alasdair MacIntyre’s social and moral philosophy. I argue that Alasdair MacIntyre’s Aristotelianism, with his emphasis on practices, practical rationality, and institutions, is best suited to examine problems in both use and development of ICTs. I show the potential of this framework by putting MacIntyre in conversation with human-computer interaction and the practice of user interface/user experience design (UI/UX) and development in an industry context.”

**oral presentation*

Psychological and Brain Sciences

Shift from Detailed to Gist-Like Memory Representations Across the Adult Lifespan

Author: Alexa Gonzalez

Sponsor: Dr. Irene Kan

“Throughout the adult lifespan, a change can occur in the composition of our memory representations. The representations we possess can be composed of full rich, detailed information or be more gist-like, capturing only the essence of an event. As we grow older, some of our representations will likely lose detailed features, leading to greater reliance on our gist memory as we age. Recognizing this shift from detailed to gist-like representations, it has been claimed that there is a differentiation in the neural regions involved. It has been proposed that if detail loss occurs, the representation will shift from the posterior hippocampus (pHPC) to the anterior hippocampus (aHPC) and the ventromedial prefrontal cortex (vmPFC). If rich details persist, then it is maintained in the pHPC with the possible formation of a representation in the vmPFC. Using a large archival dataset and taking an adult lifespan approach, the current project examined the shift from detailed to gist-like representations at both the behavioral and neural level. The pattern of behavioral results suggests that as we age, there is a decline in the ability to access detailed information, and we tend to rely more on our gist-like representations. In terms of neural connectivity, the claim was only partially supported. As expected, greater access to detailed information was associated with greater pHPC and vmPFC connectivity. Contrary to my prediction, greater access to gist-like information was associated with lower aHPC and vmPFC connectivity. To better draw

conclusions about neural recruitment, future directions could entail using a task that directly assesses gist versus detail reliance in a task-based fMRI design that ties neural activation with task performance.”

**poster*

The Impact of Modeling Mental States on Goal Directed Conversations

Author: Samuel Sinemus

Sponsor: Dr. Joseph Toscano

“Goal directed conversations, those that we have when attempting to convey a purposeful piece of information, involves understanding how interlocutors align their speech based on what each conversational partner knows. Successfully doing so requires talkers to infer the mental state of their partner, a process that is dependent on theory of mind (ToM). The current project aims to assess whether ToM can be manipulated in a conversation by priming participants to consider the mental state of others before engaging in conversation. This was done by giving one group of participants a ToM prime and another a content control prime. Subsequently, they were run through a collaborative Lego (Duplo) building task. During the task, participants had to work together to build a Lego model while restricted from viewing their partner’s workspace. One participant had a completed model in front of them and they were responsible for directing the other participant, who had the corresponding disassembled pieces, on how to build the model. Results show that participants who received the ToM prime made, on average, fewer errors and took less time than those that received the control prime.”

**oral presentation*

Serotonin Deficiency Reduces the Magnitude of Antidepressant and Anxiolytic Behavioral Effects of Cardiovascular Exercise

Author: Allison Warner

Sponsor: Dr. Benjamin Sachs

“Depression is the leading cause of global disability with an estimated 322 million cases worldwide. Unfortunately, though, even the most effective depression treatments have response rates of only about 40-60%. This means that for up to 120 million people, current depression treatments are not working. Furthermore, for the population in which treatments are not effective, the genetic and biological factors that contribute to this lack of response, also described as treatment resistance, are still largely unknown.

Something that has been theorized to contribute to some forms of treatment resistance is low levels of the neurotransmitter serotonin. Millions of people are taking antidepressants to try to alleviate their depression symptoms, but many individuals do not have access to or choose not to utilize medication approaches. One alternative low-cost approach that shows some promise in alleviating symptoms is cardiovascular exercise.

This project is concerned with understanding how low levels of serotonin impact exercise interventions intended to reduce depression symptoms. Specifically, my overarching research question is, does low serotonin prevent the antidepressant-like effects of exercise? To examine this question, I utilized a mouse model of serotonin deficiency. The findings of this study suggest that exercise appears to lead to some antidepressant and anxiety-reduction effects in serotonin deficient animals, however, the magnitude of these effects is lower than in mice with typical serotonin levels.

Based on my results, low serotonin mice can experience some of the behavioral benefits of exercise but may be less sensitive to others. Overall, these findings have implications for furthering understanding of the role of serotonin levels in antidepressant treatment responses. Learning why low serotonin mice don't respond as fully to exercise and how their response can be bolstered has the potential to inform depression treatment interventions in the future."

**oral presentation*

Theology

Through Roots and Binds: The Essence of Policing in Simone Weil

Author: Nathaniel Grimes

Sponsor: Dr. Vincent Lloyd

"The police are something of a fuzzy point in secular society. Reverence for the police is seen as the basis of any community's common life. At the same time, the police exemplify brazen patterns of deceit and domination. Following the worldwide uprisings against police in 2020, many commentators seemed forced to acknowledge that there was something deeply troubling in police practice.

My dissertation investigates how cultural memory and imagination around the police are formed, developed and transmitted, focusing on the intersection of law and religion. My thesis is that a critical focus on police power is a crucial part of any larger project of diagnosing social maladies, and this focus requires a fundamental challenge to that power. To tackle some of the broad theoretical issues entailed in

analyzing the police as both symbol and practice, for this summer research project I turned to the work of the French philosopher and mystic Simone Weil whose work interrogated notions of force, necessity, and communication. Weil's work seems instructive not only for her direct engagements with police, but for how in her writing she insisted on keeping various, sometimes seemingly contradictory or paradoxical elements of a situation in view. Rather than take Weil as offering direct policy prescriptions for my context, I chose instead a more theoretical approach, surveying the diverse ways in which she reckons with the difficulties of discerning patterns of moral and political authority.

My research focused on three dynamics in Weil's thought: first, tracking the notion of repression, which she analyzed at the level of the individual and the social; second, tracing her outline of a scientific method which could account for the various senses of the idea of order, including universal and fraternal, and third, reflecting upon her elaboration of an ideal of work which could recompose an immanent unity of thought and action. Weil's holistic approach allows for a radical critique of police society, calling attention to how power and prestige bind our imaginations to the present order, and cause us to misrecognize how our loyalties and perceptions are shaped by what appear to be natural formations. Her writings help us understand the confusion intrinsic to the function of policing as a worldly connection between work, force and virtue, and to explore other ways of conceiving the relation to help us render the forces shaping social life more rather than less intelligible."

**oral presentation*

**On God's Ground: Desire, Identity Formation, and
'Perverted Groups' in Henry Suso's *The Life of the
Servant***

Author: Ailie Posillico

Sponsor: Dr. Kevin Hughes

“In my summer research project I show how medieval Christians worked literature into an alternative space in which to enact otherwise demonized expressions of desire. Turning to the medieval Christian text of German Dominican preacher Henry Suso (1295/97-1366) as an example, I argue that literature meant to provoke desire—for God and for one's others—is foundational to the Christian tradition. Suso, I show, foregrounding the main character of "the Servant" who loves a God with whom he also identifies renders the nuances of desire audible, visible, and therefore possible in a Christian context dominated by disavowals of queer love.”

**poster*



VILLANOVA
UNIVERSITY

College of Liberal Arts
and Sciences