

FALL 2023 GRADUATE RESEARCH SYMPOSIUM

Sponsored by The Office of Graduate Studies (CLAS)



FRIDAY, OCT. 27 • 1:00 PM

DOUGHERTY HALL EAST LOUNGE

POSTER PRESENTATIONS IN CONNELLY ART GALLERY AT 3PM

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Co-sponsored by Falvey Library and the Center for Graduate Research and Education

1-3 p.m. East Lounge, Dougherty Hall – Oral Presentations

1:00	Opening remarks from Dean Woodard
1:06	Rachel Carrock, Biology
1:12	Claire Jones, Biology
1:18	Gabrielle Solomon, Biology
1:24	Juliette Murray, Chemistry
1:30	Matthew Schnell, Chemistry
1:36	Daniel Zelch, Chemistry
1:42	Adam Riekstins, English
1:48	Hannah Feldman, Environmental Science
1:54	Lorina Holterhoff, Environmental Science
2:00	Sahara Rios-Bonilla, Environmental Science
2:06	Ryan Snyder, History
2:12	Timour Kamran, Philosophy
2:18	Claryn Spies, Philosophy
2:24	Ranya Al-Khayyat, Psychology
2:30	Hanna Campbell, Psychology
2:36	Ryan Krieger, Psychology
2:42	Benjamin Swack, Psychology
2:48	Zainab Jeffrey, Theatre
2:54	Elisha Chi, Theology

3-4 p.m. Poster Presentations and Refreshments, Connelly Center Art Gallery

Cathilyn McIntosh, Biology	Oladimeji Fatoki, Education
Edwin Owusu-Ansah, Biology	Paris Baker, Environmental Science
Faith St. Clair, Biology	Luis Berrios-Hayden, Environmental Science
Elizabeth Wright, Biology	Anjum Shahina Karim, Environmental Science
Claude Baluh, Chemistry	Kevin Lower, Philosophy
Molly Moore, Chemistry	Thomas McGlone, Philosophy
Merle Bernhard, Chemistry	Rose Dietrich, Psychology
Harris Drachman, Psychology	Tekoa Robinson, Theology
Tia Nicolas, Psychology	Noelle Diane Johnson, Theatre
Reet Patel, Psychology	

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 2023 award, as well as submissions from additional students across the College. These projects 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 2023 Summer Research Fellowship committees (Doctoral and Master's): Drs. Lauren Shohet (English); Delia Popa (Philosophy); Brett Grainger (Theology and Religious Studies); Anil Bamezai (Biology); Deanna Zubris (Chemistry); Jie Xu (Communication); Joseph Toscano (Psychological and Brain Sciences); Edward Sobel (Theatre); Timothy Brunk (Theology and Religious Studies). 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

Investigating the Relationship Between Morphology, Performance, and Behavior in an Invasive Gecko

Author: Rachel Carrock

Sponsor: Dr. Alyssa Y. Stark

Organismal performance is rooted in the relationship between morphology and behavior, and is crucial to understanding the way organisms interact with their environment. Extensive research has been conducted on how various abiotic factors in natural environments affect the adhesive and running performance of geckos. However, few studies have investigated how individual variation in morphology affects performance within a species of gecko. Moreover, no work has explored how differences in performance are related to key factors, such as foraging success, social interactions, and antipredator behaviors. To test for the relationship between morphology, performance, and behavior, I focused on one species of gecko (*Lepidodactylus lugubris*) living freely on Barro Colorado Island, Panama. I measured various morphological traits related to performance (i.e., body size, mass, toepad area, number of adhesive lamellae, and hindlimb and hindfoot length), adhesive and running performance, and documented behaviors in the lab and in the field while foraging. I hypothesized that morphological differences affect maximum performance, and that high performing individuals differ in their behavior, both in lab and in the field, from low performers. Preliminary analysis revealed that the number of adhesive lamellae was conserved between individuals, while toepad area and hindlimb and foot length were positively related to body size. In addition, I found that toepad area was not significantly related to maximum adhesive performance and hindlimb length did not predict maximum running speed, regardless of body size. Further analysis will determine whether differences in clinging and running performance dictate differences in foraging and antipredator behavior between individuals. The results of this study have ecological and evolutionary implications related to how morphology may impact organismal behavior, which can influence social interactions, invasiveness, and fitness.

How do chickadees communicate about the presence and absence of food?

Author: Claire Jones

Sponsor: Dr. Brittany Coppinger

For social animals, foraging with a group can provide benefits including protection against predation and decreased individual responsibility for vigilance, which leads to foraging more efficiently. While foraging socially, animals communicate to maintain group cohesion and recruit others to food sources, but little research addresses how animals communicate about variability in food availability. In the winter, Carolina Chickadees (*Poecile carolinensis*) form foraging flocks that travel between food sources. These birds make complex, compositional chick-a-dee calls at food sources, which may serve to recruit other individuals to feed. I set out birdfeeders equipped with motorized doors at our field site, a forest in Pennsylvania. I programmed the feeder doors to open and close at set times, thus making the food available only at certain times. I recorded calls at open and closed feeders and analyzed differences in note composition, syntax, pitch, duration, and rate of chick-a-dee calls between open and closed conditions. Analysis to date suggests chickadees use certain notes more frequently at open versus closed feeders. Additionally, D notes in calls produced at open feeders tend to be longer and lower pitched than those produced at closed feeders. This research reveals how birds communicate to maintain group cohesion while foraging, which is critical to winter survival. Furthermore, flock communication in winter could impact mate selection and reproductive success in spring.

Linking greenhouse gas emissions to oyster berm barriers in salt marsh Ecosystems

Author: Cathilyn McIntosh

Sponsor: Dr. Adam Langley

Salt marshes are intertidal wetlands subject to regular tidal inundation and drainage that play a pivotal role in climate change mitigation. Under unaltered tidal conditions, coastal wetlands store large amounts of carbon offsetting natural greenhouse gas (GHG) emissions of carbon dioxide (CO₂) and methane (CH₄) by maintaining low decomposition rates. However, structures that altered tidal fluctuations in salt marsh habitats can counterbalance carbon storage rates and

increase GHG emissions. Within northeastern Florida, large oyster berms have naturally formed along salt marshes salt marsh edges, yet the impact of these oyster berms on tidal inundation or GHG emissions is unknown. My project aims to observe how large oyster berms may be altering tidal flows and GHG emissions in salt marshes.

Unraveling the role of the mitofusin-like protein *TbMFNL* in mitochondrial dynamics of the eukaryotic parasite *Trypanosoma brucei*

Author: Edwin Owusu-Ansah

Sponsor: Dr. Megan Povelones

Kinetoplastids are flagellated, unicellular eukaryotes, including free-living microorganisms and parasites of diverse species. Kinetoplastid infections can lead to human diseases, such as Chagas disease, leishmaniasis, and sleeping sickness, which are caused by *Trypanosoma cruzi*, *Leishmania*, and *Trypanosoma brucei*, respectively. Kinetoplastid parasites are unusual among eukaryotes because each cell contains a single mitochondrion. Mitochondria are critical organelles in cellular metabolism. The shape and overall function of mitochondria are determined by mitochondrial dynamics, which is the balance between mitochondrial fission (division) and fusion, both of which are mediated by specific proteins. The highly dynamic structure of mitochondria allows them to adapt to the specific energy requirements of diverse environments. This adaptation is critical for completing parasitic life cycles, often involving surviving in distinct hosts and host niches. *Trypanosoma brucei* is a kinetoplastid parasite that is an attractive model for studying mitochondrial dynamics since there is a single mitochondrion per cell that is developmentally regulated during the parasite's life cycle. In addition, as an early-diverging eukaryote, the machinery for mitochondrial dynamics may be quite different from that of other eukaryotic models such as yeast and mammals. I will investigate the localization and function of a putative mitochondrial fusion protein, *TbMFNL*, in two life cycle stages of *T. brucei* to provide insight into its role in mitochondrial dynamics and structure, as well as cell growth and morphology.

Dominance relationships, ancestry, and plumage signals among Black-capped Chickadees, Carolina Chickadees, and their hybrids

Author: Gabrielle Solomon

Sponsor: Dr. Robert Curry

Dyadic interactions determine dominance hierarchies, a structure consisting of individuals organized according to their ability to exert their influence over their groupmates, across nearly all animal taxa. To further understand dominance hierarchies, we can investigate social systems of specific taxa (e.g., birds) because they contain complex social structures. Specifically, the hybrid chickadee population in southeastern Pennsylvania is made up of Black-capped Chickadees (*Poecile atricapillus*; BCCH), Carolina Chickadees (*Poecile carolinensis*; CACH), and hybrid chickadees (HYCH). Prior studies investigated dominance between BCCH and CACH, proposing that CACH are the dominant species. However, we still do not know whether comparable patterns exist among wild chickadees in contact-zone populations. Understanding dominance hierarchies among wild chickadees will provide insight regarding dominance hierarchies in other hybridizing and non-hybridizing avian species, and animals as a whole. My goal is to investigate dominance hierarchies, and their association with ancestry and plumage brightness in the chickadee hybrid zone at Hawk Mountain (HM) in Kempton, PA. I will mark all chickadees with a passive integrated transponder (PIT) tag visiting each of the two ‘smart’ feeder arrays at HM. These ‘smart’ feeders incorporate Arduino-based radio frequency identification (RFID), identifying individuals upon arrival on the feeder’s perch to obtain seed. I will video record interactions at these arrays and calculate the dominance rank of each individual. I will perform ancestry assessments using blood samples collected from each individual, measure plumage of wild birds using a spectrometer, and follow pairs during the breeding season to determine whether dominance correlates with nesting success. I will compare RFID data streams to video recordings to determine if dominance can be measured using solely RFID data. The results of this study will fill a gap in our knowledge regarding dominance in hybridizing chickadees and contribute to our understanding of dominance hierarchies in avifauna and animals in general.

Quantifying in vitro growth and attachment of *Crithidia bombi*, a parasite of bumblebees

Author: Faith St. Clair

Crithidia bombi is a parasite of bumblebees that reduces fitness and reproductive capacity. Like most monoxenous trypanosomatids, *C. bombi* colonize their insect host by attaching to the hindgut. Certain floral diets, particularly sunflower pollen, can prevent or even clear infections through an unknown mechanism. To explore this phenomenon, we have been studying *C. bombi* both in vitro and in the bee host. Quantifying *C. bombi* in hindguts can be difficult using manual counting methods, as samples are flooded with feces, pollen, and other contaminants. We have recently used a constitutively expressed Nanoluciferase reporter to quantitate growth of the related parasite *Crithidia fasciculata* both in culture and in hindguts of its natural host, the mosquito. We have now introduced this construct into *C. bombi* and have confirmed that it can be used to determine cell density in vitro. This will allow us to accurately measure *C. bombi* growth in the presence of different pollens and pollen components. Additionally, we have adapted our *C. fasciculata* in vitro adhesion assay to determine the frequency of *C. bombi* attachment. We compared our two culture-adapted *C. bombi* strains: WHA1 and 08.076. Only WHA1 has retained the ability to infect laboratory colonies of the bumblebee, *Bombus impatiens*. Interestingly, while their growth rates are similar, WHA1 shows significantly greater attachment in vitro. These results suggest a correlation between attachment and infectivity, study of which could be relevant for other trypanosomatids. In addition, determining how pollen impacts parasites could inform habitat creation for this important pollinator species.

Superhero Activation: LPCAT1 Upregulated in Early CD4⁺ T Cell Activation

Authors: Elizabeth R. Wright

Sponsor: Dr. Anil Bamezai

CD4⁺ T cells are cells within the immune system that serve as helper cells. They are called the helper cells because they assist other immune cells at or around the site of infection or injury in carrying out immune defense. That way the body can stay healthy and function normally. There is a lot of information known about the signaling events that occur in CD4⁺ T cell activation. However, the placement and timing of this signaling is still unclear. Lipid rafts are cholesterol and

saturated phospholipid-rich areas within the plasma membrane that serve as signaling platforms for cells. Lipid rafts are known to coalesce during the activation of CD4⁺ T cells. The role of saturated fatty acid production and how that contributes to the coalescing of the lipid rafts in T cells during activation is unknown. I hypothesize that the expression of Lysophosphatidylcholine acyltransferase 1 (LPCAT1) protein is increased during activation of CD4⁺ T cells and is critical for its functional response. LPCAT1 is an enzyme that catalyzes the addition of saturated fatty acid chain during the synthesis of saturated phospholipids. These saturated phospholipids are then transported to the plasma membrane for the formation of lipid rafts. My proposed research will aid in developing a new understanding about LPCAT-1 dependent plasma membrane fluidity (lipid raft-based membrane order and disorder) and its contribution to CD4⁺ T cell-driven immunity against internal (cancer) and external (pathogen) threats.

Chemistry

Bimetallic Ruthenium 2,2'-Bipyrimidine Bridged Complexes for Water Oxygen

Electrocatalysis

Authors: Claude Baluh

Sponsor: Dr. W. Scott Kassel

Water oxidation produces hydrogen ions and electrons that can be used as a clean energy source; however, water oxidation is difficult to achieve without a catalyst. The proposed research focuses on preparing a bimetallic complex containing ruthenium and a second, less expensive metal. The second metal will be bridged to the primary ruthenium with 2,2'-bipyrimidine (bpm). The effects of the secondary metal on the overall catalytic activity will be explored, and it is expected to increase catalysis effect significantly. The focus of this work is the preparation and characterization of a series of original bimetallic ruthenium complexes.

Synthesis of Chelating Ligands Containing Ring-Expanded *N*-Heterocyclic Carbenes

Authors: Merle Bernhard

Sponsor: Dr. Eduard Casillas

Polymers are macromolecules made up of a series of repeating smaller units known as monomers. Polymers have increasingly become an essential part of our everyday use, as they are found in plastics, natural and synthetic fibers, piping, rubbers, coatings, adhesives, sealants, etc. Industries involved in manufacturing textiles, paper, or packaging materials all rely heavily on polymers as well. Aside from producing new types of polymeric materials, researchers have focused on developing catalysts used for synthesizing commercial polymers. Catalysts are a chemical substance that increases the rate of a reaction when introduced. These are especially important in polymerization as variations in catalytic structure can allow for precise control over the polymer molecular weight, composition, and architecture. These characteristics all affect the polymer's properties such as strength, flexibility, rigidity, and hardness. Because of their strong sigma-donating properties, catalysts composed of *N*-heterocyclic carbene (NHC) ligands, commonly with a 5-membered ring, have been heavily utilized in polymer chemistry. However, studies have shown that NHC ligands with less steric bulk around the metal can result in an unwanted 2:1 ratio of NHC ligand to metal, leading to loss of functionality and catalytic reactivity. The goal of this research project is to design a multi-step synthesis of chelating ligands containing a ring-expanded NHC. By expanding the NHC ring from a 5- to 7-membered ring and adding an additional donor atom (chelating), the metal center can be further buried in order to favor a desired 1:1 ratio of NHC ligand to metal. Thus, a series of six *N*-(2'-hydroxy)-benzylated diazepinium (7-membered ring) NHC analogues were prepared that vary in substitution about the aryl ring. Preparation of these analogs was accomplished through a short sequence of formylation, reductive amination, *N*-formylation and cyclization. The final metalation of these proligands with base metals is planned and will be described.

Derivatization Method for the Determination of Amino Acid Concentrations in Arctic Marine Waters

Author: Katherine Mitchell

Sponsor: Dr. Vanessa Boschi

Amplified warming due to climate change has intensified glacial melting and freshwater contribution to the Arctic Ocean. The resulting decreased sea ice extent and increased bioavailability of nutrients supports earlier seasonal growth of algal and bacterial communities. Differences in organic carbon profiles may function as a biochemical indicator of changing conditions due to warming, allowing dissolved free amino acids act as a biomarker for affected microbial activity. In order to characterize amino acids in marine samples, an analytical method was developed to derivatize and isolate these compounds from their saltwater matrix. Previous methods utilizing o-phthalaldehyde (OPA) do not allow for complete derivatization of all amino functional groups and therefore prohibited their separation from an aqueous solution and subsequent analysis using gas chromatography mass spectrometry (GC-MS). This new method uses a n-butyl chloroformate and picoline reagent media, which derivatizes all charged functional groups present on the amino acid producing a more hydrophobic compound capable of extraction and analysis using GC-MS. This method will allow for the characterization of amino acid profiles in Arctic surface water samples along a sea ice extent transect acting as an indicator of changing microbial communities due to Arctic warming.

Sleuthing the Trypanosome Genome for Haloacid Dehalogenases

Author: Molly Moore

Sponsor: Dr. Jennifer Palenchar

Human African Trypanosomiasis (HAT) and Chagas Disease are parasitic diseases caused by trypanosomes, ancient single-celled eukaryotes. Therapeutics to treat these parasitic infections are often lacking, encounter drug resistance, and/or are toxic to the host. There is a need for new therapeutics. In this vein, we present the characterization of three *Trypanosoma brucei* haloacid dehalogenase (HAD)-like proteins. All three *T. brucei* HADs were acquired from bacteria through

horizontal gene transfer (1). HAD32, HAD35, and HAD42, named for the molecular weight of the protein, are important to the life cycle of the parasite. HAD42 is annotated as a putative para-nitrophenyl (PNPP) phosphatase; however, the protein has weak similarity to HADs at the sequence level. We seek to determine if HAD42 is a true HAD protein. Sequence alignment of the three HADs showed that HAD42 is missing a catalytic residue and differs in the metal binding motif. Despite these sequence differences, PNPP kinetic assays reveal HAD42 does exhibit a phosphatase activity. We are exploring substrates beyond PNPP, as many HADs are phosphatases that are active with PNPP and other phosphorylated substrates. Metal dependency assays have been conducted to explore metal-dependency. The enzyme has activity with magnesium as metal and, curiously, preliminary results show activity with cobalt, as well. The role of this protein in the parasites is unknown. What we learn about HAD42 in the test tube will guide our work in the parasite.

Development of a Liquid Chromatography Post Column Derivatization Atmospheric Pressure Chemical Ionization Tandem Mass Spectrometry (MAE-LC-PCD-APCI-MS/MS) Method for Tetrahydrocannabinol (Δ 9-THC) Analysis in Hair

Author: Juliette Murray

Sponsor: Dr. Anthony Lagalante

Hair analysis is an extremely useful method for tetrahydrocannabinol (Δ 9-THC) detection, though it is very underdeveloped, and the current methods are not very sensitive. My thesis project is focused on developing a more selective and sensitive liquid chromatography-tandem mass spectrometry (LC-MS/MS) analysis method for Δ 9-THC in hair. I am increasing the sensitivity of this method by using the derivatizing agent Fast Red RC to react with Δ 9-THC in a new workflow. This derivatization reaction typically occurs on the benchtop before LC separation and produces two regio-isomers. This reaction will make Δ 9-THC more easily ionizable, increasing the sensitivity of Δ 9-THC analysis. However, the two regio-isomers will separate on an LC column, essentially cutting the sensitivity in half. In order to prevent the loss of sensitivity in this derivatization technique I am developing a post column derivatization method where Δ 9-THC is derivatized after it has eluted from the LC column. This prevents separation of the regio-isomers

and providing a more sensitive and selective method for Δ^9 -THC. Development of this method will allow for the advancement of hair analysis and provide a better way to detect Δ^9 -THC.

Understanding the Mechanism of Keap1 Cysteine-151-Specific Nrf2 Activators

Author: Matt Schnell

Sponsor: Dr. Aimee Egger

My research, and the research of the Egger lab at large, is, at its core, centered around a protein called Nrf2. Nrf2 is a transcription factor which plays a vital role as a key regulator in the cell's antioxidant defense mechanisms, which is extremely important in the context of human health on a broader scale. Oxidative stress causes damage to cellular components, and on an organismal level, is involved in the aging process as well as the development of chronic diseases like cancer or neurodegenerative disease. When Nrf2 is active in the cell, it helps the cell to fight these stressors and their negative impacts. As such, Nrf2 activation is a subject of high clinical interest. There are many known molecules that act as 'Nrf2 activators,' such as sulforaphane, which can be found in cruciferous vegetables like broccoli. Some 'Nrf2 activators,' like sulforaphane, work by modifying a protein called Keap1 that naturally represses Nrf2 activity. For my research, I am interested in understanding the mechanism by which particular 'Nrf2 activators' operate to activate Nrf2 so that it can combat oxidative stress, particularly through the lens of the interaction of Nrf2 activators with Keap1.

Expanding the molecular toolbox of medicinal chemists with biologically active and synthetically useful azetidines

Author: Daniel Zelch

Sponsor: Dr. Matthew O'Reilly

Objects can be chiral, which is a term from the Ancient Greek related to the right- or left- handed nature of things. Chiral objects are non-superimposable upon their mirror images, and the most classic example of chiral objects are hands themselves, as a left and right hand are mirror images of one another, but when superimposed, they are not identical. When a chiral object (a hand)

interacts with another chiral object (e.g., a left-handed glove), only one of the hands works properly (i.e., a left-handed glove will only fit on one's left). Many important biological drug targets are chiral. Therefore, only a correctly "handed" molecule can interact with a drug target efficiently, and it is important to have methods of synthesizing chiral molecules to bind to chiral biological targets, ensuring a tight fit. Azetidines, 4-membered nitrogen heterocycles, act as potent biological entities when adorned with chiral substitution at the 2-position on the ring. While there are occurrences of azetidines in FDA approved pharmaceuticals, methods of stereoselectively synthesizing them—making a single molecular "hand," called a stereoisomer—are relatively rare. Research efforts have led to an effective methodology to synthesize chiral C-2 substituted azetidines. The resulting azetidines could aid the discovery of life-changing pharmaceuticals, as medicinal chemists would be equipped with ways to expand the toolbox and library of azetidine-based drugs that could more efficiently interact with chiral biomolecules.

Education

A Comparison of Three Approaches in Promoting Youth Civic Engagement Among University Students

Author: Oladimeji Fatoki

Sponsor: Dr. Jerusha Conner

This study examined three methods of promoting youth involvement and collective action in addressing public concerns (civic engagement). The approaches were service learning, project based learning, and youth participatory action research. I conducted a thorough systematic review of 30 literature published between 2017 to 2023 from around the world. The findings were synthesized to determine the effectiveness of each approach in garnering support among youth (receptivity) and generating increased civic interest and engagement (efficacy).

English

Literary Existentialism: Beyond the Canon

Author: Adam Riekstins

Sponsor: Heather Hicks

In the past decade, existentialism has had a storming resurgence in popular culture and is a genre that's relevance is cemented as a response to recent world events. With books that have been made into blockbuster hits such as Chuck Palahniuk's *Fight Club*, Bret Easton Ellis' *American Psycho* and Don DeLillo's *White Noise*, all steeped with questions about the meaning of life and death, why are they disregarded as part of an ongoing literary tradition and as part of the existential canon itself? In this presentation, I explore how existentialism functions in our contemporary literature and media. I conduct my study by examining a database of canonized and contemporary existential works of literature. The result of this analysis is a historically informed five-part model that defines how existential fiction is composed. I then analyze the history of existentialism in pop-culture, the rise of post-structuralist theories, and the revival of existentialism in post-post-modernism. With my research I hope to help revitalize such an essential genre in scholarship by recategorizing recent pieces of literature into an established family and tradition.

Environmental Science

Development of a spatially explicit model for projecting future salinity distributions in coastal regions

Author: Paris Baker

Sponsor: Dr. Nathaniel Weston

As the global climate changes, rising sea levels are threatening the existence of tidal marsh ecosystems in many coastal regions. Altered patterns of precipitation and evapotranspiration in watersheds accompanying climate change will also alter the delivery of freshwater to coastal

systems. Changing freshwater flows together with rising seas will alter the salinity regime in coastal systems, exerting additional pressure on some tidal marsh systems. Salinity intrusion into previously tidal freshwater and brackish marshes will alter plant production and biogeochemical cycling, potentially allowing the up-estuary migration of salt tolerant marsh plant species. These changes can have profound influences on marsh productivity, greenhouse gas exchange, water quality, and the overall resilience of tidal marsh ecosystems. It is therefore important to consider future changes in salinity in coastal regions together with sea-level rise when attempting to predict the response of marsh ecosystems to climate change. Although 3-D hydrodynamic models have been successfully utilized to predict future salinity in estuaries, they require extensive knowledge of physical and geomorphological characteristics of the coastal system in question, require considerable computational power, and are not generally suitable for forecasting changes in salinity decades into the future. Studies have developed simpler 2-dimensional models of salinity changes in coastal systems, but these models are typically not spatially explicit and/or lack the precision to capture the mosaic of salinity regimes inherent to most coastal systems with many small tributaries. A relatively simple yet spatially resolved method to forecast changes in salinity throughout coastal regions at scale would benefit the scientific and management communities. To address this need, a new approach was created for predicting the salinity distribution in coastal systems using freshwater flow and distance metrics to model current and future scenarios of salinity in the marshes of Delaware Bay.

Spatial Distribution of Arbuscular Mycorrhizal Fungal Diversity and Heavy Metal Soil Concentrations as a Function of Urban Structure in Philadelphia, PA

Author: Luis Berrios-Hayden

Sponsor: Dr. Peleg Kremer

To mitigate the impacts of climate change and urbanization, multifaceted solutions that are underpinned by our understanding of biodiversity patterns and ecosystem functions within cities are needed. Arbuscular mycorrhizal fungi (AMF), known for their critical role in ecosystems, are promising candidates for simultaneously addressing multiple challenges borne of urbanization and human activity. However, few studies have investigated the effects of urban structural components and organization on the distribution of AMF and heavy metals, a common environmental pollutant

threatening biodiversity. In this study we analyze the distribution of AMF and total heavy metals (THM) and exchangeable heavy metals (EHM) as a function of the urban landscape in Philadelphia, PA using the Structure of Urban Landscapes (STURLA) Classification. A random spatially stratified sampling method was used to collect 75 composite soil samples, 15 for each of the top 5 STURLA classes equally distributed across the 5 major regions in Philadelphia. A metagenomic analysis was done using Illumina MiSeq to identify soil AMF. Soil THM was analyzed using an Xray fluorescence spectrometer (XRF) and EHM was analyzed using inductively coupled plasma mass spectrometry (ICPMS). We present a preliminary descriptive analysis of the distribution of THM and their relationship with STURLA classes. Next steps include bioinformatics on AMF to determine diversity metrics, and a structural equation model will be used to identify causal relationships between urban structures, THM, EHM, and AMF.

An immersive urban environmental geochemistry research experience at the high school level as a pathway to the geosciences

Author: Hannah Feldman

Sponsor: Dr. Steven Goldsmith

The geosciences are one of the least diverse scientific fields. From a pathways perspective, URM students are not exposed to geoscience coursework in high school at the same rate as their non-URM counterparts. Yet, the skill sets imparted in geoscience coursework are needed to address issues of societal importance, such as the remediation of urban and environmental contamination and environmental justice. This project used an immersive, locally based, culturally responsive research experience in urban environmental geochemistry at the high school level to broaden a pathway to and increase interest in the geosciences for URM students. We engaged a public high school in Philadelphia, P.A. with in-classroom modules focused on water soil, and air contamination through an environmental justice lens. The curriculum, co-designed with the high school instructor, entailed hand-on experiential learning activities with a focus on water, soil, and air sample collection in the local region, laboratory analysis using research instruments, scientific data analysis, scientific presentations, and developing critical scientific agency to engage in environmental stewardship of their community. Pre- and post-surveys, classroom observations, and focus group discussions were used to evaluate the effectiveness of this curriculum intervention.

Student surveys showed an increase in student interest in the geosciences both as a discipline and a career pathway, as well as means to address agency within their community. Additionally, there was a substantial decrease in the perception of science not being useful outside of school. Common themes garnered from student interviews included the usefulness of geoscience to enhance community engagement and agency and address environmental inequality. These results suggest the use of urban environmental geochemistry modules at the high school level enhances URM students' interest in the geosciences and can build an inclusive pathway into STEM careers, while also advancing environmental justice within their community.

Evaluating heavy metal contamination in green stormwater infrastructure within the greater Philadelphia region

Author: Lorina Holterhoff

Sponsor: Dr. Steven Goldsmith

Green Stormwater Infrastructure (GSI) is greatly effective at mitigating and preventing flooding during heavy rainfall events. However, urban soils have been found to be polluted by heavy metals, potentially negatively impacting human health. Since GSI also might serve as recreational spaces in urban areas, this pollution must be closely monitored. Cars are heavy pollutants through emissions, brake pad shavings, and material abrasion. Therefore, it can be assumed that higher traffic density in an area leads to more contamination. In order to effectively interpret sampling and analysis results from two sites in the Philadelphia area, the watersheds of the GSI sites were delineated and adapted for anthropogenic changes in the landscape. The sites were chosen for their differing traffic patterns with high traffic density in the urban site and low traffic density in the suburban site. Land cover analysis within the watersheds showed that the urban site was covered in significantly more roads (24.3%, suburban site: 5.7%) and other impervious surfaces (49.6%, suburban site: 11.9%). Contrastingly, vegetation covered 82.4% of the suburban site's watershed and only 25.6% of the urban site's watershed.

Exposure to Particulate Matter in the Philadelphia Subway

Author: Anjum Shahina Karim

Sponsor: Dr. Kabindra Shakya

In urban cities, subways are an efficient mode of public transport. It reduces both traffic congestion and urban traffic emissions. However, increased level of particulate matter (PM) in underground subways is an environmental health concern for both subway commuters and workers. This study presents the concentrations of PM₁, PM_{2.5}, PM₁₀, ultra-fine particles (UFP), and black carbon (BC) from the Philadelphia-15th Street station, one of the busiest subway lines in the city. The measurements were carried out concurrently from both the underground subway platform and the aboveground roadside level on five different working days (7/13/2022 to 7/22/2022) for 6 hours (9 am to 3 pm). The mean concentrations of PM₁, PM_{2.5}, and PM₁₀ from underground subway station were $112.2 \pm 61.3 \mu\text{g}/\text{m}^3$, $120 \pm 65.5 \mu\text{g}/\text{m}^3$, and $182.1 \pm 132 \mu\text{g}/\text{m}^3$, respectively. The underground subway station's PM₁, PM_{2.5}, and PM₁₀ were 5.4, 5.7, and 7.6 times higher, respectively compared to the aboveground roadside level. The lung deposited surface area (LDSA) of UFP ($59.4 \pm 36.2 \mu\text{m}^2/\text{cm}^3$) and BC ($9.5 \pm 5.4 \mu\text{g}/\text{m}^3$) at the subway platform was 1.7 times and 10.7 times higher, respectively than the aboveground roadside level. Positive correlation between the PM and BC in the underground subway platform suggests, the source of BC was from both the outside road traffic and inside the platform from the diesel-operated cars used for maintenance in the underground subways. This study shows the need for proper maintenance and control methods, such as improved ventilation and frequent cleaning, to reduce PM exposure at this subway station.

A Matter of Perspective: Eating Lionfish to Reduce Marine Plastic Pollution and Ease Fishery Pressure on Local Species

Author: Sahara Ríos-Bonilla

Sponsor: Dr. Lisa Rodrigues

Earth's marine ecosystems are currently suffering countless environmental threats. Within the Caribbean Sea and the Greater Atlantic Ocean, the consequences of plastic pollution and invasive species are a topic of major concern. For example, plastic has become the most predominant type of marine debris, while introduced/invasive species may pose a threat to the stability of ecosystems

by impacting native populations. Here, we opportunistically used the invasion of the lionfish (a fish native to the Pacific Ocean) into the Caribbean Sea to assess plastic ingestion within the marine trophic web without impacting local fish communities. For this, scientific divers from the University of Puerto Rico helped to collect a total of 42 lionfish from deep coral reefs within the La Parguera Marine Natural Reserve, southwest Puerto Rico. The fish were cleaned and gutted, and the fillet consumed as delicious ceviche. Their stomachs were preserved and then shipped to Villanova University to analyze if the lionfish were ingesting any type of marine plastic debris. Once in our Marine Sciences Laboratory, we isolated the plastic items found inside of their stomachs. We then chemically identified the type of polymer using an instrument called infrared spectrophotometer. Our preliminary results showed that of the 42 individuals collected, 41 had plastic present in their stomach (97.6%). The most common type of plastic was microfibers, representing more than 80% of the samples. This means that, within our sample size, plastic is present at the trophic level of lionfish, suggesting that this could also be occurring within native fishes as well. With these findings, we encourage the consumption of lionfish, thus, aiding both in the removal of this voracious predator easing the pressure its invasion imposes onto native fish species, as well as helping to reduce marine plastic as we catch and carefully degut the fish before consumption.

History

Sanctifying a Coup: Max Thornburg and The Christian Rational for TPAJAX

Author: Ryan Snyder

Sponsor: Dr. Marc S. Gallicchio

Max Weston Thornburg provided Allan Dulles, the CIA director in 1953, with the rational that justified the United States' covert coup that ousted post-colonial nationalist, Mohammed Mosaddeq, in favor of the autocratic, and Western friendly Mohammed Reza Pahlavi. In the late 1940s, Thornburg styled himself an economic expert on the Middle East due to his experience working for Standard Oil of California in Bahrain, and then Petroleum Advisor in the State

Department during World War II. He applied his “expertise” to Iran, serving as the nation’s economic advisor under prime minister Ali Razmara from 1950, until the ruler’s assassination in 1951. After the assassination, Thornburg’s work in Iran was finished, and he experienced the last years of his life’s work as a failure.

However, when Dulles sought Thornburg’s advice on what to do in Iran, between 1952 and the August coup in 1953, he brought a unique intellectual background to the task, and saw an opportunity to redeem the work he had previously begun. Thornburg is best understood as a secularized White Protestant savior of the “backward” Iranian “Heathen” whom he sought to save, not to Christianity, but in line with liberal Christian missions, from backwardness, despair, mistrust of the West, poverty, and communism. While he was truly concerned for the social well-being of Iran’s poor, he was also racially patronizing and when his “humanitarianism” was thwarted, he advocated for aggressive intervention for what he saw as their own good. The Iranian coup of 1953 was, for Thornburg, the means justified by the necessary ends of putting a government in place that would develop and thereby save impoverished Iranians from their “ignorant”, “backward”, and “Feudal” condition, save them from the wrong kind of development, Communist revolution, and ultimately save them for capitalism.

Philosophy

Benjamin, Weber, and the Critique of Technology

Author: Timour Kamran

Sponsor: Dr. Gabriel Rockhill

In this paper, I assess the appropriation of the Frankfurt School of critical theory in contemporary discussions around a critical theory of technology. Contemporary discussions of the relevance of the analyses of first-generation Frankfurt School thinkers focus on the question of whether their development of Weber’s theory of rationalization into a “critique of instrumental reason” is sufficient for making sense of the social determinations of technology today. For the most part,

contemporary scholars agree that while the critique of instrumental reason resonates with some of the ramifications of ICTs (information communication technologies), other theoretical resources are needed to theorize the social impact of contemporary technology. While remaining agnostic on the question of whether and which additional theoretical resources should be deployed for a critical theory of contemporary technology, I argue that the contribution of the Frankfurt School's "first generation" should not be reduced to an updated version of Weberian rationalization theory. In particular, I argue that the writings of Walter Benjamin contain crucial theoretical insights which while operating in a similar theoretical universe to Weberian sociological theory, still offer something unique through Benjamin's analysis of the genesis of film as mass culture as the site of the subjectivation of a mass subject. In this paper, I introduce an analogy between the advent of technologies of "mechanical reproduction"—most crucially, photography and film—and contemporary technology such as ICTs, and argue that this analogy allows us to bring these Benjaminian insights about film, mass media, and subject formation to the task of a critique of technology. This paper does not offer a complete explanation of how Benjamin's works can help to think through the social determinations of technology today. Instead, I conclude by identifying a few key textual locations and threads to follow for developing a Benjaminian theory of contemporary technology.

Margaret Cavendish's Materialist Conception of Sympathy

Author: Kevin Lower

Mentor: Dr. Julie Klein

Early modern natural philosophers developed an array of concepts for explaining the natural world. Chief among them was the concept of natural sympathy. Historically, natural sympathy was conceived as an immaterial force of attraction that produces life, order, and unity in a world of brute matter. Suspicion toward this concept grew alongside the rise of mechanical philosophy, which held that all natural phenomena are explicable in terms of matter in motion. Kenelm Digby (1603-1665) is widely identified as the champion of natural sympathy in the early modern period. He makes the concept compatible with mechanical philosophy by noting the resemblance of motions exhibited by bodies of similar weights, quantities, and figures. This project argues that a rich but understudied account of natural sympathy can be found in the writings of Margaret

Cavendish (1623-1673). Her conception of natural sympathy is materialistic but non-mechanical. She achieves this novel conception of natural sympathy by situating it within her theory of corporeal motion. Sympathetic and antipathetical motions manifest among the parts of particular bodies and between several bodies considered as wholes. This explains how material unities persist and the regularity of the natural world. Sympathy thus plays a crucial role in the natural philosophy of Margaret Cavendish, and we should include her in historical investigations of the concept of natural sympathy.

Négritude and General Will? Aimé Césaire and Léopold Sédar Senghor on Unity and Activity

Author: Thomas McGlone, Jr.

Sponsor: Dr. Sally Scholz

The differences between the concept of Négritude in the works of Aimé Césaire and Léopold Sédar Senghor have been a matter of significant contention throughout the history of the reception of the Négritude movement. It has often been the case that readers of the two poet-political-philosophers have seen fit to contrast the “radical” Césaire with the “reactionary” Senghor. While this distinction may have purchase within discussions of the political careers of the longtime Martinician mayor and representative Césaire and that of Senghor, who would become the first president of his native Senegal, it bears out less neatly in their writing. In my ongoing research, I attempt to reread what have previously been seen as philosophical tensions between Césaire and Senghor as two *tendencies* within the Négritude movement itself, which both Césaire and Senghor employ at various points in their work. The first tendency, present more often in Senghor’s work, emphasizes the normative primacy of African cultural traditions over the act of using these traditions for clear, future-oriented political ends. The second tendency, usually attributed to Césaire, reverses this, and places primacy on the act of taking up one’s historical culture over the content of that culture itself. Each of these approaches, I argue, has different implications for emancipatory movements grappling with the relations between colonialism, culture, and politics today. Understanding these two tendencies as different responses to a specific historical moment and conceptual atmosphere within the history of anticolonial struggle allows us to consider their legacies in our own,

contemporary assumptions about race, internationalism, and the possibility of a truly universal emancipation.

A Queer Phenomenology of Masked Figures

Author: Claryn Spies

Sponsor: Dr. John Carvalho

In the United States, masks have long carried an affective charge: the masked character or person on the street is typically read as—at best—unnervingly mysterious, or—at worst—dangerously criminal. While we may be tempted to think that there is nothing harmful about this visceral association, this phenomenon belies a general orientation toward the world wherein we perceive strangers first and foremost as threats. This perception, however, is not fixed. If our orientation toward masked figures negatively affects our relation to others with whom we share a world, we might be able to shift that horizon by practicing what Sara Ahmed calls a “politics of disorientation,” attending to our lived experience of this phenomenon and its (limited) conditions of possibility. My research uses phenomenological tools to demonstrate that our association of masks with criminality is not only socially constructed, dependent on the socio-historical conjuncture in which it appears, but also mutable. If we are capable of viewing masked figures differently, we may also be capable of perceiving people who have been labeled “criminal” by the legal system differently—a shift in orientation which could move us away from our harmful systems of policing and mass incarceration toward a more just and humanistic treatment of those with whom we share a world.

Psychology

Social Support Networks in Homeless Experiences

Author: Ranya Al-Khayyat

Sponsor: Dr. Janette Herbers

Parental well-being is highly associated with developmental outcomes for their children. Homelessness can be a detriment to a parent's ability to fulfill their role due to its psychological impacts.

I utilized data previously collected by Dr. Herbers and her research team. The sample consisted of families staying in shelters in the Philadelphia region. I looked at a subset of the sample of 73 families who completed a measure of social support called the Ecomap— a tool typically used to understand an individual's social network and perceived support from relationships by creating a diagram of people who provide support in the individual's life and describing the strength of that relationship. Parents also completed the Hopkins Symptom Checklist-25 and the Parent-Child Dysfunctional Interaction subscale of the Parenting Stress Index (PSI), which assessed parental distress and parental stress respectively. I conducted bivariate correlation analyses to investigate associations between relationships with adult siblings and current levels of parental distress and parenting stress.

Of the 73 subjects, 35 reported a sibling as part of their social support network when constructing their Ecomap. Reports of having a sibling were positively correlated with the level of sibling support received. Sibling Support was significantly negatively correlated with Parenting Distress. Sibling Support did not show significant correlation with Parenting Stress. When controlling for Total Support, Sibling Support and Parental Distress showed a statistical trend.

The findings suggest that having adult siblings and the quality of the sibling relationship represent an important form of social support to many parents experiencing homelessness. Partialing out Total Support parents receive shows us any unique qualities siblings may provide. While partial correlations were not statistically significant in this relatively small sample, the small effect size trending upwards suggests that sibling support may have unique meaning beyond other types of support for mitigating depressive symptoms.

I didn't mean to look, I'm just tired: The association between poor sleep, reduced inhibitory control, and attention to romantic alternatives.

Author: Hanna Campbell

Sponsor: Dr. Erica Slotter

Romantic relationship research has looked at how personality differences, relationship dynamics, stress, and other broad life events impact romantic relationships. Relationship science knows a fair deal of what predicts relationship quality but everyday fluctuations and occurrences such as stress, hormones, and sleep have not received the same attention. Past research shows that sleep impacts how well people can control their impulses and that those in romantic relationships with worse control of their thoughts and actions often pay more attention to romantic alternatives and show less commitment to their relationship. This research seeks to make a direct association between poor sleep and attention to romantic alternatives. It is predicted that poor sleep will predict worse inhibitory control. It is also predicted that poor sleep will be associated with more attention to attractive alternatives and that poor inhibitory control will mediate these associations.

Integration of spatially separated tactile information at prolonged timescales

Author: Rose Dietrich

Sponsor: Dr. Joseph Toscano

The sensory world is filled with vast amounts of information. A challenge in organizing this information into perceptual representations is that it is often ambiguous. How do humans deal with this ambiguity to accurately perceive the world? One explanation is cue integration, a process that helps reduce ambiguity by combining multiple sources of perceptual information (cues). Previous work has thoroughly investigated cue integration in vision and audition, but less is known about how humans integrate cues in the sense of touch. The tactile domain also provides an opportunity to better understand the neural pathways involved in cue integration, as perceptual information from each hand remains separate until it reaches cortex. The current study used this characteristic of the tactile system to determine whether cues are integrated early or late in processing. Participants received 1 to 5 vibration cues on each trial. Cues were drawn from either a low- or high-frequency distribution and were presented via two tactile transducers. This provides the opportunity to study differences between presentations that occurred within the same hand or across different hands. After all samples in a trial were presented, participants indicated whether the vibrations were from the low or high frequency category. It was found that participants tended to respond faster when more samples were given, providing evidence of cue

integration. Participants also responded faster when stimuli were presented across two different hands rather than to one hand, which suggests that cue integration may occur at a later stage of processing. However, this difference could be influenced by practice effects, as participants were presented with the same-hand condition first. These results are informative for our understanding of tactile perception and for models of cue integration and perceptual processing more generally.

Simultaneous active negative attentional templates for multiple distractor colors

Author: Harris Drachman

Sponsor: Dr. Charles Folk

Previous findings have shown that, when given the necessary information, observers can allocate attention towards target-defining features using “positive search templates” and divert attention away from non-target features using “negative search templates” to enhance visual search. However, there remains a lack of evidence for whether multiple negative templates can be simultaneously active to enhance visual search. This study will investigate the capacity and benefit of two simultaneous negative templates in a visual search task. Visual search benefits will be measured by increases and decreases in reaction time from target onset to response.

Exploring individual differences in personality and sleep-related practices

Author: Ryan Krieger

Sponsor: Dr. Irene Kan

Understanding factors that influence sleep quality is critical to improving the health of the general population, as it is well established that high quality sleep contributes to overall wellness. In this study, we examined how individual differences in personality traits may be associated with sleep-related behaviors. Previous research on personality and sleep has focused largely on sleep duration and sleep quality. Relatively less attention has been paid to how personality traits may be associated with sleep-related behaviors, such as in-bed activities and sleep product usage. Since sleep-related behaviors are intimately linked to sleep quality, it is critical to understand the multitude of factors — including personality — that may impact sleep practices.

We administered an online survey to 360 undergraduate and graduate students (mean age = 21.6, 68.6% female, 70.8% White). In addition to personality traits (measured with the BFI-XS-2) and sleep practices, we also assessed sociodemographic factors, sleep/wake timing preferences, and sleep quality. We found that Conscientiousness is negatively associated with sleep hygiene-incompatible in-bed activities (e.g., using electronic devices) and fall-asleep strategies (e.g., keep my eyes closed and keep trying), and it is positively associated with weeknight sleep duration (but not weekend night sleep duration). Neuroticism is positively associated with hygiene-incompatible in-bed activities. Extraversion is positively associated with sleep product usage (current or past use), while Openness is positively associated with willingness to try new sleep products. Finally, Agreeableness is not related to the sleep-related behaviors that we assessed.

This research demonstrates associations between personality and sleep-related practices. Findings may have potential for informing personalized approaches to sleep education and intervention.

My COVID Experience

Author: Tia Nicolas

Sponsor: Dr. John Kurtz

The COVID-19 pandemic was a source of great distress for many people. Emerging adults may have been the most vulnerable to the effects of the pandemic lockdown, as it suspended them from engaging in social, professional, and academic experiences. This likely caused a disruption of identity formation. Identity is assessed in various ways, and past research has shown that narratives are useful tools for identity evaluation (McAdams, 2013). This study aims to investigate the impact of past COVID-19 stress on young adults' current self-concept clarity and well-being. The sample consist of 200 young adults from the ages of 18 to 30, recruited through Connect by CloudResearch, who completed the Self-Concept Clarity Scale (Campbell et al., 1996), The Ryff Well-Being Scale (Ryff & Keyes, 1995), a modified version of the Pandemic Stressor Scale (Lotzin et al., 2022), the Dimensions of Identity Development Scale (Luyckx et al., 2008), the Basic Psychological Needs Scale (Deci & Ryan, 2000) and two narrative prompts that require participants to talk about their positive and negative experiences during the first year of the

pandemic. It is expected that high stress levels during the COVID-19 lockdown correlate with decreased current self-concept clarity and well-being among people who do not demonstrate growth motivation in their narratives of the COVID experience. People who demonstrate growth motivations in their narratives of the COVID experience will be protected from the stress level experienced during lockdown.

Time-course of processing for lexical status and syntactic class

Author: Reet Patel

Sponsor: Dr. Joseph Toscano

Spoken language comprehension requires listeners to process both low-level information, such as differences between sounds and phonemes, and higher-level information, such as differences in syntactic and semantic categories. There is debate over whether information at each of these levels of linguistic organization is processed sequentially (serial processing models) or simultaneously (parallel processing models). Recent work has addressed this issue by studying the time-course of processing within and across each level, but more work is needed to resolve the debate. The current study investigated the time-course of processing for lexical status and syntactic class using more sophisticated machine learning techniques than those that have been used in previous work. We predicted there would be overlap in the time-course of processing across different levels of linguistic organization, supporting parallel processing models. In Experiment 1, subjects heard spoken words or nonwords and saw visually presented words or nonwords and were told to indicate whether both were words/nonwords (match) or whether one was a word and the other was a nonword (mismatch). Experiment 2 followed the same procedure and task, but subjects heard and saw pairs of nouns and adjectives. The results of the experiments demonstrated that both lexical status and syntactic class are processed early and concurrently with low-level acoustic-phonetic processing. These results provide support for parallel processing models, indicating that higher-level information is accessed while low-level information is still being processed.

Effects of Early Life Stress on Adult Stress Susceptibility and Neurogenesis

Author: Ben Swack

Sponsor: Dr. Benjamin Sachs

Stress early in life is a known risk factor for developing depression and anxiety. However, previous studies utilizing preclinical animal models have shown mild early life stress can confer a degree of resilience to future adversity, while more severe early life stress tends to promote maladaptive behaviors. Current work in our lab makes use of an altered early life stress paradigm in mice that could allow further insight into reliably inducing depression- and anxiety-like symptoms. The present study correlates behavioral findings from this work with neurobiological data, potentially illuminating a mechanism by which early life stress affects adult behavior.

Theatre

Shakuntala's Legacy: Deconstructing the Passive Femininity in South Asian Drama

Author: Zainab Warda Jeffrey

Sponsor: Dr. Chelsea Phillips

Since its translation in 1789, the Sanskrit drama *Shakuntala* (*Abhijñānaśākuntala*) by Kalidasa has been widely regarded as a significant literary piece, often compared to Shakespeare's *Hamlet* in its cultural status. Its first translation into English by Sir William Jones sparked a chain reaction and produced countless other translations by Arthur W. Ryder, W.J. Johnson, Barbara Stolen Miller, and others. This work has also been eulogized by Goethe and Rabindranath Tagore. Over time, the titular character has altered and been perceived diversely through cultural periods and attributes. Nonetheless, in the contemporary era, adaptors of South Asian descent have taken it upon themselves to reclaim *Shakuntala* and grapple with the framework and presentation of the titular character in reimagined depictions. This approach is informed by postcolonial, specifically Orientalist, and transnational feminist perspectives that have developed over time. By comparing different translations and adaptations of *Shakuntala*, fresh approaches have emerged that give

Shakuntala a voice and amplify the strength of her character. In Jacques Derrida's *On Writing and Difference*, he explains how a subject is characterized in a certain way where linguistic meaning is created rather than provided. In that same lens, the portrayal of the female characters, specifically Shakuntala, is influenced by Orientalist perspectives in a colonial and cultural context, significantly altering their anatomy and agency. The contemporary efforts to rework *Shakuntala* reflect the biases that have been long ingrained in the work due to colonialism and patriarchy.

Theology

The Catholic Doctrine of Discovery and Indigenous Women

Author: Elisha Chi

Sponsor: Vincent Lloyd

This presentation of my use of the Villanova Summer Research Grant details the chapter of my dissertation that I used these funds to research and write. In this chapter I wanted to ask: How have Catholic notions of gender impacted Indigenous people from the fifteenth century through today? To answer this question, I separated the chapter into three main parts.

First, I take up a critique of the doctrine of discovery as it was explicated by the joint statement from the Vatican “rescinding” this document. In that statement, the Vatican conjures up a separation of the theological and political within early modernity that is entirely incorrect. Thus, I first explore what I term the **overt** or written political theology of the fifteenth century papal bulls that collectively comprise what we call the “doctrine of discovery.” A diverse array of scholars has noted the political power of these documents. Their work details how the bulls sparked the colonial and transatlantic slave projects of the Europeans. Together, they narrate modernity’s focus on race as inextricably tied to pre-modern Christian theology and European cultural hegemony.

Secondly, I explore what I am terming the **covert** or assumed political theology present in the documents. Herein, I argue that these papal documents were not only the start of the global racializing project, but *also* the imputation of a global cis-heteropatriarchal order. I pull upon

feminist theologians, ecofeminists, and historians to illustrate how the political theology of the doctrine of discovery was also inescapably cis-gendered and inherently patriarchal.

Finally, I combine these threads of scholarship to illustrate that the Catholic initiated project of settler colonialism not only racialized Black and Indigenous peoples, it forced its sexual and gendered norms upon them.

'You shall have no other gods before me': The Technological Structuring of the Fragmentation, Objectification, and Commodification of the *imago dei* at work on Instagram

Author: Tekoa Robinson

Sponsor: Dr. Christopher Barnett

Instagram views itself as fostering a community through the sharing of images by its over two billion users. Visitors to Instagram's "About Us" page are greeted with the following claim: "We bring you closer to the people and things you love." Given the red flags raised by Surgeon General Vivek Murthy, M.D., concerning the epidemic of loneliness in the United States and its connections to digital environments, and given the widespread findings of scholars such as Jean Twenge, Nicholas Carr, Sherry Turkle, Diana Zulli, et al. concerning the detrimental neurological, psychological, and physical effects of social media applications on youth and adults, it seems that any claims of fostering a sense of community made by a social media app, such as Instagram, must be investigated. This chapter extends the scope of the investigation through providing a critical analysis of the lived theology/spirituality at work in the structures and algorithms of the Instagram app that may be adversely affecting the spiritual development of the individual through the fragmentation, objectification, and commodification of the self (and therefore, of the image of God in the individual) and thus contributing to the diminishment of the possibility of experiencing life-giving community via the Instagram app, and beyond. Since Instagram claims to foster community through the posting of *images* by users, the second section offers a critical theological analysis of Instagram's professed and lived theologies through the deployment of the categories of idol and icon as found in Christopher Barnett's interpretation of the works of the nineteenth-century philosopher/theologian, Søren Kierkegaard.