FALL 2024

GRADUATE RESEARCH *Symposium*

NOVEMBER 15, 2024

MULLEN CENTER COURT THEATRE AND LOBBY

1-3 P.M.

ORAL PRESENTATIONS

3-4 P.M.

POSTER PRESENTATIONS AND REFRESHMENTS

Learn about exciting research from graduate students in the College of Liberal Arts and Sciences!

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1-3 p.m. Court Theatre, Mullen Center – Oral Presentations

1:00	Opening remarks from Dean Woodard
1:10	Julianna Chen, Education
1:17	Jaxon Parker, English
1:24	Casey Diaz, Environmental Science
1:31	Jenna Hassebrock, Environmental Science
1:38	Steven Powers, Philosophy
1:45	Amber Benson, Psychology
1:52	Emily Hathcock, Psychology
1:59	Madison Palladino, Psychology
2:06	Anastasiia Tompkins, Psychology
2:13	Laura Simpson, Theology
2:20	Trevor Williams, Theology
2:27	Zachary Baker, Biology
2:34	Michael Drummond, Biology
2:41	Aaron Freeman, Biology
2:48	Closing remarks from Dean Woodard

3-4 p.m. Poster Presentations and Refreshments, Mullen Center Lobby

Matthew Callaghan, Biology
Gary Nicolau, Biology
Phillip Rivera, Biology
Johanna Asante, Chemistry
Amanda Consylman, Chemistry
Madison Little, Chemistry
Hongji Chen, Computer Science
Drew Doughan, Education
Kenneth Douyon, Environmental Science
Amy Sanchez-Hamilton, Environmental Science
Matthew Riddle, Theology
Julia Linde, History
Janis Parker, History
Tyra Johnson, Human Resource Development
Kealan Vasquez, Mathematics
Tertia Gillett, Philosophy
Bryan Knittle, Philosophy
Samantha Goldman, Psychology
Emily Khoo, Psychology
Mariah Lees, Psychology
Melanie Schanke, 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 2024 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 2024 Summer Research Fellowship committees (Doctoral and Master's): Drs. Lauren Shohet (English); Delia Popa (Philosophy); Brett Grainger (Theology and Religious Studies); Adam Langley (Biology); Deanna Zubris (Chemistry); Jie Xu (Communication); Joseph Toscano (Psychological and Brain Sciences); Edward Sobel (Theatre); Peter Spitaler (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

Nano-mechanical Properties and Application of Intertidal and Subtidal Sea Urchin Glue

Author: Zachary Baker
Sponsor: Dr. Alyssa Stark

Sea urchins often adhere in high wave intensity environments using a physically and chemically complex glue-like secretion. Although the basic components of the glue are known, how the glue is applied, how it performs at the nanoscale, and if the composition or properties vary with habitat is less studied. Here we used behavioral observations and nanoscale adhesive force measurements to assess differences in the adhesive system of purple sea urchins (*Strongylocentrotus purpuratus)* from two habitats that differ in wave intensity. Glue samples were collected from sea urchins native to two regions in the Strait of Juan de Fuca near Clallam Bay, Washington: the intertidal zone (high wave forces) and the subtidal zone (low wave forces). To explore glue application behavior, we collected videos of attachment process of tube feet discs, the terminal structures of tube feet responsible for adhesion. We performed force-distance spectroscopy with an atomic force microscope to characterize the topography of the sea urchin glue (in the form of footprints) as well as measure the nano-mechanical properties, including the stiffness and adhesive force of each footprint. We also used these samples to begin to explore differences in chemical composition among habitats. Our work will improve our understanding of sea urchin adhesion at a small-scale, which may be used in the future for development of bio-inspired water-resistant glues.

Investigating the Effectiveness of Cyclodextrin Encapsulated 7-Ketocholesterol Nanoparticle to Alleviate Inflammatory Bowel Disease in Mouse Model

Author: Matthew Callaghan
Sponsor: Dr. Anil K. Bamezai

Inflammatory Bowel Disease (IBD) is a chronic autoimmune disorder characterized by persistent inflammation in the intestines, involving complex interactions among the intestinal epithelium, immune system, and gut microbiome. CD4+ T-helper (Th) cells are critical contributors to the

sustained inflammation in IBD. A key aspect of IBD is the stability of the plasma membrane, which is essential for effective signaling in T-cells. Conventional treatments for IBD, such as corticosteroids and immune suppressants, offer limited relief and are associated with significant side effects, often failing to achieve complete remission.

This study explores a new oral drug delivery method that utilizes 7-Ketocholesterol (7-KC), an oxysterol known to destabilize plasma membranes. In this approach, 7-KC will be encapsulated in a REDOX-mediated beta-cyclodextrin (OxβCD) nanoparticle conjugated with an anti-CD4 antibody. We hypothesize that this nanoparticle will effectively deliver 7-KC to the plasma membrane of CD4+ Th cells at the site of inflammation in mice with Dextran Sulfate Sodium (DSS)-induced inflammatory bowel disease (IBD). We posit that this targeted delivery of 7-KC to CD4+ T cells will result in membrane lipid raft disorder. This mechanism is anticipated to inhibit the release of pro-inflammatory cytokines, thereby reducing inflammation. Our proposed method offers a promising solution to the limitations of current IBD therapeutics and represents an innovative strategy for targeted drug delivery in IBD treatment.

Does Trophic Plasticity Lead to Bleaching Resistance? Gorgonian Morphology, Metabolism, and Behavior in Rising Temperatures

Author: Michael Drummond
Sponsor: Dr. Alyssa Stark

As anthropogenic climate change continues to drive the decline of global ecosystems, coral reefs around the world face increasing threats. Many corals rely on symbiotic dinoflagellates (Symbiodiniaceae), which produce food for the coral through photosynthesis. The health of a coral colony is tied to the homeostasis of its microbiome, a complex system easily destabilized by various abiotic factors, including marine heat waves. While coral cover has reduced by 30-50% since the industrial revolution, the Class Octocorallia, particularly gorgonians, show resistance to climate change. Although the exact mechanisms for this resilience is unknown, field and laboratory studies have determined that gorgonians are resistant to elevated temperatures, increasing in reef cover, and could hold a key to understanding how corals adapt to changing environmental conditions. One hypothesis suggests gorgonians are more successful filter feeders than other coral

taxa, allowing them to compensate when the microbiome is unstable. Preliminary results show that polyp extension, Symbiodiniaceae concentration, Respiration, Gross Photosynthesis, and Photosynthesis Respiration Ratio rates all decrease during exposure to elevated temperatures. These findings are contrary to the initial hypothesis that the corals would attempt to increase their heterotrophic feeding in response to the elevated temperatures, and instead that as temperatures elevate past 30 degrees, the coral begins to slowly shut down and potentially die.

Quantifying Coastal Wetland Loss in Northeast Florida using Satellite Imagery and Supervised Machine Learning

Author: Aaron Freeman
Sponsor: Dr. Samantha Chapman

Rising sea levels pose a threat to coastal areas around the globe. One of the most vulnerable areas in the United States is the state of Florida. The coastal wetlands of Florida provide a buffering zone of protection for communities against flooding and sea level rise through the ability to mitigate storm surges and create elevation through a process called vertical accretion. Monitoring the status of these wetlands is critical to detect areas of vulnerability and inform land management practices. This study utilizes satellite imagery data provided by Sentinel-2 which is a part of the European Union's Earth observation program. Using historical and current satellite imagery, classifications of the Guana Tolomato Matanzas National Estuarine Research Reserve were created for the years 2018 and 2024. The classifications were created using random forest, a supervised machine learning classification process on ArcGIS Pro. Classifications are used, in this case, to detect and separate the differences in spectral signatures, generating a map of marsh, mangrove, developed land, and water. A change detection analysis is performed between the two time points, which shows how the land has changed. Preliminary analysis shows a 2 to 2.5% loss of coastal wetlands within six years at GTMNERR.

Integrative taxonomic investigation into the gekkonid genus Afroedura

Author: Gary Nicolau
Sponsor: Dr. Aaron Bauer

The genus Afroedura (Flat Geckos) represents a non-adaptive radiation that consists of seven main evolutionary lineages comprising 34 species distributed widely across the southern third of Africa. However, the true diversity within these groups is underestimated, with cryptic taxa and potentially undescribed species likely being identified in six of the seven main lineages. My study aims to clarify this diversity through an integrative taxonomic approach, incorporating full-genome phylogenetic analysis, sequencing long fragments of mitochondrial and nuclear genes (Rapidly Evolving Long Exon Capture [RELEC]), and both external and skeletal morphological data. To date, we have sequenced the full low-coverage genomes of species from five lineages, examined the external morphology of around 500 museum specimens, and conducted CT scans on 17 individuals representing nine species. We have investigated cranial osteology in 9 species to investigate putatively diagnostic or phylogenetically informative characters across major lineages within Afroedura.

Investigating the influence of hydrology and nitrogen enrichment on pneumatophores of Avicennia germinans

Author: Phillip Rivera
Sponsor: Dr. Samantha Chapman

Mangrove wetlands across the globe face nitrogen (N) eutrophication. Along the Florida coast and in the Gulf of Mexico, these ecosystems are frequently flooded with N-rich runoff and pollution due to the urbanization. Most of the ecological focus in these mangrove ecosystems has been on aboveground responses to N enrichment. However, less is known about the belowground biomass and how this influx of nitrogen affects the belowground biomass. A part of this belowground complex is the pneumatophores, aboveground structures that are vital to belowground growth. Pneumatophores are specialized roots structures developed by A. germinans that allow it to cope with the anoxic conditions of its environment, functioning as snorkels. I plan to investigate the response of pneumatophore growth rates and morphology to N

fertilization using the experimental framework of the WETFEET project (www.wetfeetproject.com) which is located along the mangrove-salt marsh ecotone on the northeastern coast of Florida. In addition to nitrogen availability, the hydrological gradient could alter properties and abundance of pneumatophore due to changes in factors such flooding and anoxia. I will also measure changes in the internal anatomy of the pneumatophores using the Hitachi S-3000N Variable Pressure Scanning Electron Microscope SEM in the Villanova Imaging Lab.

Chemistry

Development of disinfectant bisQACs based on a bolaamphiphilic architecture

Author: Johanna Asante
Sponsor: Dr. Kevin Minbiole

Quaternary ammonium compounds (QACs) are crucial in healthcare, industry, and domestic settings. Most commercially utilized QACs, such as benzalkonium chloride, have a common architectural theme, with a single ammonium center and hydrophobic tail; this amphiphilic structure can affect bacterial cell lysis. However, there has been a rise in bacterial resistance over the years toward these commercially available QACs, which necessitates the development of novel compounds for effective bacterial control. Some QACs, such as chlorhexidine, feature a bolaamphiphilic architecture, comprised of two cationic centers at the molecular periphery and a non-polar region connecting them. Inspired by such structures, a series of 40 biscationic amphiphilic compounds based on an aromatic core, featuring flexibility of linker lengths, alkyl tails, and relative substituent positioning, have been synthesized to study their structure activity relationships (SARs). Antibacterial activity evaluation against a panel of bacterial strains, including ESKAPE pathogens (*A. baumannii and P. aeruginosa*), was encouraging, with micromolar inhibitory concentration (MIC) of 0.5 - 4μM against all tested strains for select compounds.

AI-Assisted Design and Laboratory Synthesis of Novel Disinfectant Amphiphiles

Author: Amanda J. Consylman

Sponsor: Dr. Kevin Minbiole

In an effort to thwart the antimicrobial resistance that continues to present human health risks, it is crucial to develop novel disinfectants. Quaternary ammonium compounds (QACs) are among the most popular and effective disinfectants in current use, but their structural variety is lacking. To counter this, an artificial intelligence model was trained using structural information from a SMILES dataset of over 800 QACs along with their antimicrobial activity (measured by minimum inhibitory concentration, MIC) against the Gram positive bacteria *Staphylococcus aureus.* The deep learning model then predicted new structures for biological assessment, of which approximately twenty compounds were synthesized. The newly synthesized compounds were tested for their bioactivity against a series of bacterial pathogens in order to feed the information back into the AI model and improve future structural predictions for novel and potent disinfectant amphiphiles.

Operando Spectroscopy Investigation of Methane Reforming in Fuel Cells with Raman Spectroscopy

Author: Madison Little

Sponsor: Dr. Eigenbrodt

Solid oxide fuel cells (SOFCs) are solid state electrochemical devices that convert the chemical energy in fuels to electrical energy through redox processes. They have three essential parts: the anode, electrolyte, and cathode. Oxygen at the cathode becomes anions and moves through the electrolyte, where it meets hydrogen from the fuel at the anode to produce water and electricity. SOFCs in particular operate at extremely high temperatures (600-1000 C) making them challenging to work with. They also use inexpensive catalysts, such as nickel (1), and have less of a need for fuel cell purity, meaning the fuel can be reformed internally, while other types of fuel cells usually require the fuel to be converted into pure hydrogen first (2). Fuel cells have high conversion efficiencies3 with low greenhouse gas emissions and noise (1). The voltage is constant as long as the fuel is applied, and they have many advantages in comparison to other energy sources such as batteries. Fuel cells can be either portable or stationary, have longer continuous runtimes, are durable in harsh outdoor environments, require less maintenance, and

can be monitored remotely (4). This research focuses on the chemistry of the anode, and how fuels such as methane can be reformed to allow for better fuel cell performance using electrochemical methods and operando Raman spectroscopy to probe the surface during operation. The coupling of these two techniques gives insight into the unprecedented mechanisms that drive the electrochemical performance of these devices.

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Computing Sciences

Comparative Analysis of Urban Delivery Districting Approaches

Authors: Hongji Chen

Sponsor: Dr. Mirela Damian

Districting algorithms are essential to logistics, yet logistics companies lack a comprehensive understanding of the advantages and disadvantages associated with different districting approaches. This study aimed to address this gap by investigating three districting methods: mixed integer programming, metaheuristics, and generalized Voronoi tessellation. These methods were implemented in C/C++ and their respective benefits and costs were evaluated to support logistics decisions. These three approaches were compared using test cases derived from ZIP Code Tabulation Areas of the Manhattan area, considering existing obstacles such as the Central Park. The fundamental vehicle routing problem was solved to measure the delivery workload within a subregion of a districting plan. Although the computation time of generalized Voronoi

tessellation was much longer than the two discrete approaches, statistic evaluation indicates that it reduced the total delivery length by 10%-20%, and its districting plan was robust to the presence of obstacles. Although generalized Voronoi tessellation could converge to different districting plans, the total delivery lengths had no significant difference. Generalized Voronoi tessellation may be a good option to minimize the running cost for logistic companies, but the converging process and choices of hyperparameters require further investigation.

Education

Books as mirrors for multiracial children? Exploring multiracial identity development through representation in children's literature

Author: Julianna Chen
Sponsor: Dr. Jerusha Conner

This qualitative case study explores the impact of multiracial characters in children's literature on multiracial identity development. The author draws from observations with participants aged 5-12 during a whole group read-aloud at a public library, semi-structured side-by-side interviews, visual data, and parental/guardian surveys. Extant research suggests that representation in literature contributes to engagement and a sense of belonging for multiracial students. In an age of controversial book bans and censorship, this study demonstrates how children respond to multiracial texts and highlights the power of literature as a tool for racial identity exploration. Data from this case study centers child literacies beyond the classroom through their racialized identity. Two positive racial identity frameworks: Poston (1990) and Root (1900), provide a lens for how multiracial children respond to multiracial literature *at what level*: 1) Personal identity; 2) Choice of group categorization; 3) Enmeshment/denial; 4) Appreciation; 5) Integration; and *to what resolution* of their racial identity: 1) Acceptance of the identity society assigns; 2) Identification with both racial groups; 3) Identification with a single racial group; 4) Identification as a new racial group. Findings from this study confirm that picture books can create opportunities for children to explore their racialized identities and social conceptions of race. Implications from this research are targeted towards child practitioners, as they will be able to identify high-quality culturally conscious multiracial picture books and construct meaningful read-aloud scaffolds to facilitate

positive racial identity development. The scaffolds (e.g., as a "manager/encourager, clarifier/prober, fellow wonderer/speculator, extender/refiner, reader") (Sipe, 2001) are guided by Sipe's (2001) framework for read-alouds. Most importantly, practitioners will draw implications for everyday practice from the experiences of multiracial students in the case study.

Critical Content Analysis of Contemporary Media and Policy in Literacy Education

Author: Drew Doughan
Sponsor: Dr. Jerusha Conner

English

"Won't we bring ourselves with us?": Post-Revolutionary Irish and Gender Identity in Teresa Deevy's Katie Roche

Author: Jaxon Parker
Sponsor: Dr. Megan Quigley

In recent years the Irish playwright Teresa Deevy (1894-1963) has received remarkable attention by scholars and theatre companies seeking to reframe her as one of the few—but forgotten—female voices active in the Abbey Theatre. While this joint effort has accomplished important work in recovering Deevy's legacy, scholars have sometimes taken for granted her proto-feminist stance, an oversight that risks neglecting a significant ambivalence underpinning her female characters: namely, the antagonism between the restrictive gender norms of the Catholic Free State—a government that Deevy defended and endorsed—and the memory of radical women's republican movements, which Deevy was once a member of, who agitated for Ireland's independence. With the support of archival research, my project aims to recontextualize Deevy's most famous play, *Katie Roche* (1936), as a symbolic reconciliation of these contradictory historical currents, where the eponymous protagonist is read as an ambivalent allegory for the revolutionary and egalitarian ideals of the Irish Republic that was declared during the 1916 Easter Rising. Set in a cottage on the west coast of Ireland, Katie Roche begins the play as a domestic servant dispossessed of her self-identity. Born in the same year as the Easter Rising, Katie's personification as the Irish

Republic is complicated when she discovers that she is the daughter of an Anglo-Irish nobleman, a member of the Protestant Ascendency who once governed Ireland, but who has since reinvented his identity into a Catholic holy man. While Katie is increasingly disenchanted with her agency and transformative imagination after she marries a wealthy Dublin architect, Deevy's play remains powerfully subversive in its portrayal of national identity through the juxtaposed dynamics between Katie and her father. This research sheds light on how an overlooked female playwright intervened and reflected a contradiction in the discourses of gender and national sovereignty during 1930s post-revolutionary Ireland.

Environmental Science

Evaluating salt marsh restoration success via biogeochemical soil characteristics

Author: Casey Diaz
Sponsor: Dr. Isabel Hong

I conducted a year-long, seasonal study to assess the temporal and spatial variability of biologic soil characteristics in restored and pre-existing salt marshes at Prime Hook National Wildlife Refuge, which was the site of a major restoration project following Hurricane Sandy. Samples were collected at Units 2 (restored marsh) and 4 (pre-existing marsh) along an elevation transect spanning low marsh, high marsh, and upland areas and the relative proportion of organic matter in each sample was measured to compare belowground biomass, which is an indicator of vegetation health.

Results show Unit 2 experienced more seasonal variation, while Unit 4 experienced more spatial variation. Unit 2's low marsh showed the percent organic matter ranged from 19% in the summer to 34% in the winter, a difference of 16%. By contrast, Unit 4's low marsh showed percent organics did not change by more than 1.3%. Unit 2's high marsh displayed a greater range with a 30% difference between winter and spring. At Unit 4's high marsh, percent organics did not change by more than 2.5%. Unit 2's upland area exhibited the smallest range in percent organics, with an 11% difference between winter and spring. Unit 4's upland area displayed the largest

difference (74%) compared to the unit's other sampling areas with 9% in the summer and 83% in the winter.

These trends show that Unit 2 does not have the same belowground biomass as Unit 4, which indicates that Unit 2's salt marsh is still working to achieve equivalence with the natural salt marshes at Prime Hook. Continued monitoring is necessary to assess Unit 2's progress in reaching natural conditions.

Assessing Community Garden Activity and Security across Philadelphia, PA

Author: Kenneth Douyon
Sponsor: Dr. Peleg Kremer

Urban community gardens offer many environmental and communal benefits, from reducing CO2 levels and the urban heat island effect to promoting public health, connectivity, and food security. Formed in 2016, the Philadelphia Garden Data Collaborative (PGDC) partners with local organizations to collect and maintain data on community gardens in Philadelphia, PA. PGDC aims to preserve land and empower growers, particularly in low-income areas facing food insecurity and gentrification. PGDC has created a comprehensive inventory of gardens and land parcels, which is crucial for evaluating urban agriculture's value and preventing adverse sales of garden land. The first iteration of data collection occurred in 2019, with the latest update taking place this past summer for this study: 719 sites, all previously listed as active, were surveyed to confirm their existence. The result is a complete census of garden activity, including data on garden identification and classification, spatial footprint, public access, and water availability. In addition, this analysis overlaid each garden with its corresponding city parcel(s) to identify land ownership and tax delinquency. The potential for growing food across these gardens was also explored to assess gardens' contribution to the broader issue of food insecurity in Philadelphia. Moreover, estimates of food production capacity were gathered by collecting the number of garden beds and their dimensions. This analysis will illustrate the abundance and spread of urban community gardens and help identify which gardens, if lost, would significantly affect food access in the city, emphasizing the importance of preserving these spaces in addressing food insecurity.

Impact of Long-term Land Cover Change on Long-term Nitrate Export in Southeastern Pennsylvania Watersheds

Author: Jenna Hassebrock

Sponsor: Dr. Steven Goldsmith

Understanding drivers of nitrogen contamination is essential for protecting aquatic ecosystem health and preserving our water supply. While many studies have examined the relationship between land use land cover (LULC) practices and nitrogen export, these studies are typically limited to historical analysis of one watershed within a specific geographic area or watersheds dominated by one specific LULC type. This corresponding lack of spatial and temporal data for mixed land use watersheds of smaller spatial scale (<250 km^2) hinders our understanding of critical LULC development thresholds that adversely impact water quality. Additionally, few studies have examined the effectiveness of forested riparian buffers on reducing nitrogen concentrations in mixed-use watersheds. In this study, we use a 20-year dataset (1999-2019) from Aqua Pennsylvania, a regional water services company, and daily streamflow to assess how changes in long-term LULC practices are impacting nitrate-nitrogen (NO_3-N) concentrations and loads in six exurban and suburban watersheds in southeastern Pennsylvania. We saw a variable response in long-term NO_3-N delivery with three of the six watersheds seeing an increase in flow normalized NO_3-N concentrations over the study period, and the remaining three watersheds seeing a decrease in flow normalized NO_3-N concentrations. There was a variable lag time, 2-5 years, in flow normalized NO_3-N concentrations and nitrogen surplus delivery. LULC changed similarly across all six watersheds from 2001-2019, with all watersheds seeing an increase in developed land and decreases in both agricultural and forested land. Furthermore, the TREND-Nitrogen data set (Brynes et al., 2020) is compared with flow normalized export to elucidate relationships with causal factors including agricultural and developed land usage. Since Aqua PA utilizes the study watersheds to provide drinking water to the Greater Philadelphia region, it is crucial to understand water quality stressors to both reduce filtration costs and preserve future water quality.

Examining the Effectiveness of Agricultural Intercropping to Reduce Nitrogen and Herbicide Leaching and Soil Erosion from Corn Monoculture Farms

Author: Amy Sanchez-Hamilton
Sponsor: Dr. Steven Goldsmith

Each year, over 94 million acres (about the 3.2x the area of Pennsylvania) of corn are planted in the U.S. Much of this corn is grown on monoculture farms that require large amounts of nitrogen (N) fertilizer. The method of planting and the height of the crop also leaves vast amounts of bare soil for which weed seeds in the soil seed bank can grow unfettered, giving need for use of herbicides. This bare soil also increases erosion in fields. These all increase prevalence of major contaminates impairing our waterways. Companion planting (intercropping) is an indigenous practice used on some farms, and many studies have been done looking at various grass/legume/smother crop plantings. However, evidence seems to be lacking in using a perennial nitrogen fixing companion plant, such as white clover (a nitrogen fixer), together with a crop like corn to relieve the need for some supplemental use of N fertilizers helping to lower nutrient leaching. Also, the colonizing habit of white clover may help deter weed growth by making germination conditions less suitable, as well as lower erosion rates, and regulate soil moisture. The perennial life cycle, in practice, would be meant to lower the need for reseeding, reducing soil disruption. Also, the added benefit of white clover being a highly valued pollinator plant during the growing season cannot be ignored. This study uses planted test plots to examine the effects of interplanting clover as a companion crop to corn to tackle some of these issues. Preliminary results do show the promise of clover as a permanent cover crop to help deter weed growth and regulate soil moisture. Data on nutrients in the soil water of the plots, and clover as an erosion control measure are still being gathered.

History

The State of Accommodations for Neurodivergent Children in History Museums

Author: Julia Linde
Sponsor: Dr. Whitney Martinko

History museums have recognized the need for greater accessibility for special needs audiences in recent years. With this in mind, as well as recognition of their important role in their communities, many history and history-adjacent museums have created programming for children with autism and similar neurotypes. This includes large institutions such as the Smithsonian, Metropolitan Museum of Art, and American Museum of Natural History, as well as smaller museums such as the Museum of the American Revolution, New York Transit Museum, Reading Public Museum, U.S.S. Constitution Museum, and Wisconsin Maritime Museum.

A combination of tours of these museums and interviews with their accessibility departments revealed that while these programs vary widely, the majority approach accommodations in similar ways. Part of this consists of mitigating sensory stressors and communication barriers. This includes reducing crowds, lowering light and sound in the exhibit space, providing sensory kits including items such as noise-canceling headphones and flashcards, providing social narratives and maps of the museum which identify potential sensory triggers and prepare children for unfamiliar environments, and creating quiet rooms for children to decompress if overwhelmed. These museums also offer a strong tactile component to their exhibits, with the acknowledgement that “hands-on” learning in an informal environment is more effective for neurodivergent children than a formal classroom setting.

All of the interviewed museum personnel stated the importance of training staff to work with a neurodivergent audience, acknowledging that many neurodivergent museumgoers cite a fear of judgment as a barrier to museum participation. They also stressed the importance of working with the local neurodivergent community in order to make sure that any program created for them is both effective and respectful. With these guidelines, the programs at these museums have proved popular and successful and provide practical examples that any history museum can follow.

"Pastors, please read this to your congregations"

Author: Janis Parker
Sponsor: Dr. Judy Giesberg

“Pastors, please read this to your congregations” focuses on the role of Black ministers in the search for family and will be featured on The Last Seen Project site. This exhibit explores a small subset of "Information Wanted" advertisements, published in the *Southwestern Christian Advocate*, to spotlight local Black churches and ministers that aided in the search for loved ones after the Civil War. It focuses primarily on Shreveport, Louisiana as one of many southern towns and cities home to local pastors leading Black communities in the late-19th century, in an effort to emphasize individual places and people who made up the larger African American religious networks. This exhibit features St. Paul’s African Methodist Episcopal Church as one of the spiritual centers for Black residents of Shreveport named in a couple advertisements. It also spotlights Reverend S.E.H. Morant, minister of another Methodist church in Shreveport, who is identified in at least four “Information Wanted” ads between 1877 and 1879. Morant was an active minister and political advocate in Louisiana, and the advertisements offer a snapshot into his role as a community leader for people searching for their relatives.

The exhibit also stresses that African American ministers themselves placed these ads looking for their own relatives. These ads demonstrate that searching for loved ones was a communal task, and that Black churches and ministers were crucial to this journey. It's impossible to know how many people were able to reunite with their loved ones, but still crucial to spotlight their efforts. This exhibit offers a glimpse into the spiritual network available to formerly enslaved people on their journey toward reunification.

Human Resource Development

Exploring the Dynamics of Diversity, Equity, and Inclusion (DEI) Practices: Insights from DEI Practitioners

Author: Tyra Johnson

Sponsor: Dr. Heather Cluley

Many organizations are pushing for more diversity but overlook the complexity of maintaining a diverse workforce. Bringing minorities into the workplace does not indicate fairness or inclusion; such thinking can increase workplace bullying and ostracism. In order to combat issues many organizations utilize training and community-based initiatives such as employee resource groups, still such efforts may not be as effective. Organizations must look to the DEI maturity model and other factors such as organizational context, practitioners' skills, and external influences to implement effective DEI initiatives. The study gains a deeper understanding of the experiences and aspirations of DEI practitioners to help create more diverse, equitable, and inclusive work environments.

Through the following research questions:

RQ1: What is it like to be a DEI practitioner in today's work environment?

RQ 2: How can organizations improve their DEI efforts?

Mathematics

Dots and Boxes with the Misere play convention

Author: Kealan Vasquez

Sponsor: Dr. Andrew Woldar

This research concerns the game of Dots-and-Boxes, played on a single row of arbitrary length, and under the misère play convention. Misère play convention is a form of play in which the players play to *not* meet the traditional winning criteria, and these forms of play are much more difficult for mathematicians to discover pleasant properties. Indeed, while the solution to optimal play normal play variation for a single row is trivial, proof of the optimal play in the

misère form still eludes mathematicians. As a result, although the body of research is plentiful for the standard convention of play for the game, the misère convention of play is much less studied. The only paper published to the ArXiv on the subject notes some complex patterns in even the simplest of games under misère play, and observed--but could not prove--that games of increasing lengths have a sequence of winners with period 10. This research makes further advances in this area, including proving this result for a version of the game with some moves restricted, observing further patterns that could lead to a complete solution to the problem, and compacting a model of the game in Python to be exhaustively searched more quickly. It is the hope of the author that this research may be used by himself and others to continue to extend the results on this problem to a full solution in all its generality.

Philosophy

Pratyabhijñā Cosmopsychism

Author: Tertia Gillett

Sponsor: Dr. Georg Theiner

The current standard view in philosophy of mind is the view that consciousness is a result of the arrangement and interaction of physical particles and forces. However, it seems that objections to physicalist theories are on the rise because a physical theory of consciousness does not appear to be forthcoming. Philip Goff points out that our knowledge of consciousness is only derived through the immediacy of our own awareness and is not publicly observable, so scientific experimentation is very limited in what it can say about consciousness. The “full story” of reality must account for evidence that is only available through the phenomenology of our private, first-person, conscious experiences. Panpsychist theories claim that consciousness is fundamental in the universe. One panpsychist variant, cosmopsychism, asserts that a single, unified cosmic consciousness is the ontological ultimate from which all other conscious subjects are derived. Cosmopsychist theories have not yet been widely embraced, but discussion in this area is thriving, and contemporary analytic cosmopsychists have only begun to look beyond the Western tradition for inspiration and conversation with other traditions that have historically

made similar arguments. The second chapter of my dissertation is dedicated to introducing the Pratyabhijñā school, a nondual Saiva tradition that flourished in Medieval Kashmir. In this chapter, I compare aspects of this tradition to contemporary analytic theories focusing on the concepts of fundamentality, unity, and consciousness. In addition to clarifying what features they share in common with other cosmopsychist theories, I introduce their novel examples and argumentation to highlight their important contributions to this discussion.

The Role of Schizophrenia in Melanie Klein's Pathoanalysis of Early Psychic Functioning

Author: Bryan Knittle
Mentor: Dr. John Carvalho

In our research, we argue that Melanie Klein's use of schizophrenia as a model for early psychic functioning can best be understood from the point of view of a pathoanalysis of human existence. Drawing on the work of Sigmund Freud, pathoanalytic approaches maintain that the best and perhaps only way to understand ordinary psychic life is through the study of the psychopathologies (i.e., neuroses, psychoses, perversions). On this view, pathology is not the negative of a supposed "normality" but instead shows us the structuring elements of human existence in general. Every pathology, then, is merely an exaggerated form of a common human problematic and thus indicates in an exaggerated way the factors and forces that determine our everyday lives. Yet there is a tendency in pathoanalytic approaches to focus more or less exclusively on the psychoneuroses (hysteria and obsessional neurosis) and perversions (sexuality). Klein's account of the anxieties and defenses of the paranoid-schizoid position in early childhood, however, shows us that it is not only possible to make use of the psychoses as a model for pathoanalytic inquiry, but that due to the specific nature of psychotic mechanisms, such an endeavor necessarily reveals aspects about ordinary psychic life that any analysis of the neuroses and perversions simply cannot.

Abolition: Utopian and Scientific

Author: Steven Powers

Sponsor: Dr. Gabriel Rockhill

In the second half of the 20th century the US prison population grew 900% ushering in the stage of "Mass Incarceration" a world-historical first in modern history. This dissertation seeks to explain the causes and major events of Mass Incarceration via a historical and materialist theoretical framework in order to jettison partial and incorrect ideological explanations for crime, criminality, and punishment. My analysis will demonstrate the centrality of class struggle and political economy to the making of Mass Incarceration. Finally, I hope to show that not only have traditional understandings of MI failed to describe the reality of the present, but also that vogue theories of change such as abolitionism fall short in practice primarily because of this philosophical misunderstanding of moral urgency and materialist transition.

Psychology

Effect of Anticipatory Stress and Cognitive Control

Author: Amber Benson

Sponsor: Dr. Irene Kan

Stress is an unavoidable part of daily living, and stressors can take many forms, ranging from minor annoyances to consequential circumstances. There is extensive literature examining the associations between stressful experiences and mental, physical, and emotional well-being. Relatively less is known, however, about how anticipatory stress affects well-being. "Anticipatory stress" refers to the stress response associated with the anticipation of a future stressful event, such as an upcoming job interview. For my thesis, I plan to examine the effect of anticipatory stress on cognitive control and evaluate whether sleep quality may moderate that relationship. Before embarking on that project, however, I first need to identify the most appropriate means of inducing anticipatory stress and a suitable way of measuring the stress response. After an extensive search of the literature, I chose to induce anticipatory stress through the Threat-of-Scream paradigm, measure cognitive control with a Stroop task, and index physiological response to stress with heart

rate. For the summer fellowship, I focused on establishing feasibility of the stress induction and measurement components. During pilot testing, participants were informed that they would hear aversive screams at a low intensity during “threat blocks” only and hear no screams during “safe” blocks. As demonstrated in the literature, although the screams were presented at low intensity, the unpredictable nature of when the scream will occur acts as an acute stressor. I found a significant difference between self-reported stress between the safe and threat blocks. However, I did not observe differences in heart rate between blocks. These findings indicate that while the Threat-of-Scream paradigm appears effective in inducing a subjective perception of stress, it is less clear whether such a change in perception is accompanied by a physiological response to stress. These findings will be instructive in the final design of my thesis project.

How highlighting Black Americans' resilience (vs. difficulties) impacts White Americans' allyship intentions

Author: Samantha Goldman
Sponsor: Dr. Caitlyn Yantis

There are two primary frameworks for teaching White people about disadvantaged groups: focusing on their resilience in the face of adversity or solely on their difficulties. Past research demonstrates that White people who focus on a Black individual’s resilience (vs. Difficulties) view that person as more competent and less helpless, indicative of respect. My study extended this work by assessing how a resilience (vs. difficulties) framing impacts White individuals’ performative and genuine allyship behaviors. Performative allyship behaviors are low cost, and require low motivation, whereas genuine allyship behaviors are high cost, high motivation. I expected that in addition to increasing respect, a resilience (vs. difficulties) framing would also promote genuine allyship. Replicating the prior literature, I found that White participants exposed to a resilience (vs. difficulties) framing showed greater respect towards a Black individual. Additionally, although framing did not directly impact allyship, a resilience (vs. difficulty) framing indirectly predicted greater overall allyship intentions due in part to increased respect. This research highlights the evidence that the way people learn about Black people's experiences shifts

respect which can in turn make people more likely to be allies. Racial allies are a key component to help social justice efforts, and finding ways to increase allyship is crucial to these efforts.

Parasocial Relationship Strength and the Need for Social Compensation as a Function of Gender Identification

Author: Emily Hathcock
Sponsor: Dr. Erica Slotter

Social belonging and acceptance are fundamental human needs. There is an abundance of evidence supporting that humans undergo various negative effects such as loneliness. Research points to several methods to temporarily satisfy the need for connection when it is not available, one option being parasocial relationships. Parasocial relationships (PSRs) are feelings of intimacy formed with an unreciprocating other person, who can be a real such as a celebrity or a fictional character. PSRs are associated with satisfying the need for connection and buffering negative psychological effects when reciprocal relationships are not available. Most studies examining PSRs focus on the general population and no work has looked at the role of PSRs among transgender/nonbinary people. Previous research suggests PSRs may satisfy the need for social well-being among individuals whose social identities and needs are not well supported in their reciprocal relationships. An online pilot study was conducted to examine if cisgender (N=129) and transgender/nonbinary (TNB) individuals (N=98) differ on measures of social support, social well-being and parasocial relationship strength. The primary aim of this study was to examine how the two groups differed in their need for social well-being and overall perceived social support both in reciprocal relationships and parasocial contexts. The results suggest that people in the TNB group experience less support from in person sources and seek more support from online sources. They also experience worse social well-being. Parasocial attachments were not stronger among TNB participants on average compared to cisgender participants, suggesting that, perhaps, PSRs may vary in strength based on the quality, or characteristics of the PSR. This study is a pilot study to my thesis that is currently underway that will expand on the findings and examine predictors of PSRs and how they can contribute to the well-being of trans and nonbinary individuals.

Long-Term Effects of Early Life Exposure to Fluoxetine in Juvenile C57BL/6 Mice

Author: Emily Khoo
Sponsor: Benjamin Sachs

Fluoxetine (FLX: Prozac) is one of the three most prescribed medications, accounting for 18.5% of the total antidepressant prescriptions dispensed in the U.S. for adolescents and young adults. It is also one of two FDA-approved pediatric antidepressants. Despite its widespread use, the long-term effects of early-life FLX exposure in response to later environmental stressors remain inadequately understood. In animal models, while fluoxetine exposure during adulthood has been associated with antidepressant and anxiolytic effects, exposure during childhood has been reported to exacerbate depression- and anxiety-like behaviors. Thus, the current study utilized a translational animal model to examine the long-term impact of adolescent FLX exposure on stress susceptibility in adult mice. We hypothesized that adolescent FLX exposure would confer vulnerability to stress-induced depression-and-anxiety-related behaviors. Consistent with the hypothesis, the results indicated that developmental exposure to FLX heightened anxiogenic like behaviors as well as susceptibility to environmental stressors, particularly among female mice. This was evident in the Open Field Test, the Light Dark Emergence Test, and the Sucrose Preference Test. This preclinical research highlights crucial insights into the long-term behavioral alterations associated with adolescent FLX exposure. Building on this research, future investigations will focus on elucidating the cellular mechanisms underlying fluoxetine's sex-specific effects.

Individual differences and effects of pattern complexity on sequence learning

Author: Mariah Lees
Sponsor: Dr. Joseph Toscano

The ability to learn and make predictions about patterns is central to many aspects of cognition, including language processing and motor learning. This study investigates factors that influence performance on the serial reaction time (SRT) task, a commonly used paradigm for studying sequence learning. First, we assess individual differences in performance on the SRT task, linking

performance to underlying mechanisms using a simple recurrent network simulation. We find that differences in the model's learning rate predict participants' performance on the task, suggesting a potential mechanistic link. Second, we investigate how properties of the pattern influence task performance. Participants were presented with patterns varying in complexity, from constant values to arbitrary sequences, with several patterns representing sequences of moderate complexity (e.g., linear growth, nonlinear growth, cyclic changes). SRT effects across 62 participants show the linear pattern was learned significantly better than the arbitrary sequence but equivalent to constant, nonlinear patterns were learned significantly better than arbitrary and equivalent to constant, yet the cyclic and cyclic changes pattern were learned significantly worse than constant and better than arbitrary. These results suggest that patterns with cyclic, as opposed to linear, properties are more difficult to learn, as shown through the SRT task. With the findings of the simple recurrent network, these data suggest potential future research in individual differences that investigates how complex patterns that unfold over time are learned.

Slowing Down Fast Fashion

Author: Madison Palladino
Sponsor: Dr. Irene Kan

As of 2023, the fashion industry was considered to be the second top contributor of pollution following oil production, and this is in part due to fashion production's impact on air pollution, water consumption, and chemical contamination. We witnessed this significant increase mainly due to the culprit of fast fashion, a type of fashion business that regularly produces clothing to match the newest trends at a rapid rate for consumers. When paired with online retailers and their ability to ship quickly, they have created an endless cycle of new products to quickly get to buyers worldwide. In addition to regulations that hold fashion companies accountable, it is important to raise consumers' awareness of their impact when making purchasing decisions. My study examined how educational infographics may impact attitudes towards fast fashion production and consumption.

Ninety-two U.S. adults completed a two-part survey. In the first session, participants reported their shopping habits, factors that affect their shopping choices, whether they re-use or repurpose

their clothes, and whether they currently shop at eco-friendly retailers (e.g., second hand shops). After completing this survey, participants viewed seven infographics regarding textile waste and how to adopt eco-friendly habits. After a delay of between 3-6 days, participants completed a second survey that focused on future behavioral intentions.

I found that exposure to educational infographics led to: a significant increase in consideration of eco-friendly fashion factors when shopping (e.g., sustainable production methods), a marginal increase in likelihood to shop at retailers that focus on recycle or re-use, and a marginal increase to engage in eco-friendly habits (e.g., repurpose torn clothing as rags), and a significant decrease in intention to trash clothing when they became worn or outdated. Taken together, these findings suggest that educational infographics may be a way to mitigate consumer overconsumption of fast fashion.

The impact of early life adversities on adolescent mental health: A potential pathway through sleep health.

Author: Melanie Schanke
Sponsor: Dr. Elizabeth Pantesco

Background: Good sleep is essential for health, but socioeconomic disparities affect sleep in children (Doane et al., 2019). It's important to explore whether homelessness impacts sleep and mediates the link between early homelessness and later mental health.

Methods: Data came from 601 adolescents with actigraphy sleep data from the Future of Families and Child Wellbeing Study. Childhood homelessness and high residential mobility were defined by caregiver reports of houselessness and residential moves per year before age five. A combined score, including both, was created. The adversity index (0-7) included exposure to single parenthood, low maternal education, teen motherhood, father incarceration, domestic violence, maternal depression, or harsh parenting at ages one, three, or five. Sleep health at age 15 was assessed using a 0-4 index (duration, timing, efficiency, regularity, quality). Depression and anxiety at age 15 were measured via BSI-18 and CES-D scales. Path analysis examined links between early adversities, including literal homelessness and high residential mobility, and adolescent mental health through sleep health, testing three models.

Results: The best-fitting model included the combined homelessness/high residential mobility score as part of the adversity index (CFI = 0.997, TLI = 0.978, SRMR = 0.017, RMSEA = 0.031). Early adversity directly affected adolescent sleep health ($\beta = 0.109$, $p = 0.020$) but not depression/anxiety ($\beta = 0.022$, $p = 0.150$). Poorer sleep health was linked to higher depression/anxiety ($\beta = 0.097$, $p < 0.001$). The indirect effect of early adversity on depression/anxiety via sleep health was significant (indirect effect = 0.005, $p = 0.049$).

Discussion: Sleep health may be a key mediator between early adversity and adolescent mental health. High residential mobility should be considered in adversity indices, especially when evaluating sleep. Findings can guide future research on tailored sleep interventions for families with high residential mobility.

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How Food Insecurity in Childhood Shapes Adolescent Behavior

Author: Anastasiia Tompkins
Sponsor: Dr. Janette Herbers

Abstract

In 2022, 17 million (12.8%) American households experienced food insecurity. Food insecurity in early childhood is linked to worse self-control, associated with misconduct in teenage males. In girls, low self-control and early puberty predict violent behavior, while in boys, they predict substance use. Self-control often declines in adolescence, particularly among early-developing children. Food insecurity has been linked to earlier pubertal onset in females, but not in males. This study investigates whether pubertal timing and self-control mediate the relationship between early childhood food insecurity and adolescent behavioral problems.

Methods:

The study included 1,328 participants (51.4% males) from the Future Families and Childhood Wellbeing Study. Food insecurity was assessed using the U.S. Household Food Security Survey at age 3 and 5. Pubertal development and self-control were measured at age 9, and adolescent delinquency and externalizing behavior were assessed at age 15. Regression analyses examined the effect of food insecurity on delinquency, with pubertal status and self-control as mediators, controlling for poverty.

Results

The model did not explain delinquency in adolescence; poverty accounted for variance in all variables (*p*s < .032). Similar results were observed for parent-reported externalizing behavior (*p*s < .013). Poverty positively influenced self-control (*p*s = .000) and negatively influenced delinquency (*p*s < .011) and pubertal development (*p*s < .032). Higher self-control had a small positive effect on delinquency in both genders. Early puberty in boys was linked to less delinquency.

Discussion

Early childhood food insecurity did not significantly affect self-control, puberty, or delinquency. Poverty was the strongest predictor across all outcomes, indicating that food insecurity it is not uniquely predictive of child externalizing symptoms. Previous studies using this data did not control for poverty but rather income. Future research should explore internalizing behaviors and further investigate the role of poverty in child development.

Theology

Spiritual but not Religious Christianity?

Author: Matthew Riddle
Sponsor: Dr. Brett Grainger

The increasing trend of individuals identifying as "spiritual but not religious" or "religiously unaffiliated" has prompted questions about religion today. This study explores the phenomenon through the lens of “deconversion,” which is described as a shift from inherited beliefs to self-authored and integrative forms of faith. This transition does not necessarily suggest a rejection of

religious concerns but rather a personal reconfiguration of inherited traditions. This research examines the role that spiritual practices play in this process. Through long-term participant observation and interviews with practitioners of Centering Prayer, this study investigates how meditation influences religious participation, identity, and practice. The findings reveal that the majority of individuals were drawn to Centering Prayer out of disillusionment with traditional religion and a desire for broader, more inclusive spiritual frameworks. Another major catalyst to spiritual practice was personal trauma that led to a desire for healing and transformation, and a desire to serve others. Furthermore, the study found that younger participants tended to integrate contemplation into their professional lives and were less involved in traditional religious activities. In contrast, older generations were more active in church leadership, focusing on bringing contemplative practices into religious communities in order to change them from within. Overall, the research highlights the difficulties of clearly distinguishing between identities and practices that are distinctly religious or spiritual. Instead, openness, fluidity, and the integration of diverse traditions and the blending of spiritual and secular life reflects the expanding and evolving nature of contemporary religiosity. Therefore, these examples of life beyond the boundaries of tradition show that deconversion does not equal the loss of religious life or concern, but rather reveals the diversity of spiritual experiences and practices woven into and out of traditional religious institutions and identities.

Doing Time at the Prison Museum

Author: Laura Simpson
Sponsor: Dr. Vincent Lloyd

This project examines the Sing Sing Prison Museum as a case study to explore how carceral logic underwrite dominant conceptions of temporality in the US. By examining the museum's representations of the ongoing history of Sing Sing Prison, I attend to the ways that understandings of past, present, and future are negotiated through carceral narratives and frameworks; I also focus on the "excess" that marks the limits of these frameworks. I engage cultural analysis, literary analysis, and critical theory to argue that this excess gestures toward a form of ethical possibility for living into divergent temporalities undetermined by carceral logic.

The Canticle of Creatures

Author: Trevor Williams
Sponsor: Dr. Anthony J. Godzieba

The sacramentality of *The Canticle of Creatures* is an indispensable aspect of its fraternal vision of creation. St. Francis of Assisi perceived that the world bore a symbolic association with the Trinity and that this meant that the divine is present in creation itself. However, a common tendency today is to believe that God's transcendence, that he is more than or other than the world, is to make a claim about an unbridgeable distance. This claim can sometimes be used in a helpful way, but it is also misleading in so far as we imagine that God's distance is reducible to a kind of physical distance or *height*. In other words, if God is "high up," and we place our ultimate value in that faraway place, then we will have nothing left for our lives here "below." Many philosophers have critiqued Christianity for this very issue. I take a different mode of approach in that I turn to Falque's analysis of Franciscan theology as it is present throughout his authorship. He claims to begin with finitude and so interprets *The Canticle of Creatures* as attesting to a fundamental distinction between the experience of God as "excess"—that which overwhelms us—and of "poverty"—that which is of us. In the end, I affirm Falque's sensibility that one must recover something distinct about finitude as a positive good, but I push back a little. I argue that divine transcendence means that the Trinity is more present than is acknowledged in many contemporary critiques. The fraternity of *The Canticle of Creatures* depends on this rich sense of sacramentality where, for St. Francis, the environment has intrinsic dignity because it does not force us to choose between God or the world. We are truly brothers and sisters with all created things.