



Scholars AT THE Capitol 2023

February 15, 2023
9:45 a.m. – 11:45 a.m.

MINNESOTA
PRIVATE
COLLEGES

Minnesota State Capitol
Rotunda

Recognizing Undergraduate Research

Minnesota Private Colleges' 2023 Scholars at the Capitol celebrates the scholarship of 35 students and the efforts of their research advisors. The breadth of the subject matter presented during Scholars at the Capitol represents the wide range of student learning that occurs every day at Minnesota Private Colleges.

Undergraduate research provides opportunities for students to explore the kinds of projects they will pursue later in their educational paths and careers.

This abstract booklet is organized alphabetically by institution.

Cover Illustration: Sara Ann Richardson

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Aaliyah Abdi

Augsburg University, Department of Psychology

Faculty Advisor: Dr. Alex Ajayi, Ph.D., LP

Presence and Search of Life Meaning during COVID-19: Examining Narrative Themes and the Roles of COVID-19 Stress and Religiosity

Past research has shown that meaning in life is associated with several indices of psychological well-being, however, much less is known about factors that predict meaning in life. To address this gap, the current study examines potential predictors of two dimensions of meaning in life (i.e., search for meaning and presence of meaning) in the context of the COVID-19 pandemic. The research team investigated the role of COVID-19 stress, religiosity, and sociocultural factors in predicting meaning in life in a sample of 248 diverse adults (Mage = 22.41, SD = 8.168). In addition, COVID-related narratives were examined for themes of meaning-making. Researchers found disparate associations between the research team's predictors and the two dimensions of meaning. Researchers also found that race and gender predicted reported levels of meaning. Thematic analysis of the COVID-related narratives showed two broad meaning-making dimensions representing positive and negative valence. Overall, this study will help researchers understand how people come to meaning in life and find life satisfaction during the COVID-19 pandemic.

Keywords: Meaning in life, search for meaning, wellbeing, race, COVID-19, stress, religiosity, gender

Xeng Yang

Augsburg University, Department of Mathematics, Statistics and Computer Science

Faculty Advisor: Dr. John Zobitz, Ph.D.

Modeling, Visualization, and Analysis of Temporal Patterns in Soil Carbon Fluxes

This project combined novel techniques from ecosystem ecology and data science to develop a data product that computes half-hourly soil carbon fluxes at a given ecological site. These fluxes provide baseline metrics for monitoring changes in soil carbon for future climate scenarios. The research team acquired nearly-continuous precipitation, soil temperature, air pressure and other ancillary data from the National Ecological Observatory Network (NEON, www.neonscience.org) at four different locations throughout the continental United States, primarily located along the West Coast. The data are inputs to the flux-gradient method, which applies Fick's law of diffusion in the soil. The research team modified previously existing code from NEON in a statistical software program (R) to acquire, compute, and produce "tidy" output of soil carbon fluxes with the flux-gradient method. Water content increases the activity of microbes inside the soil, thereby increasing soil fluxes and their associated uncertainty. Using statistical modeling the research team investigated how this rapid change and recovery in soil fluxes varied between sites.

Keywords: Ecosystem, ecology, soil, graphs, patterns

Sam Carlson

Bethel University, Department of Physics and Engineering

Faculty Advisor: Dr. Nathan Lemke, Ph.D.

Digital Laser Locking of a Robust, Optical Frequency Standard

The atomic transitions in Rubidium vapor are used to develop optical timing systems for use outside the laboratory. Applications of high-precision frequency standards range from laser communications to global navigation technologies (GPS). Bethel's NASA-funded atomic clock project works toward an optical timing system that could one day be sent to space. In this project, a 778-nanometer laser drives transitions in Rubidium-85 and Rubidium-87 while a high-speed analog-to-digital (ADC) system demodulates and locks the signals. When blue-light fluorescence is maximized, the frequency is known to extreme precision to match the atomic transition. The frequencies of Rb-85 and Rb-87 are then compared on a 100-second timescale to a stability greater than one part in one trillion. In summer 2022, a programming-based feedback control system was configured to replace an aging, physical knob system. Future project goals include using more feedback systems to control the laser power and the Rubidium temperature. All these improvements increase the timing precision up to 10-100 times.

Keywords: Atomic clock, laser locking, optics, NASA

Amy Ruiz Plaza

Bethel University, Department of Biological Sciences

Faculty Advisor: Dr. Paula Soneral, Ph.D.

Genetic Representation and Clinical Correlates of Breast Cancer Biomarkers for BIPOC Women in the United States

Breast cancer is the most diagnosed cancer in the United States, yet genomic testing remains accessible to a small subset of citizens. To what extent are BIPOC women represented in molecular models for breast cancer? This research explores the representation, clinical outcomes, and genetic profiles of BIPOC women in databases for biomarkers of breast cancer. The research team analyzed 817 primary tumors from The Cancer Genome Atlas (TCGA) for alteration in cancer-associated genes, and correlated these parameters with race/ethnicity and clinical outcomes. Researchers found that white women were 11.6% overrepresented, and BIPOC women underrepresented by as much as 15.47%. BIPOC participants exhibited higher-stage tumors compared to white counterparts, and mortality rates were highest among Black/African Americans (20%). Highly aggressive, triple-negative tumors were more prevalent in BIPOC women, whereas white women exhibited a larger range of more treatable genetic subtypes. Taken together, these data demonstrate significant disparities in the representation and clinical outcomes of BIPOC women in genomic datasets.

Keywords: Diversity, equity, inclusion, breast cancer, precision medicine, genomic testing, biomarkers

Sidra Michael

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Faculty Advisor: Dr. Kathleen Ryor, Ph.D.

Black Aesthetics: The Black Arts Movement in Chicago and Los Angeles

This research comparatively analyzes the art of the Black Arts Movement as it manifested in Chicago and Los Angeles. Through reading art historical texts, looking at the sociopolitical and cultural contexts of the areas, and analyzing artworks, I formulate conclusions about how and why the movement manifested itself differently in each area and how that affected art-making. The movement in Chicago was quite militaristic and emphasized organization. This resulted in art that was community-based, collaborative, accessible, emphasized positive and mobilizing messages, and was aimed toward a wider Black audience. In Los Angeles, the focus was to carve out a space for Black artists in Los Angeles' art world. The art that was produced was subtle, experimental, independently created, and meant for an "art" audience. Ultimately, the project aim is to show the diverse art of this movement and dispel stigmas around Black art being monolithic and synonymous with protest art.

Keywords: Black art, Black Power, liberation, social movements

Augustus Williams

Carleton College, Department of Mathematics and Statistics

Faculty Advisor: Dr. Katie St. Clair, Ph.D.

Compartmental Modeling of SARS-CoV-2 in Brazil

Since the beginning of 2020, there have been 570 million cases of COVID-19 worldwide and over 6.38 million deaths. For countries that struggled to mitigate the pandemic's spread early on, its impacts have been devastating. Brazilian leadership has been accused of severely mishandling COVID-19, having the third highest amount of cases and the second highest amount of deaths of any country. Using public data from the Johns Hopkins Coronavirus Resource Center, we explored the spread of SARS-CoV-2 in Brazil to better understand one of the worst outbreaks of COVID-19 in the world and test the viability of compartmental models for public policy intervention. Research findings suggested that these models were not only accurate in their predictions, but also aided in comprehension of the reasoning behind Brazil's struggle to handle COVID-19.

Keywords: COVID-19, SARS-CoV-2, compartmental model

Savannah Supan

College of Saint Benedict, Department of Nutrition

Faculty Advisor: Dr. Ted Gordon, Ph.D.

Tribal and State Government Responses to the COVID-19 Pandemic

During the first wave of the COVID-19 pandemic, many governors issued executive orders forcing bars and restaurants to close. Because tribal governments are independent of state governments, state executive orders do not apply. Policy makers and pundits often critique tribal sovereignty as granting tribal governments free reign to make decisions that benefit Native communities at the expense of non-Natives. The first wave of the pandemic provided us with the opportunity to compare tribal and state government responses to determine which kind of government was more likely to make economic sacrifices to address a public health emergency. The research team collected data on 498 casino closure and reopening dates and compared them to the responses of the state government in which they reside. Researchers found that tribal governments, on average, acted faster to close casinos and waited longer to reopen. The research team concludes that, contrary to the concerns of some critics, tribal governments made swifter and stronger economic sacrifices to prevent spread of COVID-19.

Keywords: Tribal casino, sovereignty, COVID-19

Meliyah Anderson-Tryon

The College of St. Scholastica, Department of Psychology and Sociology

Faculty Advisor: Dr. Nicole Nowak, Ph.D.

Effects of Nature Exposure on Multidimensional Mood, Heart Rate, and Ranked Aggression in Response to Aggressive Stimuli Priming

Exposure to simulated and real natural environments can reduce negative and increase positive emotion (Kjellgren & Buhrkall, 2010). The research team measured ranked aggression, mood, and heart rate and hypothesized: (1) exposure to a video clip of a mixed martial arts (MMA) fight (aggressive stimuli) will produce an increase in heart rate, a decrease in mood, and higher ranked aggression scores, and (2) exposure to a video clip of nature scenes vs. urban environment after the MMA video will decrease heart rate, increase positive mood, and lower ranked aggression scores. Exposure to nature had psychological benefits but did not impact participants' physiological state. Mood increased for the nature group and decreased for the urban group. The MMA video did not increase heart rate or ranked aggression; it is possible that nature exposure would act as a stronger antidote to psychological and physical stress if that stress was induced by a reliable intervention such as a social stress test.

Keywords: Psychology

Jack Branby

The College of St. Scholastica, Department of Biology

Faculty Advisor: Dr. Laura Hansen, Ph.D., Creighton University School of Medicine

Pro-NP Antioxidant Enzymes and UV-Induced DNA Damage

This project proposes to evaluate the delivery of two antioxidant enzymes—superoxide dismutase (SOD) and catalase (CAT) to the skin to suppress UV-induced DNA damage. This would be done by using a topical Gransil GCM-5 lotion along with antioxidant nanoparticles to produce Pro-NP™. In previous studies, it has been shown that the nanoparticle formulation in Pro-NP™ reduced UVR-generated ROS. Based on previous studies about the usage of Pro-NP™, the research team expects to see a reduction in DNA damage shown by the decrease in CPD, 8-oxo-dG, and γ H2AX in pig skin. If Pro-NP™ treatment reduces levels of UVR-induced ROS in the skin and reduces the accumulation of ROS-induced DNA damage, there could be a long-term reduced risk in the development of skin cancer. Pro-NP™ would need to undergo clinical trials to reach the open market if it resulted in a variable reduction of DNA mutation.

Keywords: Cancer biology

Hakima Amiri

Concordia College, Moorhead, Department of English

Faculty Advisor: Erin Hemme Froslic

Fallen Stories

On August 15th of 2021, two weeks after the U.S. troops left Afghanistan, the Taliban soldiers rolled into the capital, Kabul. A nationwide panic took over the airports and borders of the country. The deep-rooted mistrust in the Taliban terrorist group caused a mass refugee crisis out of Afghanistan. Images of people falling off planes circled the silent international community adding to already misunderstood images of Afghans. Soon after, August 15 became a painful memory — where once lay the home and hopes of millions of people turned to pebbles. The researcher interviewed Afghans who had fled the scene of chaos. The goal of the project was to encourage a culture of empathetic dialogue regarding the stories of refugees and their struggles in both their home country and the U.S. The aim of these dialogues is to prompt thinking about ways people can continue making the U.S. an inclusive country.

Keywords: Refugee crisis, Taliban, refugee, empathetic dialogue

Luke Young and Sophie Schaumann

Concordia College, Moorhead, Department of Biology

Faculty Advisor: Dr. Jennifer Sweatman, Ph.D.

Abundance of Microplastics in the Gastrointestinal Tract of Dabbling and Ground-foraging Waterfowl

Microplastics, plastics <5mm, are a growing pollutant within ecosystems. Due to improper disposal and accidental dispersal, plastics are entering natural ecosystems and fragmenting into microplastics. Microplastics are present in and have multiple sub-lethal effects on seabirds in marine environments. However, studies assessing microplastic prevalence are lacking in freshwater environments and continental waterfowl. The research team surveyed gastrointestinal tract contents of species of waterfowl representing different feeding habits: ground foragers and dabblers, primarily geese and mallards, respectively. Waterfowl were harvested and donated by a hunting outfitter and guide service out of Devil's Lake, North Dakota. Researchers bisected, sieved, and filtered contents. Researchers visually observed samples under stereoscopes and analyzed plastic numbers and characteristics. Microplastics were found in almost all organisms (90%), and microplastic abundance was significantly higher in ground foragers than in dabblers. Future research may focus on studying water, soil, or other species samples, in addition to identifying specific polymers in the microplastics to help identify their source.

Keywords: Microplastics, habitat, wetlands, waterfowl

Malia Braiedy

Concordia University, St. Paul, Department of Science

Faculty Advisor: Dr. Amanda Brosnahan, Ph.D. and Dr. Taylor Mach, Ph.D.

Staphylococcus aureus Strains that Differ in SEIX Presence and ABC Carriage Have Different Toxin Profiles

Staphylococcus aureus (*S. aureus*) is a bacteria that can exist asymptotically, but can be dangerous due to its individual toxin profile. While approximately 30% of the population is currently carrying *S. aureus* (CDC, 2022), the mortality rates of those who are carrying it are only 10-30% (van Hal et al., 2012). This is due to the 20+ different superantigens that *S. aureus* can have (Xu et al., 2012). Samples of *S. aureus* often have superantigen SEIX, which seems to have an inverse relationship with other toxins (i.e., SEA, SEB, SEC).

Keywords: Staphylococcus aureus, superantigen, toxin

Julian Yang, Kora Kritzberger & Jarrid Pizel

Concordia University, St. Paul, Department of Science

Faculty Advisor: Dr. Mary Ann Yang, Ph.D.

Effects of Incubator Humidity on Ex Ovo Embryonic Viability

The Chorioallantoic Membrane (CAM) is a highly vascularized membrane that forms around chicken embryos during early embryonic development. The immunodeficiency of chick embryos during the early stages of embryonic development and the fact that CAM is also the site of rapid angiogenesis are two characteristics of CAM that make it a suitable platform for biological testing. Testing can range from carcinogenesis, medical drug screening, and tissue engineering regarding different biomaterials. This study looks at building standardized ex ovo culturing methods of chick embryos so CAM is viable to use for testing. Previous literature has not stated the importance of relative humidity when culturing chick embryos in an ex ovo setting. The research team's studies suggest that higher relative humidity combined with the Tahara vessel ex ovo culturing platform leads to the highest viability of chick embryos to day seventeen.

Keywords: Chorioallantoic membrane, ex ovo, embryo, humidity, tissue engineering, incubator

Haley Jostes

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Faculty Advisor: Dr. Dwight Stoll, Ph.D.

An Approach to High Throughput Measurement of Accurate Retention Data in Liquid Chromatography

Efforts to simulate liquid chromatography (LC) separations depend on experimental retention measurements to use as the basis for the models. Often these modeling efforts are limited by datasets that are too small because of the cost associated with making measurements. In this project, the research team explores the possibility of using small-volume columns instead of typical conventional columns for retention measurements. Since retention factor is a thermodynamic property of the mobile/stationary phase system under study, it should be independent of the column's dimensions. We propose using ratios of retention factors to translate measurements between columns of different dimensions, so that measurements made using small columns can be used to make predictions for separations with conventional columns. This approach will significantly increase the rate at which high-quality retention data can be collected to thousands of measurements per instrument per day, which in turn will have a profound impact on the quality of models and simulations that can be developed for LC separations.

Keywords: Liquid-chromatography, modeling, simulations

Carley Swanson-Garro

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Faculty Advisor: Dr. Martin Lang, Ph.D.

Lizzo Sells Shapewear: The Commodification of the Body Positivity Movement on Instagram

In light of the growing shapewear market and recent studies on the negative impact of corporate commodification on the body positivity (BoPo) movement, this article analyzes celebrity artist Lizzo's promotion of her shapewear brand Yitty from a cultural studies perspective. Using Adorno and Horkheimer's theory of culture industry, a theoretical critique of neoliberalism, and self-objectification theory, this article performs a content analysis of Lizzo's Instagram to critically examine her body positivity content. Through a comparison of Lizzo's Instagram posts before and after the launch of Yitty in spring 2022, results indicated that although Lizzo's recent posts still meet certain criteria of the BoPo movement, such as normalizing flaws and marginalized bodies, the promotional aspect of her posts is actually detrimental to the movement. The implications of a neoliberal promotion of products as the solution to negative body image are discussed. Future research should explore the role other celebrity influencers play in aiding brands in co-opting of the body positivity movement.

Keywords: Body positivity, Instagram, shapewear, Lizzo, culture industry, neoliberalism, self-objectification, social media

Anika Besst

Hamline University, Department of Theatre Arts and Communication Studies

Faculty Advisor: Dr. Laura Dougherty, Ph.D.

Journalism Meets Performance: An Anthology of Ferocious Healing

Storytelling is the foundation for the fields of journalism and performance. While journalism is for truth-telling and performance offers empathy-building, the two can be merged to tell stories that leverage the strengths of both fields. Prior research supported the convergence of these fields to create more spaces to share and hear stories, especially those less commonly sought after. The researcher created a performance to test these findings, *An Anthology of Ferocious Healing*, which explored what healing and peace mean to young adults in a world that can be complicated. These stories of respite were collected through interviews with individuals aged 18 to 25 years old, as well as adults in direct contact. The researcher included the unedited content from these interviews in a resulting performance through various storytelling techniques. The performance was written in a gallery format providing the audience with a self-paced, multimedia, and multisensory experience. This work blends many disciplines to experiment with and expand the ways stories are told.

Keywords: Storytelling, mass media, journalism, performance, social justice

Pearl Buabeng

Hamline University, Department of Biology, Neuroscience Program

Faculty Advisor: Dr. Bridget Jacques-Fricke, Ph.D.

Determining the Gene Expression Pattern of Adhesion-Related Genes Nectin1 and BRINP2 in Early Neural Crest Development

Neural crest cells (NCCs) are a population of stem cells found in vertebrate embryos. During early embryonic development, NCCs migrate throughout the embryo and differentiate into skin pigment cells, craniofacial skeleton, the peripheral nervous system, and more. Learning more about neural crest development is vital for preventing congenital disorders, such as cleft lip and palate, and frontonasal dysplasia. The research team's previous work identified 674 genes that are potential novel regulators of NCC development. Two of these genes, Nectin1 and BRINP2, have roles forming adhesions between cells. Nectin1 proteins organize tight junctions and adherens junctions. BRINP2 is a member of the MACPF superfamily, which form adhesions between migrating cells. Using in situ hybridization, the research team shows that both Nectin1 and BRINP2 are expressed throughout premigratory and migratory stages of NCC development. Future research includes functional analysis of these genes. Using morpholinos, researchers can effectively "turn off" these genes to see what differences in NCC development occur in their absence.

Keywords: Developmental biology, neuroscience, birth defects

Xiu Mei Golden, Gloriah Omwanda & Kevin Tovar

Macalester College, Department of Biology

Faculty Advisor: Dr. Elena Tonc, Ph.D.

Characterizing the Role of Immune and Neuronal Activities in a Model of Vulvodynia

Vulvodynia is a chronic vulvar pain condition, affecting ~10% of women identifying individuals. Risk of developing vulvodynia is associated with contact allergies, like exacerbated responses to methylisothiazolinone (MI), a preservative commonly used in household cleaners and personal care products. Nonetheless, the etiology is poorly understood. The research team has established a mouse model of vulvodynia, where repeated MI exposure leads to prolonged pain sensation. The model also recapitulates key findings from patients, including increased neuronal density, mast cell frequency, and fibroblast activity in the affected tissue. This suggests that MI is a candidate allergen that could provoke inflammation-driven chronic pain in humans. The research team is investigating the mechanisms behind these changes by characterizing fibroblast function as well as mast cell and fibroblast interactions to elucidate how the interplay between the two cell types might lead to the establishment of chronic pain. Additionally, the research team is measuring the expression of inflammatory mediators that can lead to central sensitization in this model as potential therapeutic targets.

Keywords: Chronic pain, allergies, inflammation, vulvodynia, immunology, neuroscience, mast cells

Brody Beskar

Saint John's University, Department of Physics

Faculty Advisor: Dr. Adam Whitten, Ph.D.

Seasonal Variability in Atmospheric Aerosols

Atmospheric aerosols play a significant role in Earth's climate by scattering and absorbing sunlight as it travels to earth. In this project atmospheric aerosol number density and particle radii were studied to find patterns. Previously collected irradiance values from the year 2018 were used and converted into aerosol optical depth (AOD) values. These AOD values were then further analyzed to find particle number size distribution fit parameters and then graphed using a bimodal distribution for each month. These graphs were then compared and studied to find patterns among seasons and weather events. It was shown that variability changed throughout the seasons, but due to large amounts of variability in the atmosphere, more data would need to be analyzed to establish a trend in particle radius or number density. This research provided a unique look into rural Minnesota's atmospheric processes, whereas most aerosol research is conducted in populated cities or coastal regions.

Keywords: Atmosphere, aerosols, physics, genetic algorithm

Allison Moysis

Saint Mary's University of Minnesota, Department of Biology

Faculty Advisor: Dr. Debra Martin, Ph.D.

The Long-term Effects of Atrazine on Blood Glucose Levels and the Circadian Rhythm

Atrazine, a known herbicide, contaminates water sources via runoff. Many animals, including humans, can be exposed through a contaminated water source. Atrazine has been shown to disrupt the endocrine system, which can lead to obesity or insulin resistance. This is reflected by abnormal blood glucose readings and irregular circadian rhythm of blood glucose throughout a 24-hour period. Fluctuations of blood glucose levels can be an indication of diabetes mellitus, specifically type 2 diabetes, which is an epidemic in the United States. However, there have been mixed reports of the correlation between atrazine consumption and insulin resistance, so further studies are needed to determine this relationship. For 16 weeks, mice were given atrazine in their drinking water to determine the long-term effects of atrazine. The blood glucose was monitored at weeks 5, 10 and 16 to determine the impact of atrazine exposure on circadian blood glucose levels.

Keywords: Atrazine, insulin, blood glucose, Circadian rhythm

Nicholas West

Saint Mary's University of Minnesota, Department of Chemistry

Faculty Advisor: Dr. Heidi Dahlmann, Ph.D.

Development of Phosphoramidate Catalysis for Carbonyl-Olefin Metathesis

Carbonyl-olefin metathesis (COM) is ring closing carbon-carbon bond formation that provides access to cyclic alkenes. A popular method for mediating COM reactions is through Lewis Acid catalysis; however, these catalysts require anhydrous conditions, which complicates setup. Phosphoramidates are up and coming in organocatalysis and have been shown to catalyze COM reactions without the need for anhydrous conditions. Herein, the research team reports the synthesis and characterization of phosphoramidate catalysts tested on a model substrate. These results will further guide Brønsted-Lowry acid-catalyzed COM reaction development.

Keywords: Synthesis, organocatalysis, characterization, phosphoramidate

Hannah C. Bladow

St. Catherine University, Department of Psychology

Faculty Advisor: Dr. Arturo Sesma, Ph.D.

Transgender and Gender Diverse Individuals of Various Resident Locations and Racial and Ethnic Identities' Healthcare Experiences

Research has outlined barriers to healthcare for trans individuals. As resident location becomes more rural, healthcare access and quality decrease. It is unknown how this explicitly impacts Black, Indigenous, and people of color (BIPOC) transgender and gender diverse (TGD) patients' access to healthcare. However, research has demonstrated higher rates of healthcare insecurity and a medical education system that perpetuates racist and inaccurate information, lacking in the nuance of intersectional realities faced by TGD BIPOC. This study examines the relationships between race, location of residence, and healthcare access/quality for TGD individuals. Survey questions assess attributes of healthcare access and experience, and demographic questions. The research team is wrapping up data collection and will complete the data analysis soon. Anticipated outcomes include calls to action for healthcare practices and policies affecting TGD BIPOC and creating a social media page to disseminate findings to the general public and share TGD public health and advocacy resources.

Keywords: Black, Indigenous, People of Color, BIPOC, transgender, gender diverse, TGD, healthcare, resident location

Abigail Nachreiner & Isabel Honzay

St. Catherine University, Department of Economics and Political Science

Faculty Advisor: Dr. Lacey Chu, Ph.D.

Pedagogical Shift and Parental Mental Health During the COVID-19 Pandemic: Evidence from the United States

The global COVID-19 pandemic has negatively affected the mental health of individuals around the country. In this study, the research team explores the effect of pedagogical shifts, including in-person to distance learning or class cancellation, on the mental health of parents with school-aged children in the United States. The research team's study utilizes a national dataset from the Household Pulse Survey collected by the Census Bureau from April 23, 2020, through December 21, 2020. After applying the data to the multivariate regression models, researchers find that pedagogical shifts significantly increase the severity of anxiety and depression symptoms and worsen parents' mental health. Notably, parents with children who had their classes canceled experienced significantly higher levels of anxiety and depression symptoms than those with children who switched to distance learning. These findings are first verified robustly using alternative models and mental health measures. These findings highlight an urgency for state, federal, and societal policy changes to address the growing mental health issues.

Keywords: Class cancellation, COVID-19, distance learning, mental health, parenthood, political affiliation

Jose Gonzalez Ramirez

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Faculty Advisor: Dr. Audrey Bowden, Ph.D., Vanderbilt University

Construction of External Fixation Target and Internal Pupil Tracker for SmartOCT System

Glaucoma, frequently referred to as the “silent thief of sight,” is the leading cause of irreversible blindness worldwide (1). Optical coherence tomography (OCT) is an imaging technique that is used non-invasively to diagnose glaucoma by analyzing cross-sections of the retinal nerve fiber layer. However, one of the problems is that OCTs are expensive and not portable. Glaucoma’s prevalence is most common in African, Hispanic, and European ancestry. This research aims to create a portable OCT for low-income and rural communities that can be used outside of a clinic. In creating a portable OCT one of the limitations is the accuracy and precision one would receive in the clinic. Creating a fixation target and a pupil tracker allows for increased image resolution. Fixation reduces ocular movements and pupil tracking increases the accuracy and precision of the image (2). The research project focuses specifically on creating an ophthalmic fixation target and eye tracker that can be used with the smartOCT device.

Keywords: Pupil tracker, fixation target, Vis-OCT, OCT, computer programming, Glaucoma

Athziri Marcial Rodriguez

St. Olaf College, Department of Biology

Faculty Advisor: Dr. Sheng Chih Jin, Ph.D., Washington University School of Medicine

Understanding the Genetic Architecture of Congenital Hydrocephalus Using Whole Genome Sequencing

Congenital hydrocephalus (CH) describes the drainage failure of cerebrospinal fluid (CSF) and subsequent abnormal accumulation of CSF in the brain of newborns. As a result of CH, cerebral ventricles are enlarged, causing increased cerebral pressure. With approximately 69,000 reported cases of CH in the United States each year, this condition makes up one-third of all congenital malformations in the nervous system (Bondurat et al. Pediatric neurosurgery 1995). Research suggests that nearly 40% of familial CH cases result from uncertain genetic etiologies. (Haverkamp et al. European Journal of Pediatrics 1999). Given the severity of CH, in addition to the inefficiency of its treatment, a pressing need exists to understand the genetic underpinnings of CH to improve therapeutic approaches. Whole-genome sequencing (WGS) has allowed for the uncovering of both coding and non-coding variants associated with CH. The research team identified de novo coding and non-coding variants in three parent-offspring trios using an extensive bioinformatics pipeline.

Keywords: Rare disease genetics, bioinformatics, pediatrics, whole-genome sequencing, de novo variant

Andrew Jantz

University of Northwestern – St. Paul, Department of History and Related Fields

Faculty Advisor: Dr. Adina Kelley, Ph.D.

Circumscribing Climate: Reaffirming Traditionally Accepted Motives for Esarhaddon's Egyptian Campaigns

In 674, 671, and 669 BCE, Esarhaddon, the monarch of Assyria, launched military campaigns against Egypt. Past scholarship has attributed these invasions to existing political and military tensions between the Assyrian and Egyptian rulers. Recently, scholars uncovered additional information about Assyrian climate that seemed to suggest different motives for Esarhaddon's Egyptian campaigns. This study will consider this new palaeoclimatological analysis, which concluded that the Assyrian heartland (defined as Northern Iraq) suffered from a megadrought beginning in c. 725 BCE. While it seemed plausible that this drought could have encouraged the Assyrians to seek a more stable grain supply, such as Egypt's harvest, a review of both primary documents and secondary literature suggested that the Assyrians were able to successfully adapt to this drought through other means, such as the construction a large canal system.

Keywords: Climate, Assyria, military, history

Abigail Thelen

University of Northwestern – St. Paul, Department of History and Related Fields

Faculty Advisor: Dr. Matthew Hyre, Ph.D.

Relational Ontology and Quantum Mechanics

The field of Quantum Mechanics (QM) has puzzled physicists from its inception and challenges our current paradigms in the fields of physics, philosophy, and theology. This research explores one of the attempts — namely, Relational Quantum Mechanics (RQM) — to reconcile QM’s underlying Measurement Problem, with an emphasis on Wigner’s Friend and Schrodinger’s Cat thought experiments. RQM proposes that all properties are relational and only have ontological weight with respect to an interaction with another system. The theory rejects the notion of an objective (observer-independent) state on the basis of QM’s experimental results, which suggest that different observers can provide different accounts of the same events. The philosophical and theological implications of a relational view on our understanding of truth are discussed. Remaining questions are presented to guide further research on the implications of quantum physics.

Keywords: Quantum mechanics, relational ontology, engineering, philosophy, theology

Freddy Flores Dominguez

University of St. Thomas, Department of History

Faculty Advisor: Dr. Kari Zimmerman, Ph.D.

Chicano Radicals: The East Los Angeles Brown Berets

As part of the Chicano Movement of the late 1960s, the contribution of the East Los Angeles Brown Beret faction advanced the fight for Chicano civil rights but was often critiqued for their radical tactics. By examining the arc of their activity, this project analyzes the foundational role of radical groups in social movements. In particular, this research considers the polarizing effects of radicalization in social movements and the role of law enforcement. Ultimately, the story of the Brown Berets serves as a reminder to contemporary social movements of the ongoing need to dismantle traditional power structures both within the faction and larger society.

Keywords: Social movements, Chicano, radicalization, Brown Berets

Ellen Patronas

University of St. Thomas, Department of Ethics and Business Law

Faculty Advisor: Dr. Heather Shirey, Ph.D.

Creative Placemaking in Twin St. Paul Neighborhoods: A Comparative Analysis of Frogtown and the Creative Enterprise Zone

Located on Dakota and Ojibwe land, St. Paul is a unique hub of arts, enterprise, and history. The city's landscape has been shaped by racial covenants, economic hardships, and migration to surrounding suburbs. Today, community members, developers, and government officials are involved in ongoing discussions about how to best enhance infrastructure and businesses throughout the city, especially in urban areas, while protecting residents and each neighborhood's identity and culture. One way of doing this is through creative placemaking. Creative placemaking refers to the use of art-based solutions to enhance public spaces to support sustainable communities. This research is a comparative study of community mural projects in St. Paul's Creative Enterprise Zone (CEZ) and Frogtown neighborhood with the goal of understanding how both areas deploy creative placemaking to shape identities, support economic growth, and strengthen communities.

Keywords: Community art, creative placemaking, murals, urban landscape

Thank you to everyone who supported scholars' research projects and a special thanks to the Augsburg University team for their support of the Scholars at the Capitol event.

The Minnesota Private College Council represents 18 private nonprofit higher education institutions in Minnesota. The Council's mission is to serve members' shared needs and advocate for public policy that:

Meets the educational needs of students
Enhances private higher education
Strengthens Minnesota's economic and civic fabric

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